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Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.	312	138 073
	494	144 937
Aeronautical Instruments Lab., Naval Air Development Center, Johnsville, Pa.	143	143 433
Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.	174	138 705
	194	144 096
	545	138 242
Aeronautical Radio, Inc., Washington, D. C.	621	145 919
Aeronautical Research Inst. of Sweden	296	144 305
Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	71	161 071
	84	161 069
	321	161 803
	361	161 312
	411	161 318
	551	144 858
	568	161 407
	604	161 496
	654	161 477
	655	161 517
Aeronautical Structures Lab., Naval Air Material Center, Philadelphia, Pa.	143	143 354
Aeronutronic, Newport Beach, Calif.	131	138 860
	275	147 548
	281	147 919-1
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		147 919-3
	316	144 414
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Aerophysics Co., Washington, D.C.	144	143 653
Aerophysics Development Corp., Santa Barbara, Calif.	412	144 695
		145 001
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	518	137 951
	539	145 065
Aeroprojects, Inc., West Cheater, Pa.	305	147 625
		148 457
Aerosciences Lab., General Electric Co., Philadelphia, Pa.	247	144 133
	261	144 189
		144 200
	274	143 879
		143 901
	297	143 900
	311	144 190
	324	144 132
	471	145 182
	477	145 181
	556	145 184
	595	145 180
	606	145 183
	666	145 693
	691	145 704
Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio. formerly Aero Medical Lab.		
Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	6	161 070
	9	138 912
	14	143 544
		161 083
	38	161 075
	201	143 944
	239	161 298
	250	161 804
		161 814
		161 832
	257	161 042
	312	161 033
	356	161 335
	359	161 333
	370	161 334
	452	161 310
	453	161 419
	454	161 440
	456	161 410
		161 426
	460	161 427
		161 438
	483	161 092
	596	161 483
	598	161 452
		161 504
		161 534
	600	161 485
		161 524
	603	161 523
Aerovox Corp., Olean, N.Y.	494	151 922
Air Force, Washington, D.C.	396	161 357
Air Force Armament Center, Eglin AFB, Fla.	42	142 903
Air Force Cambridge Research Center, Bedford, Mass.	5	161 100
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	148	142 802
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	199	161 150
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	256	161 305
	261	144 431
	269	148 036
	293	143 967
	314	144 382
	319	144 216
	366	144 602
	366	161 346
	368	161 344
	369	161 289
		161 341
	388	161 340
	404	144 588
	423	161 345
	426	144 418
	428	144 587
	428	161 342
		161 343
	477	161 429
		161 432
	494	144 967
	512	161 431
	542	161 430
	550	161 368
	557	161 450
		161 451
	561	145 109
	571	145 105
	614	161 521
	616	161 520
	621	145 302
	622	145 303
	661	145 246
	691	161 522
Air Force Flight Test Center, Edwards AFB, Calif.	188	144 149
Air Force Missile Development Center, Holloman AFB, N. Mex.	14	143 657
	25	143 682
	90	138 733
	96	138 861
	122	138 951
	164	143 184
	188	143 183
	213	143 186
		143 633
	274	143 992
		143 993
	275	143 990
	297	144 397
	358	144 424
	370	144 596
	428	144 594
	457	144 795
	512	144 978
	560	144 979
Air Force Missile Test Center, Patrick AFB, Fla.	58	143 020
	262	144 318
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	374	144 441
	388	144 421
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Air Force Personnel and Training Research Center, Lackland AFB, Tex.	38	143 136
Air Force Special Weapons Center, Kirtland, AFB, N. Mex.	571	145 141
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Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	371	144 802
Airesearch Mfg. Co., Phoenix, Ariz.	539	144 669
Airtron, Inc., Linden, N. J.	494	137 649
Alabama U., University	170	143 782
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Alaska U., College	517	144 846
Albany Medical Coll., N. Y.	359	144 688
Alco Products, Inc., Schenectady, N.Y.	198	136 475
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Allan Memorial Inst. of Psychiatry (Canada)	600	161 528
Allied Research Associates, Inc., Boston, Mass.	31	143 200
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Alloyd Research Corp., Watertown, Mass.	174	138 494
American Brake Shoe Co., New York	257	161 044
American Car and Foundry Co., New York	65	139 164
American Electro Metal Div., Firth Sterling, Inc Yonkers, N. Y.	42	143 513
American Electronic Labs., Philadelphia, Pa.	262	137 518
American Geographical Society, New York	34	143 078
American Inst. for Research, Pittsburgh, Pa.	116	143 615
American Machine and Foundry Co., Boston, Mass.	148	144 020
American Machine and Foundry Co., Chicago, Ill.	521	137 568
American Meat Inst. Foundation Chicago, Ill.	648	145 762
American Potash and Chemical Corp., Henderson, Nev.	41	130 743
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American Radio Relay League, West Hartford, Conn.	327	144 235
Amherst Coll., Mass.	28	143 476
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Andersen Labs., Inc., West Hartford, Conn.	375	144 417
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Anderson Physical Lab., Champaign, Ill.	428	161 336
Antenna Lab., Calif. Inst. of Tech., Pasadena	203	143 158
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Antenna Lab., Ohio State U., Research Foundation, Columbus	43	138 993
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Antenna Systems Lab., U. of New Hampshire, Durham	641	145 284
Antioch Coll., Yellow Springs, Ohio	9	138 912
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	328	144 317
	356	137 997
	404	144 763
	405	144 813
	408	144 556
	457	144 957
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	656	145 507
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		145 552
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Applied Physics Lab., Johns Hopkins U., Silver Springs, Md.	29	143 542
	389	144 719
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	512	145 144
	540	145 446
	555	145 094
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	651	145 730
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Applied Psychological Services Wayne, Pa.	117	143 388
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Applied Science Labs., Inc., State College, Pa.	486	161 382
Arctic Aeromedical Lab., Ladd AFB, Alaska	13	143 530
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		144 847
	462	144 837
		144 838
		144 839
		144 841
		144 845
		144 848
	466	144 835
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Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.	122	143 817
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A. R. F. Products, Inc., River Forest, Ill.	494	145 336
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Arinc Research Corp., Washington, D. C.	623	145 918
Arizona State Coll., Flagstaff	353	144 583
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Arizona State Coll., Tempe	9	143 696
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Arizona U. Coll. of Agriculture, Tucson.	360	143 349
Arkansas U., Fayetteville	362	137 724
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Armour Research Foundation, Chicago, Ill.	43	143 562
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	174	151 025
	185	143 624
	193	131 593
	207	143 463
		161 130
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	213	138 456
	300	144 136
	319	144 274
	324	138 452
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	543	145 245
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Army Air Defense Human Research Unit, Fort Bliss, Tex.	326	144 234
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Army Chemical Corps, Fort Detrick, Md.	18	161 063
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Army Chemical Corps Engineering Command, Army Chemical Center, Md.	41	143 261
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Army Chemical Warfare Labs., Army Chemical Center, Md.	20	143 722
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	41	139 140
	124	143 534
		143 695
	126	139 142
		143 503
		143 539
		144 037
	126	144 207
	128	143 536
	143	144 208
	164	143 694
	169	143 718
	200	138 274
	239	138 259
	243	143 913
		144 036
	244	144 033
		144 169
	257	144 107
	259	144 035
	306	144 127
	311	143 739
	359	138 343
	360	144 666
		144 668
		144 684
	362	144 740
	451	138 345
	468	144 667
		144 679
		144 711
		145 137
	512	138 342
	515	144 683
	595	145 635
	601	145 140
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	282	144 151
	286	144 044
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Army Engineer Waterways Experiment Station, Vicksburg, Va.	614	146 038
Army Medical Research and Nutrition Lab., Denver, Colo.	21	138 599
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Army Medical Research Lab., Fort Knox, Ky.	21	143 264
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	239	144 222
	240	138 333
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	242	138 341
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	463	144 953
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Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.	10	143 532
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Army Prosthetics Research Lab, Washington, D.C.	403	144 726
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Army Research Office, Washington, D. C.	466	161 133
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Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.	275	144 125
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Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.	43	143 416
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Army Signal Radio Propagation Agency, Fort Monmouth, N.J.	32	143 137
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Army Signal Research and Development Lab., Fort Monmouth, N. J.	44	138 636
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Army Snow, Ice, and Permafrost Research Establishment Wilmette, Ill.	139	143 363
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Army Transportation Research and Engineering Command, Fort Eustis, Va.	172	161 114
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Army White Sands Signal Agency, White Sands Missile Range, N. Mex.	58	138 629
Arnold Engineering Development Center, Tullohoma, Tenn.	39	143 275
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	664	145 295
	665	145 371
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ARO, Inc., Tullohoma, Tenn.	39	143 275
	77	143 274
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	412	144 585
	664	145 295
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Assistant Secretary of Defense, Research and Development, Washington, D. C.	44	161 107
Associated Engineers, Inc., Springfield, Mass.	282	144 055
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Astronautics Inst., Westinghouse Electric Corp., Baltimore, Md.	164	143 593
Ateliers de Construction Electriques de Charleroi (Belgium).	45	142 952
Atlantic Research Corp., Alexandria, Va.	177	143 323
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Atomics International, Canoga Park, Calif.	425	137 811
Audiology Lab., Northwestern U., Evanston, Ill.	21	143 378
Automation Instruments, Inc., Boulder, Colo.	652	161 530
Avco Corp., Wilmington, Mass.	424	144 438
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Avco-Everett Research Lab., Mass.	212	143 155
		143 521
	362	144 345
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	432	144 736
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	691	137 763
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Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.	14	143 250
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	90	139 147
	122	143 432
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	125	143 430
	144	143 723
	359	144 717
	463	145 036
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Aviation Psychology Lab., U. of Illinois, Urbana	454	138 224

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Badger, W. L., Associates, Inc., Ann Arbor, Mich.	260	161 290
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Badger Mfg. Co., Cambridge, Mass.	486	161 387
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Baird-Atomic, Inc., Cambridge, Mass.	699	145 529
Ballistic Research Labs., Aberdeen Proving Ground, Md.	58	138 616
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	75	128 524
	93	161 102
	94	143 329
	96	138 880
	164	143 260
	165	143 146
	275	144 034
	288	144 084
	293	144 085
	316	144 079
	324	144 083
	389	144 805
		144 809
		145 061
		145 063
	390	144 803
		144 808
	398	144 729
	405	145 060
	434	138 676
	437	145 062
	512	144 901
	534	144 653
	536	161 446
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		161 445
		161 447
	614	145 274
	641	145 658
		146 004
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Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.	150	143 683
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Battelle Memorial Inst., Columbus, Ohio	64	138 609
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	94	143 277
	131	143 365
	150	142 934
	306	161 302
	375	137 806
		144 748
	396	161 323
	399	145 015
	401	145 032
	416	144 650
	486	161 377
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	487	161 392
	496	137 810
	547	145 332
	607	161 498
	624	137 516
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Barnes Engineering Co., Stamford, Conn.	131	143 340
Bausch and Lomb Optical Co., Rochester, N. Y.	429	144 645
Behavior Research Lab., Washington, U., St. Louis, Mo.	237	144 182
Bell Aircraft Corp., Buffalo, N.Y.	188	143 588
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Bell Telephone Labs., Inc., New York	75	143 648
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Bendix Aviation Corp., Southfield, Mich.	375	161 351
Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.	497	145 260
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Bethany Coll., W. Va.	118	143 927
Biological Research Labs., Boston U., Mass.	463	144 789
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Birmingham U. (Gt. Brit.)	192	143 959
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Bjorksten Research Labs., Inc., Madison, Wis.	70	161 095
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Bliley Electric Co., Erie, Pa.	150	143 034
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Block Associates, Inc., Cambridge, Mass.	691	161 522
Blue Hill Meteorological Observatory, Milton, Mass.	137	143 364
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	140	143 693
Bockamollan, Brosarps Station (Sweden)	282	161 297
Boeing Airplane Co., Seattle, Wash.	86	143 692
	483	138 215
	625	161 484
Bolt, Beranek, and Newman, Inc., Cambridge, Mass.	313	144 115
	327	143 979
	410	144 819
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Boston Coll., Chestnut Hill, Mass.	236	144 464
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British Columbia U. (Canada)	72	139 156
British Cotton Industry Research Association	605	145 240
Brooke Army Medical Center, Fort Sam Houston, Tex.	21	143 605
Brown U., Providence, R. I.	91	143 632
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Brown U. Div. of Applied Mathematica, Providence, R.I.	72	143 786
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		143 868
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	208	144 287
	320	143 771
	325	144 404
	410	137 930
		138 438
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	429	138 078
	523	145 216
	537	144 863
	662	145 176
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Brown U. Div. of Engineering, Providence, R. I.	147	138 587
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	562	137 916
	663	145 391
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Bucknell U., Lewisburg, Pa.	354	161 339
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Bureau of Reclamation, Washington, D. C.	487	161 378
Bureau of Ships, Washington, D. C.	82	138 630
Bureau of Yards and Docks, Washington, D.C.	34	161 060
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	62	161 054
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	256	144 110
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	374	144 513
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		161 359
	396	161 357
	492	144 512
	493	145 003
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Bureau Technique Zborowski, Brunoy (France)	188	143 446
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Burke Research Co., Warren, Mich.	68	138 628
California Agricultural Experiment Station, Davis	15	138 628
California Inst. of Tech., Pasadena	15	138 650
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California Research Corp., La Habra	68	143 267
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California U., Berkeley	72	143 409
	170	143 777
	181	142 818
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		143 670
	248	144 016
		144 017
	254	137 549
		138 226
		144 257
	288	137 562
		138 138
		144 315
		144 369
	405	144 546
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California U., Berkeley, Medical Center, San Francisco	24	143 875
California U., Los Angeles	18	130 572
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	87	143 049
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		143 216
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	120	143 700
	151	144 286
	175	138 840
	197	143 485
	201	143 104
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	202	143 213
	208	138 839
	246	144 168
	275	144 277
	276	144 014
		144 278
	313	144 139
	320	143 834
		144 140
	483	144 769
	562	144 931
	626	145 488
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California U., School of Medicine, Los Angeles	25	143 381
	120	143 845
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Cambridge U. (Gt. Brit.)	675	145 682
Carnegie Inst. of Mathematics, Pittsburgh, Pa.	95	130 623
Carnegie Inst. of Tech., Pittsburgh, Pa.	72	138 632
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	181	161 108
	189	143 658
	204	143 839
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	314	143 980
	390	144 831
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Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.	174	143 569
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Carrier Corp., Syracuse, N.Y.	487	161 397
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Carter Observatory (New Zealand)	353	138 236
Case Inst. of Tech., Cleveland, Ohio.	151	143 661
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Centro Radioelecttrico Sperimentale "G. Maroni", Rome (Italy)	151	143 642
CGS Labs., Stamford, Conn.	160	143 954
Chance Vought Aircraft, Inc., Dallas, Tex.	303	138 472
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Chemical Lab., U. of Kansas, Lawrence	469	145 173
Chesapeake Bay Inst., Johns Hopkins U., Annapolis, Md.	481	144 712
Chicago Midway Labs., U. of Chicago, Ill.	45	138 623
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Cincinnati U., Ohio	522	161 435
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Climax Molybdenum Co. of Michigan, Detroit	399	144 447
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Cloud Physics Lab., U. of Chicago, Ill.	477	137 910
Coastal Studies Inst., Louisiana State U., Baton Rouge	140	143 423
Coating and Chemical Lab., Aberdeen Proving Ground, Md.	66	151 172
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Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge	100	144 [illegible]
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Laboratory of Aerophysics and Physical Mechanics, Polytechnic Inst. of Brooklyn, Farmingdale, N. Y.	128	143 [illegible]
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	666	161 497
Institute for the Study of Metals, U. of Chicago, Ill.	90	138 702
	129	143 420
	155	138 420
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Institute of Aerophysics, U. of Toronto (Canada)	216	142 915
	413	144 739
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Institute of Andean Biology, Lima (Peru)	15	143 749
Institute of Educational Research, Indiana U., Bloomington	237	144 377
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Institute of Field Physics, U. of North Carolina, Chapel Hill	432	144 487
Institute of Flight Structures, Columbia U., New York	77	138 602
	186	143 618
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	295	138 589
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Institute of Geophysics, U. of California, Los Angeles	682	145 653
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Institute of Mathematical Sciences, New York U., N. Y.	72	138 859
	88	138 985
	132	143 262
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	209	143 846
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	319	143 890
	328	143 971
	406	144 765
		144 766
	434	144 435
	435	144 427
		144 436
	531	144 703
		144 854
		145 066
	537	138 255
	543	144 970
	558	137 566
	570	145 071
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Institute of Molecular Physics U. of Maryland, College Park	167	143 457
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	559	137 813
Institute of Optics, U. of Rochester, N. Y.	91	138 653
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Institute of Personality Assessment and Research, U. of California, Berkeley	7	143 386
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Institute of Polymer Research Polytechnic Inst. of Brooklyn, N. Y.	69	143 086
Institute of Psychiatry, Maudsley Hospital, London, (Gt. Brit.)	237	143 837
Institute of Research, Lehigh U. Bethlehem, Pa.	206	138 254
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Institute of Rubber Research, U. of Akron, Ohio	66	143 458
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Institute of Statistics, North Carolina State Coll., Raleigh	73	142 862
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Institute of Statistics, U. of North Carolina, Chapel Hill	73	143 028
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Institute of Tech., U. of Minnesoata, Minneapolis	42	139 167
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Institute of Theoretical Physics Stanford U., Calif.	557	144 764
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Instituto de Optica, Madrid (Spain)	204	143 452
Instituto de Quimica Fisica (Spain)	27	143 450
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Instituto Nacional de Tecnica Aeronautica "Esteban Terradas" (Spain)	68	143 152
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Instrumentation Lab., Mass. Inst. of Tech., Cambridge	278	144 223
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Integrated Range Mission, White Sands Missile Range, N. Mex.	167	143 357
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International Business Machines Corp., Poughkeepsie, N. Y.	662	145 550
International Latex Corp., Dover, Del.	527	145 440
International Research Associates, New York	240	138 233
International Resistance Co., Philadelphia, Pa.	50	129 892
International Telemeter Corp., Los Angeles, Calif.	75	143 282
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Ionics, Inc., Cambridge, Mass.	488	161 386
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Ionospharen-Institut Breisach (Germany)	378	144 589
Ionosphere Research Lab., Pennsylvania State U., University Park	256	144 164
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Iowa Agricultural Experiment Station, Ames	279	144 058
Iowa Inst. of Hydraulic Research Iowa City	170	143 734
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Iowa State U. Iowa City	11	138 841
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	121	143 370
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Iowa State U. of Science and Tech., Ames	120	143 362
	470	131 176
Israel Inst. of Tech., Haifa	659	145 298
Instituto di Chimica Generale dell'Universita, Palermo (Italy)	29	143 050
Istituto Elettrotechnico Nazionale "Galileo Ferraris" (Italy)	321	143 962
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ITT Labs., Nutley, N. J.	321	144 043
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James Forrestal Research Center, Princeton, N. J.	172	138 556
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Jet Propulsion Center, Purdue U., Lafayette, Ind.	64	138 745
Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena	129	143 889
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Johannes Gutenberg U. (West Germany)	685	145 239
John Harrison Lab. of Chemistry U. of Pennsylvania, Philadelphia	133	143 849
Johns Hopkins Hospital, Baltimore, Md.	16	143 385
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	605	145 687
	608	145 686
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Johns Hopkins U. School of Engineering, Baltimore, Md.	254	143 983
Johnson, J. W., and Wiegel, R. L., Berkeley, Calif.	36	130 022
Kaiser Aluminum and Chemical Co., Spokane, Wash.	416	144 646
Kansas State U., Manhattan	205	143 667
Kansas U., Lawrence	27	138 216
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Karolinska Institutet, Stockholm (Sweden)	23	143 071
Kellett Aircraft Corp., Willow Grove, Pa.	259	138 542
Kennametal, Inc., Latrobe, Pa.	67	130 366
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Kentucky U., Lexington	317	138 436
Kettering Lab., U. of Cincinnati, Ohio	360	161 319
Koehring Co., Milwaukee, Wis.	649	145 277
Koenig, Louis, Research, San Antonio, Tex.	489	161 394
Koppers Co., Inc., Pittsburgh, Pa.	519	151 915
Kuthe Labs., Inc., Newark, N. J.	266	136 097
Laboratoire d'Infra Rouge Technique et Applique, Gif-aur-Yvette (France)	207	143 279
Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy)	189	143 910
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Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge,	176	143 601
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Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge	196	144 097
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Laboratory for Research in Social Relations, U. of Minnesota, Minneapolis	119	143 421
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Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.	558	137 708
Laboratory of Aviation Psychology, O[illegible]		

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Laboratory of Climatology, Centerton, N. J.	612	138 183
Laboratory of Social Relations, Harvard U., Cambridge, Mass.	599	145 087
Laboratory of Statistical Research, U. of Washington, Seattle	73	143 797
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Lamont Geological Observatory, Palisades, N. Y.	31	138 716
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Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.	260	144 410
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Laval U. (Canada)	309	144 007
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Lavole Labs., Inc., Morganville, N. J.	50	139 087
Lawrence Radiation Lab., U. of California, Berkeley	675	145 577
Lear, Inc., Grand Rapids, Mich.	372	144 543
Ledoux and Co., Teaneck, N. J.	246	161 295
Lehigh U., Bethlehem, Pa.	279	144 041
Lincoln Lab., Mass. Inst. of Tech., Lexington	51	138 606
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Linfield Research Inst., McMinnville, Oreg.	133	143 697
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Little, Arthur D., Inc., Cambridge, Mass.	214	143 594
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	329	151 925
	525	161 411
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	633	145 402
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Litton Industries, College Park, Md.	51	143 355
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Llosa, R. San Juan	145	161 271
Lockheed Aircraft Corp., Burbank, Calif.		161 272
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Lockheed Aircraft Corp., Marietta, Ga.	199	144 065
Lockheed Aircraft Corp., Sunnyvale, Calif.	417	161 327
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Lof, George O. G.	11	143 392
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Lund U. (Sweden)	608	145 610
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Lyman Lab., of Physics, Harvard U., Cambridge, Mass.	683	145 385
McGill U. (Canada)	252	144 275
McGraw Hill Book Co., Inc., New York	264	161 088
Machlett Labs., Inc., Springdale, Conn.	155	142 994
Magnetic Research Corp., El Segundo, Calif.	155	131 651
Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.	205	138 448
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Mallory, P. R., and Co., Inc., Indianapolis, Ind.	51	161 081
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Mallory Battery Co., North Tarrytown, N. Y.	51	139 060
Manchester U. (Gt. Brit.)	6	143 520
Mansfield Tire and Rubber Co., Ohio	66	138 660
Manufacturing Labs., Inc., Cambridge, Mass.	308	144 050
	321	144 220
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Marathon Battery Co., Wausau, Wis.	267	138 104
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Marine Lab., U. of Miami, Coral Gables, Fla.	253	144 247
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Marine Physical Lab., Scripps Institution of Oceanography, San Diego, Calif.	184	143 613
Maritime Administration, Washington, D. C.	279	161 019
Markite Co., New York	503	144 917
Marguqrdt Corp., Van Nuys, Calif.	618	161 492
Martin Co., Baltimore, Md.	146	143 603
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Maryland U., College Park	84	143 639
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	115	144 029
	156	143 156
	197	143 640
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	210	143 680
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	354	144 416
	355	138 223
	365	138 539
	422	144 429
	424	137 932
	532	138 049
	555	144 780
	605	161 508
	659	138 063
	675	145 511
		145 643
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Massachusetts Inst. of Tech., Cambridge	26	138 605
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	260	143 906
	306	144 135
	308	144 059
	317	144 145
	367	137 989
		144 798
	395	138 575
	401	144 559
	406	144 659
	427	144 229
	478	137 505
	482	144 926
	519	137 861
	523	144 990
	541	144 982
	543	144 956
	548	145 178
	559	138 568
	608	138 134
	669	145 331
	688	145 384
	692	145 631
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Massachusetts Mental Health Center, Boston.	357	161 349
Massachusetts U., Amherst	181	143 227
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	470	144 962
	564	144 959
Material Lab., New York Naval Shipyard, Brooklyn	38	143 255
	156	138 567
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	193	145 905
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	403	145 028
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	527	144 677
	652	145 356
Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.	404	144 699
		144 700
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	526	144 742
	528	145 111
Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	280	151 912
	372	111 648 (aup. 5)
	484	161 364
	518	144 991
	520	161 434
	546	161 363
	550	161 414
	564	161 360
	655	161 502
		161 506
	671	161 500
Materials Research Corp., Yonkers, N. Y.	673	161 489
Materials Research Lab., Watertown Arsenal, Mass.	92	127 593
	318	144 073
	321	144 072
	670	145 355
	692	145 631
Mauch Labs., Inc., Dayton, Ohio	379	144 749
Max-Planck Inst. für Stromungsforschung (Germany)	87	143 402
Medical Coll. of Virginia, Richmond	24	143 783
	244	143 914
Mellon Inst. of Industrial Research, U. of Pittsburgh, Pa.	184	137 656
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	470	144 900
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Melpar, Inc., Falls Church, Va.	504	138 128
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Menzel, Donald H., Cambridge, Mass.	696	145 573
Metal Hydrides, Inc., Beverly, Mass.	129	161 261
Metallic Surfaces Research Labs., Ltd., Uxbridge (Gt. Brit.)	29	143 291
Metallurgical Research Labs., Syracuse U. Research Inst., N. Y.	514	161 443
Metals Processing Lab., Mass. Inst. of Tech., Cambridge	283	143 984
Metals Research Lab., Brown U., Providence, R. I.	87	143 091
	546	137 931
	671	161 487
Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.	192	143 829
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Metals Research Lab., Case Inst. of Tech., Cleveland, Ohio	81	143 759
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Metcalf Research Lab., Brown U., Providence, R. I.	250	138 329
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Metcut Research Associates, Cincinnati, Ohio	174	161 276
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Meteorologic Lab., U. of Illinois, Urbana	478	137 693
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Miami U., Coral Gables, Fla.	321	137 659
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Miami Valley Hospital, Dayton, Ohio	601	161 527
Michael Reese Hospital of Chicago, Ill.	245	143 835
Michigan State U., East Lansing	119	143 120
	202	143 671
	291	137 834
		144 086
		144 466
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Michigan U., Ann Arbor	21	143 264
	30	161 080
	309	143 933
	407	144 772
		144 451
	411	137 839
	433	138 608
	485	145 343
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Michigan U. Coll. of Engineering, Ann Arbor	38	143 040
	86	143 196
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Michigan U. Coll. of Literature, Science, and the Arts, Ann Arbor	660	145 543
Michigan U. Research Inst., Ann Arbor	51	142 696
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	84	127 864
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	284	161 040
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	308	138 457
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	314	144 121
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	635	137 648
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Microwave Associates, Inc., Burlington, Mass.	268	143 977
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Microwave Electronics Lab., Rutgers State U., New Brunswick, N. J.	156	143 958
Microwave Engineering Labs., Inc., Palo Alto, Calif.	156	138 832
	268	143 973
	635	137 990
		145 548
Microwave Lab., Stanford U., Calif.	19	142 959
	93	142 983
	205	143 841
	210	143 842
	268	143 995
		144 314
	324	143 994
	324	144 380
	504	137 862
	567	144 927
	636	145 117
		145 574
	680	145 688
	688	145 017
	692	145 289
	693	145 652
	697	145 290
Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.	156	138 554
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Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.	52	143 024
	156	129 483
	157	143 400
		143 768
		143 769
	268	144 213
		144 341
	269	143 989
	380	144 437
		144 822
	435	144 423
	505	144 821
		144 861
		145 149
	636	145 399
	679	145 768
Midwest Applied Science Corp., Lafayette, Ind.	282	144 233
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Midwest Research Inst., Kansas City, Mo.	69	139 232
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	292	144 486
	372	161 317
	523	145 451
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Milan U. (Italy)	608	145 675
Millikan Lab. of Physics, Pomona Coll., Claremont, Calif.	560	144 965
Mine Safety Appliances Co., Callery, Pa.	620	137 517
Minerals Research Lab., U. of California, Berkeley	67	128 604
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Minnesota U., Minneapolis	11	143 393
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	186	161 129
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	250	138 458
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		138 462
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Minnesota U. School of Business Administration, Minneapolis	74	143 459
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Mississippi Southern Coll., Hattiesburg	357	161 316
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Missouri U. Engineering Experiment Station, Columbia	77	143 259
Modena U. (Italy)	133	143 596
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Montana State U., Bozeman	310	144 443
Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia	322	144 155
Motorola, Inc., Chicago, Ill.	380	144 914
Motorola, Inc., Phoenix, Ariz.	52	128 771
Mount Zion Hospital, San Francisco, Calif.	16	143 356
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Narragansett Marine Lab., U. of Rhode Island, Kingston	128	143 702
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National Bureau of Standards, Washington, D.C.	85	151 388
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	545	161 089
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National Research Labs., Ottawa(Canada).	78	143 577
	146	143 579
	190	143 576
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	201	142 878
	309	134 228
	364	144 509
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	541	144 884
	613	145 538
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National Science Foundation Washington, D.C.	451	151 567
National Security Industrial Association, Washington, D.C.	88	143 131
Naval Air Development Center, Johnsville, Pa.	157	144 108
Naval Air Test Center, Patuxent River, Md.	485	145 306
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Naval Avionics Facility, Indianapolis, Ind.	269	144 185
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Naval Boiler and Turbine Lab., Philadelphia, Pa.	421	144 919
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Naval Civil Engineering Lab., Port Hueneme, Calif.	52	161 104
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	515	145 155
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	649	145 158
Naval Construction Battalion Center, Port Hueneme, Calif.	38	143 439
Naval Engineering Experiment Station, Annapolis, Md.	83	143 873
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Naval Ordnance Lab., Corona, Calif. (Con.)	167	144 111
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	167	143 457
		143 823
	190	143 309
	295	144 334
	298	144 158
	311	144 040
	316	144 047
	322	144 048
	326	144 193
	355	145 084
	395	145 030
	397	161 324
	411	144 720
	425	144 722
	431	145 027
	567	144 987
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Naval Ordnance Plant, Indianapolis, Ind.	80	143 893
Naval Ordnance Test Station, China Lake, Calif.	33	130 430
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	292	144 201
	322	144 049
	327	144 481
	367	144 702
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	431	144 876
	474	144 757
	478	145 124
	479	144 984
	479	145 167
	474	144 870
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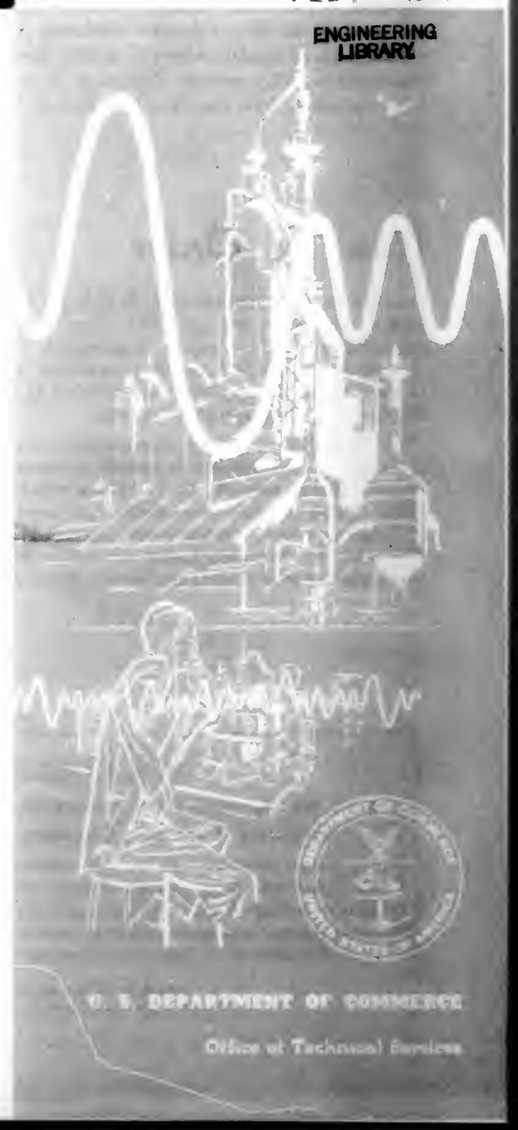

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MISCELLANEOUS

Report on NRL progress. Dec 59. (PB 151 345) $1.25, $10.00/year 97

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Photographic dosimetry at total exposure levels below 20 mr. Oct 59. 26p. (PB 151 388) 50 cents 85

PHYSICS

Deviations from thermal equilibrium in shock waves. 1940 reprinted 1959. 81p. (PB 161 102) $2.25 93

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PHYSICS (con.)

Effect of temperature on the magnetic properties of silicon-iron, cobalt-iron and aluminum-iron alloys. July 59. 57p. (PB 161 078) $1.50 88
Some structural guides to the development of high dielectric constant esters for capacitors. Sep 59. 25p. (PB 151 797) $1.00 92

RESEARCH METHODS, TECHNIQUES, AND EQUIPMENT

Mass spectrometer system for materials: research summary report. Phase I. July 59. 31p. (PB 161 073) $1.00 96

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ASTRONOMY

Astrophysics

Air Force Cambridge Research Center, Bedford, Mass.
THEORETICAL ANALYSIS OF THE PAR-SCOPE: AN OSCILLOSCOPE DISPLAY FOR WEATHER RADARS, by Edwin Kessler, III. July 59, 37p. 20 refs. Instrumentation for Geophysics and Astrophysics no. 12; AFCRC-TR-59-244.
Order from OTS $1.00 PB 161 100

The PAR-Scope, an oscilloscope display for use with pulsed radars and fluctuating targets, uses gated averaged amplitude information as one coordinate and azimuth or elevation as the other coordinate; its display is a profile of the average reflectivity of the target for the radar waves. The PAR-Scope is operated with a scanning antenna, permitting simultaneous operation with the Range-Height Indicator or Plan-Position display. Such combinations provide means for rapid three-dimensional quantitative mapping of average reflectivity in the vicinity of the radar, and should be of importance in studies seeking to relate the distributions of radar weather echoes to the air motions. Theoretical analysis of PAR-Scope performance considers the response of the scanning system to spatial variations of average reflectivity and to the rapid fluctuations characteristic of weather echoes. It is shown that reflectivity distributions of major interest can be easily represented to an accuracy within 1 db of that implicit in the radar calibration.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
BIBLIOGRAPHY OF EXTRATERRESTRIAL RADIO NOISE: SUPPLEMENT FOR 1952, by Martha Stahr Carpenter. Rept. on Contract N6onr-401(22). 15 Apr 58, 89p. 134 refs. Research rept. EE-371.
Order from LC mi$4.80, ph$13.80 PB 143 350

See also PB 135 731

Harvard Coll. Observatory [Cambridge, Mass.]
THE OPERATION OF A SOLAR OBSERVATORY AT SACRAMENTO PEAK, NEW MEXICO, by Donald H. Menzel, Henry J. Smith and Barbara Bell. Final rept. on Contract AF 19(604)146., 22 Dec 58, 34p. 55 refs. AFCRC TR-58-288.
Order from LC mi$3.00, ph$6.30 PB 138 810

Miscellaneous Operations included the improving of the photographic laboratory, devising of new processing techniques, and general collaboration on standardization of photographic procedures. Considerable new work has been done in the field of optical engineering, toward the long-range improvement of existing equipment and the construction of new accessories. Some attention given to the problem of automatic data reduction. Solar-Terrestrial Correlations studies have been carried on relative to geomagnetism, corona, sunspots, flares, and various terrestrial ionospheric effects. Theoretical developments in magnetohydrodynamics, the dynamics of ionized media, collision processes and shock waves, torsional oscillations and solar magnetic fields have simplified and clarified many important subjects. Another important theoretical study has been the development of new techniques for calculating the intensities of spectral lines of complex atoms.

Lowell Observatory, Flagstaff, Ariz.
THE COLOR-MAGNITUDE DIAGRAM OF THE PLEIADES CLUSTER II, by H. L. Johnson and R. I. Mitchell. Final rept. on Contract Nonr-1674(00) [1958] 17p. 13 refs.
Order from LC mi$2.40, ph$3.30 PB 138 610

Two or three-color photographic and photoelectric photometry of virtually all of the known members of the Pleiades cluster is given. The photographic photometry was done on plates taken with the 13-inch telescope, while the photoelectric work was done with the 21-inch and 42-inch reflectors of the Lowell Observatory. We believe that a number of the stars that were previously thought to be members of the Pleiades are actually not members. We find a total of 262 members and 27 probable brighter than $V = 16$. No white dwarfs were found; they would have been if they were brighter than $M_V = 11.8$. A sudden increase in the width of the main sequence is observed at $V = 12.0$. This scatter may be associated with the probable fact that the fainter stars

are still in the process of gravitational contraction. A "flare" of one faint Pleiades star was observed, and five other faint stars are thought also to be "flare" stars. It is suggested that the "flare" activity might be connected with the process of gravitational contraction of young late-type stars.

Manchester U. (Gt. Brit.).
RESEARCH ON MOON ECHO PHENOMENA, by J. V. Evans. Final technical rept. for 1 May 56-1 May 59 on Contract AF 61(514)947. [1959] 33p. 23 refs. AFCRC-TR-59-184.
Order from LC mi$3.00, ph$6.30 PB 143 520

The research work summarized is concerned with the study of radio reflections from the moon. Results have been obtained both at 100 Mc/s and 120 Mc/s which indicate that at these frequencies the moon behaves as a quasi-smooth reflector such that 50% of the returned power is reflected from a region at the centre of the visible disc having a radius of about 1/10th of the moon's radius. The echoes show long period fading which has been attributed to the magneto-ionic effect in the earth's ionosphere. By observing this fading on two close spaced frequencies it has been possible to obtain measures of the total electron content of the ionosphere. These results indicate that for most of the time there are three times the number of electrons above the height of the critical frequency to the number below. Hence the ionosphere must extend to about 1,000 kms. above the surface of the earth.

Minnesota U. School of Physics, Minneapolis.
AURORAL X-RAYS, COSMIC RAYS AND RELATED PHENOMENA DURING THE STORM OF FEBRUARY 10-11, 1958, by J. R. Winckler, L. Peterson and others. Nov 58, 36p. 12 refs.
Order from LC mi$3.00, ph$6.30 PB 143 418

Balloon observations were made during the auroral storm of February 10-11, 1958 at Minneapolis. Strong x-ray bursts in two groups were detected. The groups appeared coincident with two large magnetic bays, with strong radio noise absorption, and with the passage across the zenith of a very large array of auroral luminosity. From the x-ray intensity and measured energies an electron current of 0.6×10^6 electrons/cm^2/sec is present. These electrons ionizing the upper D-layer account for the increased cosmic noise absorption. The x-rays themselves are 1000 times less intense and do not provide sufficient ionization. Visual auroral forms during this storm are reported to have lower borders at the 200-300 km level. There is thus a difficulty in bringing the electrons to the D-layer without an accompanying visible aurora. A cosmic ray decrease accompanied the storm and was observed to be from 4% to 6% at sea level, 21% in the balloon altitude ionization, and 15% in total energy influx at 55° geomagnetic latitude. Compared to the great intensity of the magnetic and auroral phenomena in this storm, the cosmic ray modulation is not exceptionally large.

Northwestern U., Evanston, Ill.
A STUDY OF THE STARS IN THE ORION CLUSTER (1) [AND] A STUDY OF THE GALACTIC CLUSTER h PERSEI (2) by K. Aa. Strand. Final rept. on Investigation and Research in Astronomy, Contract Nonr-2115(00). Oct 58, 5p.
Order from LC mi$1.80, ph$1.80 PB 143 707

Brief comments were made on the several directions of research.

Ohio State U. Research Foundation, Columbus.
RELATIVE SOLAR INTENSITY OBSERVATIONS AND ATMOSPHERIC TRANSMISSION OF STARLIGHT, by Roger Hosfeld, George J. Neilson, and J. Allen Hynek. Final rept. on Contract AF 19(604)2039. 1958, 22p. 1 ref. RF proj. 717; AFCRC TR-58-259.
Order from LC mi$2.70, ph$4.80 PB 139 169

Under this contract a photoelectric photometer was developed for measuring the surface brightness of the sun by comparison with the intensity of stars during the daytime. A stepwise method of decreasing the solar signal was incorporated into the procedure. The signal reduction was accomplished by the use of objective and focal plane diaphragms, optical scattering, and electronic attenuation, with each step subject to calibration. The photometer also permits photoelectric examination of solar surface details of the order of 3 seconds of arc in diameter. Stellar scintillation studies carried out during this investigation were primarily concerned with the variations in scintillation signals observed through a rectangular aperture at different orientations in azimuth, and their relationship to wind direction and velocity in the earth's upper atmosphere. A compact, specialized telescope developed for this purpose utilized a rotating rectangular section of an off-axis parabolic mirror of 24-inch focal length.

BEHAVIORAL SCIENCES

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TRACKING PERFORMANCE AS A FUNCTION OF FEEDBACK SPECIFICITY, by Darwin P. Hunt. Rept. on Criteria for the Design and Arrangement of Displays. Mar 59, 39p. 8 refs. WADC Technical rept. 58-584; AD-212 311.
Order from OTS $1.00 PB 161 070

The research reported herein was conducted to determine (a) the relationship between complex compensatory tracking and the specificity of displayed error, i.e., the number of categories of error information, and (b) the extent to which this relationship is influenced by task difficulty and amount of practice. Tracking error and control motion were the criterion measures. The results suggest that (a) linear increments in the number of categories of error information result in a negatively accelerated reduction in the tracking error; (b) as the operator becomes more proficient, the superiority of the greater number of categories is reduced; (c) the effects of the number of categories of information on control motion depends upon the difficulty of the task; and (d) although the amount of control motion generally decreases as the operator becomes more proficient, the magnitude of this decrease is greater for the "easy" task than for the "difficult" task.

School of Aviation Medicine, Randolph AFB, Tex.
CHANGES IN PLASMA CORTICOSTEROIDS AND BICARBONATE AS A RESULT OF PILOTING SUPERSONIC AIRCRAFT, by Henry B. Hale, James P. Ellis and Clyde H. Kratochvil. Apr 59, 5p. 10 refs. Rept. 59-61.
Order from LC mi$1.80, ph$1.80 PB 143 742

While flying high-speed military aircraft, pilots frequently hyperventilate to a degree sufficient to induce marked alkalosis. Psychogenic factors are thought to be responsible for the hyperventilation. Comparison was made of pre- and postflight plasma bicarbonate (determined titrimetrically) and corticosteroid levels (Sweat's technic) for 20 instructor pilots and 47 student pilots flying F-100 aircraft for 50 minutes. No differentiation of students and instructors was possible on the basis of either pre-or postflight values; therefore, the data for the two groups were combined. The plasma bicarbonate value following the flight was $1.1 \pm .24$ mEq./liter (mean $\pm$S.E.) lower than before the flight. Free 17-hydroxycorticosterone was increased $5.8 \pm .70$ μg./100 ml., while conjugated 17-hydroxycorticosterone increased $5.7 \pm .75$. The free corticosterone-like fraction increased $3.1 \pm .34$ μg./100 ml., while the conjugated corticosterone-like fraction increased $3.2 \pm .35$. Each of these changes was significantly different from zero ($P < .001$). No statistically significant correlation was found between the fall in bicarbonate and any of the increases in steroid fractions.

Personnel and Training

Human Resources Research Office, George Washington U., Washington, D. C.
THE DEVELOPMENT OF JOB DESCRIPTIONS FOR NIKE AJAX BATTERY OFFICERS, by Charles L. Darby, William F. Brown and others. Rept. on [Contract DA 49-106-qm-1]. Apr 59, 81p. Technical rept. 54.
Order from LC mi$4.80, ph$13.80 PB 143 565

This study is the first stage of a research project designed to determine the level of skill and knowledge required of officers assigned to NIKE AJAX batteries, so that courses of instruction can be scientifically devised to train officers for maximum effectiveness. Job descriptions were developed for the positions of Battery Commander, Battery Executive Officer, Integrated Fire Control Platoon Leader, and Launcher Platoon Leader. Information was obtained from experienced battery officers, based on the job descriptions, through check-list responses indicating the training needs associated with selected activities. The activities judged most important for all four officer positions were: serving as battery control officer, insuring equipment readiness, and training and evaluating operators.

Institute of Personality Assessment and Research, U. of California, Berkeley.
THE USE OF TRAIT RATINGS IN AN ASSESSMENT OF 100 AIR FORCE CAPTAINS, by Donald G. Woodworth and Donald W. MacKinnon. Rept. on Contract AF 18(600)08. Sep 58, 44p. 17 refs. WADC-TN-58-64; AD-202 845.
Order from LC mi$3.30, ph$7.80 PB 143 386

As part of a project for developing officer assessment techniques, 30 rating dimensions were used by 10 raters to record their psychological evaluations of 100 captains. A cluster analysis of these ratings yielded three reliable cluster scores. Analyses indicated that the three cluster scores could be defined as measuring general effective intelligence, personal soundness and assessability, and effective leadership. The three cluster scores did not correlate significantly with available Air Force criterion evaluations of the subjects. When the subject officers were differentiated on the basis of being rated or nonrated, it was found that the correlations between cluster scores and two of the criteria rose to levels which were significant within the rated group. This was interpreted as an indication that differentiation on the criterion side of the relationship is needed for significant advancement toward an understanding of the Air Force officer personnel evaluation variables, or the relating of psychologically meaningful measures to these criteria.

Naval Personnel Research Field Activity, San Diego, Calif.
DEVELOPMENT AND STANDARDIZATION OF WOMEN'S MECHANICAL TEST FORM 6W, by Bernard Rimland and John H. Steinemann. Dec 58, 18p. 3 refs. BuPers Technical Bulletin 58-14.
Order from LC mi$2.40, ph$3.30 PB 143 254

MECH 6W represents an improvement over the previous test used for Waves in several respects. The raw score mean on the 100 item MECH 6W is 49, as compared with 36 on the previous test. Only four per cent of Waves tested fell below the chance level on MECH 6W as compared with 22 per cent on the previous test. The standard deviation has been raised from 8.11 to 10.94. The correlation between MECH 6W and the previous test is .80 for a sample of 300 Waves and .91 for a sample of 412 male recruits. (These coefficients are to some extent inflated by an overlap of items in the two tests, however). Adoption of MECH 6W for the testing of Wave recruits appears warranted.

Naval Personnel Research Field Activity, San Diego, Calif.
EFFECT OF EXTRANEOUS NUMERICAL INFORMATION ON THE U. S. NAVY ARITHMETIC TEST, by Bernard Rimland. March 59, 17p. 5 refs. BuPers Technical Bulletin 59-4.
Order from LC mi$2.40, ph$3.30 PB 143 252

The subtests containing extraneous information tended to be less homogeneous (i.e., to have smaller variances, Kuder-Richardson reliabilities and smaller item-test correlation coefficients) than the subtests composed of the same items without extraneous information. The findings of this research do not support

the inclusion of extraneous information in arithmetic reasoning items if a relatively pure and homogeneous measure of arithmetic reasoning is desired, as is the case in the Navy Arithmetic Test.

Naval Personnel Research Field Activity, San Diego, Calif.
EFFECTS OF TIME LIMITS AND OF "RIGHT ANSWER NOT GIVEN" IN THE U. S. NAVY ARITHMETIC TEST, by Bernard Rimland. May 59, 18p. 6 refs. BuPers Technical Bulletin 59-5.
Order from LC mi$2.40, ph$3.30 PB 143 253

The use of "right answer not given" as a possible response to the arithmetic reasoning items was not found superior to the use of five numerical choices. The use of "right answer not given" as a possible response increased the difficulty of the test to a slight (but statistically significant) extent. No evidence was found indicating that any combination of 10, 12 or 14 minute time-limits for the computation subtest and 30, 35 or 40 minute time-limits for the reasoning subtest was better than the original operational combination of 12 and 35 minutes. The insensitivity of the Arithmetic Test to reductions of about seven minutes consideration should be given to reducing the time limits, providing that later research shows this to be possible with no reduction in validity.

Naval Personnel Research Field Activity, Washington, D. C.
VALIDITY OF NON-COGNITIVE TESTS AT NUCLEAR POWER SCHOOL (SUBMARINE) by David Kipnis and Albert S. Glickman. May 59, 16p. 1 ref. BuPers Technical Bulletin 59-6.
Order from LC mi$2.40, ph$3.30 PB 143 251

The results obtained with the experimental tests indicate that they may be valuable supplements to current cognitive predictors of NP school performance. If confirmed by additional research already in progress, two potential benefits are in prospect: (a) it will be possible to increase the accuracy of selection, improve quality of manpower input, and increase the level of performance in programs such as these; or (b) it will be possible to increase the pool of men capable of performaing satisfactorily while maintaining the standards that are considered satisfactory at present.

Navy Experimental Diving Unit, Naval [Weapons Plant] Washington, D. C.
MECHANICAL RESPIRATOR TECHNIQUES IN THE EVALUATION OF SCUBA, by G. M. Janney and W. F. Searle, Jr. 30 June 58, 46p. Research rept. 6-58.
Order from LC mi$3.30, ph$7.80 PB 139 171

A "mechanical respirator" has been and is currently used in research and evaluation projects at the Experimental Diving Unit to determine breathing resistance in breathing apparatus. The equipment and the procedure followed when using it are described. The accuracy and the usefulness of the data obtained through the use of the mechanical respirator are discussed.

Personnel Lab., Wright Air Development Center, Lackland AFB, Tex.
FEASIBILITY OF A METHOD FOR ESTIMATING SHORT-TERM AND LONG-TERM EFFECTS OF POLICY DECISIONS ON THE AIRMAN PERSONNEL SYSTEM, by John W. Merck and Frank B. Ford. June 59, 21p. 1 ref. WADC-TR-59-38; AD-217 079.
Order from LC mi$2.70, ph$4.80 PB 143 689

This report describes and indicates the utility of a model which simulates the flow of airmen through the Air Force personnel system under a given set of policies. This model makes it possible to estimate, with as much accuracy as is available in the input information, the effects of that set of policies at future points in time. These effects may be gauged in terms of the future distribution of grade levels, career fields, or other pertinent information which may be built into the model.

Personnel Lab., Wright Air Development Center, Lackland AFB, Tex.
OCCUPATIONAL CLASSIFICATION IN SOME MAJOR GOVERNMENT AGENCIES, by Joseph E. Morsh and Forrest R. Ratliff. WADC-TN-59-37; AD-212 540.
Order from LC mi$4.80, ph$13.80 PB 143 690

On the basis of information obtained during personal visits and conferences, current practices in occupational classification in some major military and civilian agencies of the Federal Government are reported. The following agencies are included: Department of the Air Force, Bureau of Naval Personnel in the Department of the Navy, the Adjutant General's Office in the Department of the Army, the Bureau of Labor Statistics and the Bureau of Employment Security in the Department of Labor, the Census Bureau in the Department of Commerce, and the United States Civil Service Commission. The prime purpose of the survey was to generate hypotheses for the furtherance of occupational classification research in the Air Force. In a concluding section of the report the present state-of-the-art of occupational classification is discussed and research implications are suggested.

Personnel Research and Development Corp., Cleveland, Ohio.
THE INFLUENCE OF RATING SCALE CONSTRUCTION UPON THE CHARACTERISTICS OF RATINGS RENDERED. Rept. on Contract Nonr-2221(00). Oct 58, 136p. 5 refs.
Order from LC mi$6.90, ph$21.30 PB 143 703

Four rating scale formats were used by the first and second line supervisors of four groups of clerical workers. The formats varied from unstructured to highly structured. The format incorporating trait titles and behavioral descriptions of scale steps demonstrated marked superiority over both more and less structured formats. This format demonstrated higher interrater reliability, less halo and less leniency than did the other formats. Variability was approximately equal for all formats. The study will be reported in four parts. Part I will report respective reliability, leniency, halo, and variability. Part II will be concerned with the characteristics of the eight scales as

they are influenced by the several formats. The comparisons of these self ratings with ratings made by superiors will be presented in Part III. To verify the results of the basic study, truncated versions of Formats I and III were used in two clerical and one manufacturing situation in industrial organizations. These results will be presented in Part IV.

School of Aviation Medicine, Randolph AFB, Tex.
THE PRESENT STATUS OF PHYSICAL FITNESS IN THE AIR FORCE, by Bruno Balke and Ray W. Ware. May 59, 10p. 8 refs. Rept. 59-67.
Order from LC mi$1.80, ph$1.80 PB 143 374

Work capacity, a sensitive and realistic measure of "physical fitness," was determined on more than 500 military and civilian Air Force personnel for the purpose of collecting material for the standardization of physical performance capacity. A treadmill test permitted an evaluation of results in physical as well as in physiologic terms. On the basis of results, physiologic considerations, and observations of men at various stages of physical training, an arbitrary rating scale of work capacity is suggested. According to this pilot study 42 percent of the test population had to be rated as "poor" and 40 percent as "fair." Only 18 percent could be considered as having a "good" or better physical condition. Sedentary living habits, more than aging or other factors, were apparently the main antagonists of good physical fitness.

Washington U., Seattle.
DIFFERENTIAL PREDICTION OF NAVAL SCIENCE AND APTITUDE GRADES AT THE UNIVERSITY OF WASHINGTON FROM BATTERIES OF FOURTEEN AND OF THREE VARIABLES, by Thomas D. F. Langen. Rept. on Predictor Selection Techniques, Contract Nonr-477(08). Oct 58, 95p. 41 refs.
Order from LC mi$5.40, ph$15.30 PB 143 714

The Washington Pre-College Differential Grade Prediction Battery is an effective instrument for the selection of Naval ROTC students for either the subsidized or the non-subsidized programs. It is slightly superior to either of the instruments now used by the Navy Department in selecting such students. The results of this exploratory study are such as to warrant further study on a larger scale.

Psychology

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TRANSFER OF TRACKING PERFORMANCE AS A FUNCTION OF A DELAY BETWEEN THE CONTROL AND THE DISPLAY, by Marvin Levine. Rept. on Learning and Transfer in Reference to Training Aid Design, Contract AF 18(600)50. Nov 53, 33p. 13 refs. WADC Technical rept. 53-237.
Order from LC mi$3.00, ph$6.30 PB 138 912

Using a one-dimensional, compensatory tracking task, an investigation was made into the way tracking performance transfers as a function of changes in an exponential delay inserted between the operator's control and his display. The research was divided into two studies. The first investigated performance on a transfer task containing a 3.000 second exponential delay following training with delays of either .015, .150, .900, 2.100, or 3.000 seconds in the system. The second investigated performance on a transfer task containing a delay of .015 seconds following training with delays of either .015, .900, or 3.000 seconds in the system. The results show that (a) when operators transfer to the longest delay, training with any of the shorter delays is equally efficient; (b) when operators transfer to the shortest delay, training efficiency decreases with decreasing similarity of the training and transfer situations.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A LINEAR LEARNING MODEL FOR A CONTINUUM OF RESPONSES, by Patrick Suppes. Technical rept. no. 19 on Contract Nonr-255(17). 18 Oct 58, 29p.
Order from LC mi$2.70, ph$4.80 PB 143 018

The aim of the present investigation is to formulate and analyze a linear model for simple learning with a continuum of responses. The analogous model for a finite number of responses has been extensively studied both experimentally and mathematically.

Arizona State Coll., Tempe.
FIRST-ORDER CONDITIONING OF MEANING AND THE PARALLEL CONDITIONING OF A GSR, by Arthur W. Staats, Carolyn K. Staats, and Hugh L. Crawford. Technical rept. no. 6 on Psychological Processes in Language Communication, Contract Nonr-2305(00). Sep 58, 9p. 13 refs.
Order from LC mi$1.80, ph$1.80 PB 143 696

A GSR was conditioned to the word LARGE, as it was presented in a list of words to the Ss, using shock and noise as UCS. The word BIG was also presented at the end of the list to test for generalization of the conditioned GSR. Generalization did not occur. Subsequent to this conditioning procedure, the evaluative meaning of LARGE, and its synonym BIG were measured using an appropriate semantic differential scale. Negative evaluative meaning had been conditioned to LARGE. This meaning did not generalize to BIG. Thus, the same procedure which conditioned a GSR to a word also conditioned negative evaluative meaning to the word--but in neither case did the conditioned response generalize to a synonym word. It was found, in addition, that the intensity of the conditioned GSR was significantly correlated with the intensity of the conditioned meaning response. The results support the theory that word meaning consists of responses which are classically conditioned to a word through systematically pairing it with certain aspects of the environment. Alternative interpretations of the relationship of the GSR and meaning response were discussed. It was pointed out that further studies utilizing the methodology of the present experiment might shed light on the unanswered questions raised by the discussion. In general it was felt that the present procedure would be useful in establishing the principles of the learning of word meaning.

Arizona State Coll., Tempe.
MEANING AND (M): CORRELATED BUT SEPARATE, by Arthur W. Staats and Carolyn K. Staats. Technical rept. no. 7 on Psychological Processes in Language Communication, Contract Nonr-2305(00). Oct 58, 12p. 17 refs.
Order from LC mi$2.40, ph$3.30 PB 143 391

Two approaches to meaning were summarized and contrasted. Word meaning may be considered to be the verbal responses made to the word, or word meaning may be a conditioned response, part of the response elicited by the object denoted by the word. The present paper described the latter as meaning and distinguished word meaning from a word's verbal associates. The correlation between intensity of meaning and verbal associate measures which has been reported was seen to be a result of the artifact that the same operation strengthens both: the more often a word is paired with its associates the stronger the connections between them. In addition, the meaning of the associates is conditioned to the word. This view was supported by showing that the associates of a word have the same meaning as the word. The two approaches to meaning were discussed further and it was concluded that words could not gain meaning through verbal associations per se. Originally, it is through pairing words with systematic aspects of the environment that their meaning is gained. The meaning acquired in this process may later be conditioned to other words.

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
THE MOTIVATIONAL EFFECTS OF REST PERIODS ON PERFORMANCE, by Samuel A. Hicks. Aug 59, 21p. Technical memo. no. 8-59.
Order from LC mi$2.70, ph$4.80 PB 143 532

This study investigated the effects of different rest schedules on the performance of a heavy rotary task. The schedules used were: (1) Fixed Interval (FI) - rest after a given amount of time (2) Fixed Ratio (FR) - rest after a given number or responses. Forty enlisted men were used as subjects for this experiment. The results indicate that for the type of task under consideration here the FR schedule elicits greater total output than does the FI schedule. There are indications that this effect may be a direct result of the work load or physical strength of the operator. Variables requiring further investigation are cited in this report.

Colorado U., Boulder.
SOCIAL AND PERSONALITY FACTORS IN ATTITUDE CHANGE, by O. J. Harvey. Annual technical rept. on Contract Nonr-2149(02). Nov 58, 14p.
Order from LC mi$2.40, ph$3.30 PB 143 462

Connecticut Coll., New London.
CONFORMING BEHAVIOR AND PERSONALITY VARIABLES, by Mortimer H. Applezweig and George Moeller. Technical rept. no. 8 on Contract Nonr-996(02). Apr 58, 25p. 25 refs.
Order from LC mi$2.70, ph$4.80 PB 138 603

Conforming behavior of 41 college freshman women, as measured in an Asch situation, was compared with 38 scales of the Edwards Personal Preference Schedule, the Gough California Psychological Inventory, and the Gordon Personal Profile. It was found that only the Abasement scale of the Edwards, and possibly the Sociability scale of the Gordon were able to generate significant relationships with a kind of behavior which should have been predictable from some 12 to perhaps 27 of the 38 measures used. Excepting the five scales of Gough's 18, on the basis of questionable comparability of samples, a total of 33 measures were correlated with conformity behavior. Only two were found to have construct validity for this type of social conformity criterion.

Educational Testing Service, Princeton, N. J.
EMPIRICAL TRIAL OF METHODS FOR ESTIMATING THE DISTRIBUTION OF TRUE SCORES, by Frederic M. Lord. Rept. on Contract Nonr-2214(00). Oct 58, 16p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 143 698

For each of two groups of examinees, the third and fourth moments of the distribution of true scores on a French achievement test are estimated by two different methods. One set of estimates results directly from the classical assumptions that the errors of measurement are distributed normally and independently of true score. The other set of estimates is obtained under the "item-sampling" model. A check is obtained on the item-sampling model by (a) applying it to the two groups separately, (b) applying it to the same groups combined. Pearson type-I curves are fitted to the estimated moments and the resulting estimated frequency distributions of true scores are drawn. The two methods of estimation are found to give almost the same results for the four-semester group, but somewhat different results for the eight-semester group. Theoretical considerations show that the two methods must give nearly the same results when a test is highly reliable. A manageable formula displaying the relation between the two methods of estimation in the case of the third true-score moment is presented.

Educational Testing Service, Princeton, N. J.
RESPONSE SET AS A MEASURE OF PERSONALITY, by Norman Frederiksen and Samuel Messick. Rept. on Contract Nonr-694(00). Feb 58, 34p. 36 refs. AD-156 771.
Order from LC mi$3.00, ph$6.30 PB 138 339

The present research was primarily oriented toward the use of response sets to measure stylistic consistencies revealed in test-taking behavior. The study was concerned with whether or not set scores could be obtained independently of content and with at least potentially useful reliability. Also investigated were the extent to which set and content scores obtained from different tests measure the same or different characteristics, and the extent to which set scores change with experimental conditions designed to modify set. The major findings were: (1) Reliable set scores can be obtained. (2) The three "criticalness" set scores were found to be substantially intercorrelated. (3) "Critical" instructions altered mean

criticalness set scores in the expected direction to an extent that is significant for one test, nearly significant for another test, and non-significant for the third test. (4) Although uncritical tendencies are correlated with acquiescence, the two response sets are not identical. (5) Content scores from the report-writing tests were found to be intercorrelated with each other, but low correlations were obtained between content and set scores. (6) Content scores were related to Mathematics Aptitude, Reasoning, and Vocabulary, but "criticalness' set was generally unrelated to ability. (7) Patterns of correlations with personality variables suggest the possibility of using different response sets to measure various personality consistencies.

Iowa State U. [Iowa City].
SENTENCE COMPLETIONS E: SUSCEPTIBILITY TO "SCORE FAKING", by Arthur L. Benton, Harold P. Beechtoldt, and Joan D. Kemble. Rept. on Research on Aptitude-for-Service Tests for Enlisted Personnel, Contract Nonr-311(11). 15 Apr 58, 5p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 138 841

Sentence Completions E consists of 20 incomplete sentences, each with three possible endings which the subject is required to rank in terms of the one that best describes how he thinks or feels, the one that least well describes how he thinks or feels, and the one that occupies an intermediate position in these respects. There are six possible response patterns associated with each ranked item. For each item there is one response pattern which was found on two independent samples both to be modal for enlisted men with records of successful naval service and also to discriminate significantly between these men and groups of men with records of unsuccessful naval service, as defined by discharges for reasons of personal inadequacy or delinquent conduct. The test is scored in terms of the number of these discriminating response patterns which appear in the total performance.

Louisiana State U., Baton Rouge.
GROUP EFFECTIVENESS, COERCION, CHANGE AND COALESCENCE AMONG DELINQUENTS COMPARED TO NON-DELINQUENTS, by Howard A. Bryant, D. A. Dobbins, and Bernard M. Bass. Technical rept. no. 15 on Behavior in Groups, Contract N7onr-356(09). Oct 58, 16p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 143 392

The hypothesis was tested that institutionalized delinquents are more susceptible to peer group influence than non-delinquent boys matched in intelligence and age. Three groups of 5 delinquents at each of 4 age levels: 14, 15, 16 and 17, were contrasted with 12 corresponding groups of boys from a small town public high school. Each member of each group privately ranked 5 cities according to their estimated size. A discussion followed in order to obtain a group decision. Then a final private decision was recorded by each member. Rank order correlations within and between members were the measures of agreement and accuracy used to test the hypothesis. Although non-delinquents were significantly more in agreement before and after discussion, delinquents increased more in agreement as a consequence of discussion, although not significantly so. The hypothesis generally was supported that delinquents are more sensitive to the effects of interaction with their peers; they coalesce more (but not significantly according to parametric tests); they shift their opinions significantly more; they profit more in accuracy (but not significantly) and they are more coerced by their peers accepting the opinions of others more publicly than privately at all age levels examined. It would appear that delinquents, even more than non-delinquents, are likely to respond to suggestion to change, if the suggestions come from peers during discussion and if group decisions are permitted. The results are consistent with observations about the significance of the gang to the delinquent and suggest that changing attitudes and reeducating delinquents will be facilitated by judicious use of their own peer groups.

Louisiana State U., Baton Rouge
TEST OF A PROPOSED THEORY OF LEADERSHIP, by Bernard M. Bass. Annual rept. no. 4 on Behavior in Groups, Contract N7onr-356(09). 15 Nov 58, 6p. 12 refs.
Order from LC mi$1.80, ph$1.80 PB 143 422

Analyses of data based on an original experiment with 255 subjects have been finished. Attention has been focused on testing specific hypotheses drawn from a theory of leadership and group behavior. The theory itself, with a review of the literature, has been completed. New experiments and methodological examinations carried out. (See also PB 137 057)

Naval Retraining Command, San Diego, Calif.
INTERPERSONAL VARIABLES RELATED TO RECIDIVISM IN MILITARY DELINQUENCY, by Virginia Ives, Marguerite Q. Grant, and Kelley B. Ballard. Technical rept. no. 8 on Rehabilitation Research, Contract Nonr-1535(00). 15 Dec 57, 15p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 138 649

Ninety-one men confined for military disciplinary offenses were interviewed just prior to their restoration to regular duty. The interviews were tape-recorded and the recordings were rated twice independently on 430 rating items. Each of these items was correlated with a dichotomous success-failure criterion based upon a report of each man's duty status six months after restoration. Forty-seven items proved to be significantly related to restoration behavior. The majority of these items appear to be related to aspects of the man's level of interpersonal maturity. The present study is seen as preliminary and will be followed by a more detailed study on a larger sample.

Minnesota U., Minneapolis.
MISCELLANEOUS STUDIES IN WORD ASSOCIATION, by James J. Jenkins and Wallace A. Russell. Technical rept. no. 24 on The Role of Language in Behavior, Contract N8onr-662(16). [1958] 14p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 143 393

Personnel Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SOME STATISTICAL METHODS FOR DETECTION OF NONSTANDARD TEST ADMINISTRATION, by Leland D. Brokaw. Jan 59, 36p. 11 refs. WADC-TN-59-34; AD-210 475.
Order from LC mi$3.00, ph$6.30 PB 143 540

This paper reports the application of statistical techniques to the detection of fallacious values in test score distributions. Fallacious scores may appear from several sources, including cheating, improper procedures of test administration, or errors of scoring. Three techniques were chosen which are peculiarly appropriate to the task of detection of abnormalities of score distributions occasioned by the shifting of a group of scores from its proper place within the distribution: the sign test, the Kolmogorov-Smirnov test, and the significance of the difference between standard deviations. The techniques were applied to eight 100-case samples of basic airmen who had been tested and retested at Lackland Air Force Base on alternate forms of the Armed Forces Qualification Test. A control sample was selected, and the test scores from the other seven samples were altered to replicate conditions encountered operationally. The sign test proved more efficient than the other techniques, identifying six of the seven samples containing fallacious data. The other two techniques each identified four of the seven samples, but not the same four samples.

Psychological Labs., Carnegie Inst. of Tech., Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS. III. CONFORMITY BEHAVIOR: A PSYCHOLOGICAL REINTERPRETATION, by E. P. Hollander. Technical rept. on Contract Nonr-1849(00). Oct 58, 17p. 15 refs.
Order from LC mi$2.40, ph$3.30 PB 143 705

The central thesis developed is essentially as follows: an individual functions within a social field largely in terms of his perception of the "group expectancies" regarding his behavior. Depending upon his motivational and perceptual states, as they relate to certain features of the social field, he will be more or less given to behavior in keeping with these expectancies. Expectancies are not static but rather depend upon the outcome of past interaction between the individual and relevant others. A core element then is the historical or time-linked effects of interaction in determining the countervailing perceptions of the individual and these others.

Psychological Labs., Carnegie Inst. of Tech. Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS. IV. SOME FURTHER FINDINGS ON LEADERSHIP, FOLLOWERSHIP AND FRIENDSHIP, by E. P. Hollander. Technical rept. on Contract Nonr-1849(00). Nov 58, 12p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 143 460

Using poor nomination data secured from graduating medical students at the University of Pittsburgh, an analysis was undertaken paralleling previous the analysis by Hollander and Webb of nominations on leadership, followership, and friendship. Corroboration of these earlier findings was obtained. Some implications were seen regarding the differential evaluative base underlying these nominations.

Psychological Research Association, Inc., Arlington, Va.
A REPORT ON RESEARCH CONCERNING A METHOD FOR OPTIMIZING THE EFFICIENCY OF TRAINING PROGRAMS, by James F. Parker, Jr. Annual rept. on Contract Nonr-2489(00). Dec 58, 14p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 143 617

This report is intended to describe the basic nature of the program and to indicate results which might be forthcoming. It is not designed as a definitive report on results obtained during a particular phase of the project.

Psychologisch Laboratorium van de Universteit te Nijmegen (Netherlands).
THE PROCESS OF ASSIMILATION WITH STRANGERS TO A NEW LIVING AND WORKING ENVIRONMENT. Annual Technical rept. no. 1, 1 Feb 58-1 Mar 59, on Contract DA 91-508-EUC-285. Mar 59, 71p. 1 ref. AD-213 233.
Order from LC mi$4.50, ph$12.30 PB 143 366

The investigation is carried in two separate parts (I and II). Investigation I refers to the process of assimilation with unmarried Italians, natives of Sardinia, who are employed as miners in the Dutch National Coalmines. In this investigation 3 groups of 20 Italians are interviewed. Investigation II refers to the process of assimilation with 40 Indian-Dutch families who were expelled from their native country and settled in the Netherlands in the hope of building up a new existence. The present Report can only give an account of the results of phase I, investigation II.

Vanderbilt U., Nashville, Tenn.
AUTHORITARIANISM AND LEADER ACCEPTANCE, by Edward P. Crockett (Master's thesis). Technical rept. no. 5 on Contract Nonr-2149(02). Oct 58, 22p. 29 refs.
Order from LC mi$2.70, ph$4.80 PB 143 708

The relationship between authoritarianism and acceptance of formal leadership in established organizations was examined from the following standpoints: (a) Acceptance of formal leadership as a function of member authoritarianism. (b) Leader acceptance as a function of leader authoritarianism. (c) Leader acceptance as related to the degree of correspondence between authoritarianism in the leader's and follower's personalities.

Vanderbilt U., Nashville, Tenn.
EXTRAPUNITIVENESS AND AUTHORITARIANISM: CHANGES IN ATTITUDINAL CORRELATES AS A RESULT OF FRUSTRATION, by Jack M. Wright. Technical rept. no. 7 on Contract Nonr-2149(02). [1959] 26p. 17 refs.
Order from LC mi$2.70, ph$4.80 PB 143 710

The results of relating changes in professed attitudes of individuals (as a result of frustration) to extrapunitiveness, as measured by the P-F Study, and authoritarianism, as measured by the California F-scale, and relating these changes to one another, and summarized below. When frustrated by an authority figure, authoritarians increased (in a positive direction) their evaluations of peer group, authority figures, people in general, and self, more than did nonauthoritarians. Evidence was also found to the effect that authoritarians are more easily frustrated than are nonauthoritarians. Through the technique of partial correlation, evidence was found of a tendency on the part of authoritarians to suppress aggression toward a frustrating authority, necessitating an increased positive evaluation of self and others as a form of compensation. Lack of any significant correlations between the P-F Study and changes in the variables, or with the F-scale, is discussed as being the result of lack of consideration on the part of this instrument of certain factors of a social nature which aid in determining reactions to frustration.

Vanderbilt U., Nashville, Tenn.
RECIPROCAL INFLUENCE OF GROUP AND THREE TYPES OF LEADERS IN AN INSTRUCTED SITUATION, by O. J. Harvey. Technical rept. no. 4 on Contract Nonr-2149(02). Oct 58, 21p.
Order from LC mi$2.70, ph$4.80 PB 143 706

The small groups studied were squads from an Army airborne division. From these, three different types of leaders were sociometrically determined. The formal leader was the official squad leader but not preferred as leader by the men. The informal leader was preferred by the men to be the squad leader but was not the official leader. The formal-informal leader was both the official squad leader and preferred by the men to be. The total number of subjects was 354, 285 experimental and 69 control. In comparison to the control groups, the leaders in all conditions conformed markedly to the judgments of the members despite the large differences in the leader and members' stimuli. Even in those conditions where leaders did depart from group judgments in their own evaluations, the influence on the group was almost nil. Significant differences occurred among the different leaders in the extent to which they were influenced by group judgments. Most conforming to the evaluations of other members of the group was the unpopular formal leader in the absolute, or more uncertain, condition. Possible implications of this for military leadership were indicated. Authoritarianism, group satisfaction and solidarity, and informal status in the group did not relate to influencibility. However, members' popularity in the squad did correlate significantly to their influence by the leader in the informal-absolute and informal-gradual conditions, the conditions in which the leader was the one preferred by the men to be their leader.

Vanderbilt U., Nashville, Tenn.
STATUS AND CONFORMITY TO PRESSURES OF INFORMAL GROUPS, by O. J. Harvey and Conrad Consalvi. Technical rept. no. 6 on Contract Nonr-2149(02). Oct 58, 16p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 143 709

This study was concerned primarily with the differential conformity of the leader, second and lowest ranking member to pressures in the informal group. The informal groups were 27 cliques sociometrically selected from a training school for delinquent boys. The main finding of the study was that the second status member, the one only one step removed from the top, was significantly more conforming to judgments of the other members than was either the leader or lowest status man. The leader was least conforming but, due perhaps to smallness of the sample, not reliably less than the lowest status person.

Walter Reed Army Inst. of Research, Washington, D. C.
ASPECTS OF GROUP BEHAVIOR UNDER ATOMIC ATTACK, by Donald N. Michael. Aug 56, 16p. Management of Mass Casualties Publication no. 582.
Order from LC mi$2.40, ph$3.30 PB 143 753

A lecture presented to the students of the course "Medical Care of Atomic Casualties" at Walter Reed Army Medical Center.

[Washington U., St. Louis, Mo. School of Medicine]
THE EFFECTS OF MASSED AND SPACED ELECTROCONVULSIVE SHOCK ON CONFLICT BEHAVIOR IN THE MALE ALBINO RAT, by G. J. Williams. Status rept. for June-31 Dec 57 on Contract Nonr-816(06). [1957] 7p. AD-203 078.
Order from LC mi$1.80, ph$1.80 PB 138 205

See also PB 140 182

Washington U., Seattle.
THE GENERAL AND PRIMARY FACTORS IN STUDENT EVALUATION OF TEACHING ABILITY, by Thomas F. Hodgson. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). Oct 58, 101p. 15 refs.
Order from LC mi$5.70, ph$16.80 PB 143 713

The following points are covered:
Methodology
Studies of the general factor model
Definition of symbols
Simple structure
Orthogonal rotation
Oblique rotation
Extended vector analysis
Final rotated matrix
Analytic solutions
Oblique transformation matrix H and primary factors
Correlations among primary factors
The general factor
Augmented factor space, followed by
Discussion

BIOLOGICAL SCIENCES

Arctic Aeromedical Lab., Ladd AFB, Alaska.
A SIMPLIFIED APPARATUS FOR THE PREPARATION

OF TISSUE SLICES, by John P. Hannon. May 59, 11p. 7 refs. Technical rept. 57-42; AD-220 679.
Order from LC mi$2.40, ph$3.30 PB 143 530

The construction and use of a simple tissue slicing apparatus is described. It offers the following advantages: it can be easily constructed from readily available and inexpensive materials; it is easily adapted to the cutting of different thicknesses of slices; it is simple to learn to use; and it is especially useful where small amounts of tissue are available for slicing.

[Harvard U., Cambridge, Mass.]
TETANUS TOXOID PRODUCTION, by Monroe D. Eaton, Clarke T. Gray, and Pauline Miller. Final rept. for May 54-31 Oct 58 on Contracts N5ori-07655 and Nonr-1866(21). [1958] 12p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 143 394

A summary of observations

Oak Ridge National Lab., Tenn.
GENETIC DIFFERENCES IN HEMOGLOBIN AS MARKERS FOR BONE MARROW TRANSPLANTATION IN MICE, by Raymond A. Popp, G. E. Cosgrove, Jr., and R. D. Owen. Mar 59, 4p. 18 refs. AFSAM rept. 59-44.
Order from LC mi$1.80, ph$1.80 PB 143 368

Both hemoglobin type and red cell serotype seem to be autonomously controlled by the genotype of the nucleated cell from which the erythrocyte is derived. Thus, genetic differences in hemoglobin can be used as markers for bone marrow transplantation in irradiated mice. Hemoglobin typing may be particularly useful where the H-2 markers cannot be used.

Anatomy and Physiology

Aero Medical Lab., Wright Air Development Center Wright-Patterson AFB, Ohio.
THE EFFECTS OF POSITIVE ACCELERATION ON THE RELATION BETWEEN ILLUMINATION AND INSTRUMENT READING, by William J. White and Mitchell B. Riley. Nov 58, 13p. 7 refs. WADC Technical rept. 58-332; AD-206 663.
Order from LC mi$2.40, ph$3.30 PB 143 544

The following basic findings resulted from an analysis of the data from this experiment: (1) At the higher levels of instrument illumination, increasing acceleration and decreasing luminance produce relatively small increase in reading errors. (2) At marginal levels of illumination, acceleration and luminance interact to produce a relatively large increase in error. (3) Intensity of illumination can compensate for the decline in visual performance at stress levels above 1 g.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SHORT TIME HUMAN TOLERANCE TO SINUSOIDAL VIBRATIONS, by Gerd H. Ziegenruecker and Edward B. Magid. Rept. on Acoustic Energy Control. July 59, 18p. 15 refs. WADC Technical rept. 59-391.
Order from OTS $0.50 PB 161 083

Short time human tolerance criteria for sinusoidal vibration from 1 to 15 cps were determined using 10 healthy male subjects ranging in age from 23 to 34 years. At each frequency, the amplitude was increased at a constant rate from zero to the point where the subject stopped the run because he thought that further increase might cause actual bodily harm. The lower levels of tolerance were found to be between 1 and 2 g at 3 - 4 cps and at 7 - 8 cps. The highest tolerance level of 7 - 8 g was found at 15 cps. Subjective tolerance limits were found to be caused by one or more of seven specific sensations or symptoms. Physiological observations during vibration exposure were also made.

Air Force Missile Development Center, Holloman AFB, N. Mex.
PHYSIOLOGICAL EFFECTS OF INERT GASES, by S. F. Cook and H. A. Leon (U. of California). Rept. on Contract AF 29(600)1313. June 59, 40p. 42 refs. AFMDC-TR-59-26; AD-216 891.
Order from LC mi$3.00, ph$6.30 PB 143 657

This report presents the results of investigations on the use of helium and other inert gases in sealed cabin environments. Included in the report is an extensive bibliography of previous work in this field as well as results obtained from experiments conducted under the above contract. This Technical Report is prepared from progress reports and the final report submitted by Professor Cook during and upon completion of the studies.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE EFFECT OF TEMPERATURE ON TOLERANCE TO POSITIVE ACCELERATION, by Benjamin F. Burgess, Jr. Rept. no. 16 on Proj. NM 19 01 12.1; 26 May 59, 13p. 3 refs. NADC-MA-5905.
Order from LC mi$2.40, ph$3.30 PB 143 738

With the advent of space flight, the problems associated with the physiological effects of extreme temperatures may become a critical factor relating to pilot performance under conditions of high acceleration. In order to determine the effects of high environmental temperatures on G tolerance, six trained centrifuge subjects were exposed to positive acceleration in the heated gondola of the Johnsville centrifuge. Seven thermocouples were located at strategic places over the body surface in order to obtain an accurate recording of skin temperature. Although humidity was not controlled, it was recorded during all centrifuge runs. The environmental temperatures studied ranged from 75°F to 160°F where a decrement in G tolerance of 1 G has been obtained at the upper temperature range.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A STUDY OF THE EFFECTS OF POSITIVE ACCELERATION UPON ERYTHROCYTE HYDRATION IN HUMAN SUBJECTS, by Richard L. Fenichel, and George H. Kydd. 12 May 59, 15p. 9 refs. Rept. no. 1 on Proj. NM 19 02 12.2; NADC-MA-5904.
Order from LC mi$2.40, ph$3.30 PB 143 250

The seven subjects employed in this study were exposed to a standardized pattern of positive G. Each subject experienced positive accelerations, which were begun at 1.5 G and were increased at half G increments, with 5-minute rest periods between runs, until the subject lost peripheral lights. Table I shows the acceleration schedule that was employed. Blood samples were drawn before the acceleration series was begun, after the third run, and after the run in which the subject lost peripheral lights.

California Agricultural Experiment Station, Davis.
PHYSIOLOGICAL RESPONSES TO ARTIFICIAL ALTERATIONS IN WEIGHT, by C. F. Kelly, A. H. Smith, and C. M. Winget. Annual progress rept. no. 2, 15 Apr-15 Dec 57, on Contract Nonr-2211(01). 15 Dec 57, 30p.
Order from LC mi$2.70, ph$4.80 PB 138 628

These experiments indicate that chickens can survive accelerative forces up to 4 G_S, though with considerable mortality and growth repression. Up to 2.5 G_S, however, this treatment appears to have little effect (i.e., normal growth and negligible mortality). No definite syndrome has been established for birds dying while exposed to an accelerative force. Birds grown under an accelerative force show some anatomic changes. Physiological changes observed have been quite variable, and sometimes contradictory between different trials. It is assumed that these differences arise from other factors (age of animals, temperature acceleration schedule, etc.) and can be rationalized with the accumulation of more data. Consistent changes have been observed in heart rate (increased) and respiratory frequency (decreased). On return to normal gravity, the physiological differences between centrifuged birds and their controls disappear in about 3 weeks. In some cases there is a period of over compensation (viz.: respiratory frequency, which is decreased in centrifugation, becomes faster than the controls during the first two weeks at normal gravity.) Some progress has been made on the development of a high-G_S strain.

California Inst. of Tech. [Pasadena].
FACTORS STIMULATING PRODUCTION OF HEMOGLOBIN AND RED CELLS. Annual rept. for year ending 31 Dec 57 on Contract Nonr-220(09). 6 Dec 57, 2p.
Order from LC mi$1.80, ph$1.80 PB 138 650

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
PERCEPTRON SIMULATION EXPERIMENTS, by Frank Rosenblatt. Rept. on Contract Nonr-2381(00). June 59, 37p. 8 refs. Rept. VG-1196-G-3.
Order from OTS $1.00 PB 161 065

A number of papers and reports have been published describing the theory of a new brain model called the perceptron. The perceptron is a minimally constrained "nerve net" consisting of logically simplified neural elements, which has been shown to be capable of learning to discriminate and recognize perceptual patterns (References 5, 6, 7, 8). This paper is concerned with a report of digital simulation experiments which have been carried out on the perceptron, using the IBM 704 computer at the Cornell Aeronautical Laboratory. These experiments are intended to demonstrate the performance of particular systems in typical environmental situations, free from any approximations which have been used in the previously published mathematical analyses. In the simulation programs, the action of every cell and every connection in the network is represented in detail, and visual stimuli are represented by dot patterns corresponding to illuminated points in a retinal mosaic.

Florida U. Coll. of Medicine, Gainesville.
ESTIMATION OF THYROXINE OUTPUT BY THE THYROID GLANDS OF NORMAL AND ADRENALECTOMIZED RATS BY MEANS OF A SIMPLE COOLING TEST, by Melvin J. Fregly. May 59, 8p. 17 refs. AFSAM rept. 59-28.
Order from LC mi$1.80, ph$1.80 PB 143 383

Adrenalectomy, administration of propylthiouracil, or a combination of these two treatments increased significantly the rate of cooling of rats restrained and subjected to air at 5° C. Propylthiouracil administration increased rate of cooling 55 percent above that of untreated control rats while adrenalectomy increased rate of cooling 84 percent. The combination of these two treatments increased rate of cooling 99 percent. Dead rats cooled 201 percent faster than control rats. Administration of graded doses of thyroxine to both adrenalectomized-PTU-treated rats and to normal-PTU- treated rats indicated that 1.9 and 4.4 gamma per day of thyroxine, respectively, were required to return rate of cooling to that of comparable controls. These doses are, therefore, the best estimates of thyroxine outputs by thyroids of these animals. The results suggest that adrenalectomy is accompanied by diminished thyroid function. This fact makes difficult any evaluation of the relative roles of thyroid gland and adrenal glands in the maintenance of body temperature of rats exposed to cold.

Institute of Andean Biology, Lima (Peru).
CREATININE EXCRETION AND BODY COMPOSITION AT HIGH ALTITUDES, by Emilio Picón-Reátegui. Feb 59, 9p. 16 refs. AFSAM rept. 58-98.
Order from LC mi$1.80, ph$1.80 PB 143 749

To test the hypothesis that urinary creatinine can be used in the prediction of body compartments we have measured urinary creatinine excretion and related these data to body mass and to body compartments on the same subjects.

Johns Hopkins Hospital, Baltimore, Md.
A BUBBLE METHOD FOR ESTIMATION OF P_{CO_2} AND P_{O_2} IN WHOLE BLOOD [AND] AN ANALYSIS OF ERRORS IN THE BUBBLE METHOD FOR ESTI-

MATION OF P_{CO_2} AND P_{O_2} IN WHOLE BLOOD, by Richard L. Riley, Richard H. Shepard and others. Nov 58, 21p. 22 refs. AFSAM repts. 58-(135, 136). Order from LC mi$2.70, ph$4.80 PB 143 385

A detailed description is presented of a bubble-equilibration method for determination of carbon dioxide and oxygen tensions in blood. This modification represents an attempt to adopt the best features of previously published methods with special emphasis on speed, simplicity, and standardization of technic.

Mount Zion Hospital, San Francisco, Calif.
STUDIES OF THE RELATIONSHIPS BETWEEN NEUROPHYSIOLOGICAL AND BEHAVIORAL PROCESSES IN MAN, by Bertram Feinstein. Final rept. for 1 Apr 56-30 June 58 on Contract AF 18(603)48. 17 July 59, 49p. 6 refs. AFOSR-TR-59-58; AD-216 107. Order from LC mi$3.30, ph$7.80 PB 143 356

Instruments and test facilities developed for research in cerebral electrophysiology under the present contract are described. Two papers are included, a stereotaxic technique in man allowing multiple spatial and temporal approaches to intracranial targets, by Bertram Feinstein and Elwood W. Wright, and a stimulus pulse polarity reversal unit, by W. Watson Alberts (reprint).

Pennsylvania U., Philadelphia.
THERMAL RADIATION IN PHYSIOLOGY, by James D. Hardy. Final rept. for 15 Nov 57-1 July 58 on Contract Nonr-551(11). 15 Nov 58, 7p. 13 refs. Order from LC mi$1.80, ph$1.80 PB 143 466

Development of a radiometer for recording and measurement of skin temperature.

Quartermaster Research and Engineering Center, Natick, Mass.
EFFECT OF CONTINUOUS COLD EXPOSURE ON NOCTURNAL BODY TEMPERATURE OF MAN, by M. B. Kreider, P. F. Iampietro and others. July 59, 10p. 6 refs. Technical rept. EP-117. Order from LC mi$1.80, ph$1.80 PB 143 413

Effects of continuous cold stress on 24-hour patterns of body temperature were studied in 5 men. Cold stress consisted of living at 60°F (15.6°C) for 14 days, wearing only shorts. This cold period was preceded and followed by 2 weeks at 80°F (26.7°C). Activity (minimal) and diet were the same for the entire 42-day period. One blanket was used at night. Rectal temperatures (T_r) and skin temperatures (T_s) were measured. During sleep T_r fell more rapidly and to lower values (35.6°C) during cold exposure than during the control period (36.1°C). During sleep T_s was slightly lower in the cold than in the control period; also, T_s did not exhibit the gradual drop characteristic of sleep in the control period. Comparison of T_r and T_s between the first 2 days and the last 2 days of cold period revealed the following differences: (1) nocturnal T_r fell 0.23 degrees C(0.4 degrees F) lower on the later cold nights; (2) nocturnal toe temperatures were 15 degrees C (27 degrees F) higher on the later cold nights. Temperatures of the arch followed the same pattern as those of the toe. No significant differences were found in daytime temperatures between early and later cold days. The data suggest that evidence for acclimatization to cold in terms of altered body temperature responses may be fruitfully sought in responses during rewarming and/or sleep.

St. Louis U. School of Medicine, Mo.
FAILURE IN TEMPERATURE REGULATION DURING PROGRESSIVE DEHYDRATION, by Alrick B. Hertzman and Iain D. Ferguson. Rept. on Physiology of Flight, Contract AF 33(616)3357. July 59, 32p. 44 refs. WADC Technical rept. 59-398. Order from OTS $1.00 PB 161 084

During exposure to an ambient temperature of 43.3°C. (110°F.) without food or water, the body weights of young male subjects decreased at the rate of 0.5 per cent per hour of exposure, their body temperatures rose 0.1°C. per hour, but the total sweat production changed little despite the increase in body temperature Calculations indicated that the latter was due to a slightly inadequate sweating which in turn was attributed to a rising thermal threshold for sweating. Regional sweating rates varied widely during the exposure, particularly on the upper parts of the body. Cutaneous conductances, thermal circulatory indices and the pad pulses in the finger and toe changed very little; there was no evidence of peripheral circulatory failure in these experiments. The theoretical implications are discussed.

School of Aviation Medicine, Randolph AFB, Tex.
AUDITORY ACUITY MEASURED BY AUTOMATIC AND MANUAL AUDIOMETRY, by Max H. O'Connell. Nov 57, 6p. 11 refs. Rept. 58-13. Order from LC mi$1.80, ph$1.80 PB 138 995

Auditory thresholds were established for 24 subjects on the Rudmose model ARJ-3 audiometer, on the SAM model 56-2 automatic audiometer, and on the standard Maico H-1 audiometer. The test results are compared by percent agreement and probability of such differences occurring by chance. The result of one retest per subject is also given. Additional test-retest data obtained at the 1955 Wisconsin State Fair, using the SAM model 56-2, are presented.

School of Aviation Medicine, Randolph AFB, Tex.
MEASUREMENT OF AUDITORY THRESHOLD BY MANUAL AND SAM AUTOMATIC AUDIOMETRY, by Max H. O'Connell and Paul M. Baccaro. Mar 59, 11p. 10 refs. Rept. 58-131. Order from LC mi$2.40, ph$3.30 PB 143 746

Threshold data were obtained on two groups of unskilled listeners -- one group with "normal" hearing and the other with "subnormal" hearing. No significant differences were found between the single descent and triple descent audiometric technics when averaged

over the two groups; test-retest reliability coefficients were .84 and .96 for the normal and subnormal groups, respectively. The SAM Model 57-1 automatic audiometer provided test results which were significantly different from the average of single and triple descent audiometry. Test results showed significantly poorer thresholds at 500, 1000, and 6000 cps, a significantly better threshold at 4000 cps, and no significant difference at 2000 cps for the normal group. The subjects in the subnormal group showed significantly poorer thresholds at 500, 1000, 2000, and 6000 cps, significantly better thresholds at 4000 cps, and no significant difference at 3000 cps. Although the results showed statistically significant differences between manual and automatic audiometry, the three test methods yielded mean threshold scores which were highly similar.

School of Aviation Medicine, Randolph AFB, Tex.
PHYSIOLOGIC RESPONSE TO SUBGRAVITY: MECHANICS OF NOURISHMENT AND DEGLUTITION OF SOLIDS AND LIQUIDS, by Julian E. Ward, Willard R. Hawkins, and Herbert D. Stallings, Jr. Jan 59, 5p. 4 refs. Rept. 59-2. Order from LC mi$1.80, ph$1.80 PB 143 585

In order to study the mechanics of nourishment during weightlessness, 165 subgravity parabolas were flown in an F-94C aircraft. Twenty-five experimental subjects attempted to drink from an open container, a contained fitted with pierced lid and plastic straw, and a plastic squeeze bottle. Observations were made regarding deglutition of solids, including swallowing of both well and poorly masticated boli. Drinking from open containers proved to be more difficult than had been anticipated. For reasons of safety, closed containers, such as squeeze bottles, must be used to transfer liquids to the mouth under conditions of zero-gravity; the use of straws is not practical. Deglutition of liquids or well masticated solids can be accomplished with little or no difficulty in the weightless state. However, a large solid bolus of food is a potential aspiration problem. Regurgitation of stomach contents may become a serious annoyance during orbital flight. Only a small quantity of liquids should be taken at one time. Movements or abdominal pressures, which may initiate vomiting, must be avoided.

School of Aviation Medicine, Randolph AFB, Tex.
SOURCES OF VARIABILITY AMONG ARTICULATION TESTS FOR NORMAL EARS WITH PB WORD LISTS, by Asher S. Wolfe and Max H. O'Connell. Mar 59, 7p. 12 refs. Rept. 58-123. Order from LC mi$1.80, ph$1.80 PB 143 747

Results of the experiment indicated that: (1) test scores were poorer for the higher signal intensity levels; (2) one test list was definitely more intelligible than the other three lists at all presentation levels; (3) linear increases in articulation scores, as the tests proceeded, were not significant thus tending to refute a learning effect; and (4) the low reliability of these lists precludes the acceptance of the test material as a reliable measurement tool.

University Hospitals, Iowa City, Iowa.
BEATS IN COCHLEAR MODELS, by Juergen Tonndorf. June 59, 22p. 18 refs. AFSAM rept. 59-57. Order from LC mi$2.70, ph$4.80 PB 143 584

Beats in cochlear models were studied from two aspects: (1) Their effect upon cochlear fluid motion which, occurring along elliptic orbits, essentially represent Lissajous figures. The orbits expanded and contracted synchronously with the beat rate. Thereby, a partial rectification (asymmetric expansion) became apparent which, occurring in opposite directions in the two scalae across the partition, constituted the beat. This latter phenomenon was caused by the stiffness gradient of the cochlear partition. (2) Their effect on the traveling wave pattern along the partition was originally described by Bekesy. Stroboscopic examination revealed that the beat frequency modulates the two primaries thus producing two additional side bands. The displacement pattern of the membrane when viewed by high-speed motion picture photography, however, did not give any evidence of these five frequencies. Only the intertone (and the beat) were present. It then became apparent that the model is really a pattern analyzer of complex sound. In terms of cochlear fluid motion, it is able to resolve complex Lissajous figures by a spatial filter action along the partition into simple Lissajous figures. Any deviation from steady Lissajous figures, which ordinarily result from primaries in relation of integral numbers, produces beats. Thus beats of imperfect unison as well as of mistuned consonances have essentially the same cause: a cyclic phase change between the two primaries.

Vision Research Labs., U. of Michigan, Ann Arbor.
THE EFFECTS OF TARGET SIZE AND SHAPE ON VISUAL DETECTION: II. CONTINUOUS FOVEAL TARGETS AT ZERO BACKGROUND LUMINANCE, by H. Richard Blackwell and Stanley W. Smith. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Jan 59, 26p. 8 refs. 2144-334-T. Order from LC mi$2.70, ph$4.80 PB 143 442

In this experiment, the luminance difference for threshold detectability has been measured for 45 targets of varying size and shape at a zero background luminance. Measurements have been made on eleven observers with the method of constant stimulus utilizing the temporal forced-choice procedure. Foveal presentation has been used, with an exposure duration of 0.010 second. The targets used have included circles, rectangles, multiple-legged targets, and special targets composed of two rectangular areas of different dimensions. In all cases, noncircular targets were less detectable than circular targets of equal area. The data for noncircular targets have been subjected to empirical and theoretical analyses. The empirical analysis described the data of the present study in some detail. The data were also analyzed in terms of the theoretical analysis, based upon an element contribution hypothesis, with additional empirical factors. Application of this analysis to the data from the present study required modification of one of the two empirical factors derived from the first study, and addition of a third empirical factor. Accordingly, the theoretical analysis appears to have demonstrated somewhat less descriptive generality than the empirical analysis. (See also PB 142 793)

Vision Research Labs., U. of Michigan, Ann Arbor.
THE EFFECTS OF TARGET SIZE AND SHAPE ON VISUAL DETECTION: III. EFFECTS OF BACKGROUND LUMINANCE, DURATION, WAVELENGTH AND RETINAL LOCATION, by S. W. Smith, H. R. Blackwell, and C. M. Cutchshaw. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Dec 58, 21p. 11 refs. Rept. no. 2144-346-T.
Order from LC mi$2.70, ph$4.80 PB 143 444

This experiment studied the comparative detectability of circular and noncircular targets under a variety of conditions. It was found that noncircular targets were usually considerably less detectable and were never more detectable than circular targets of equal area. The primary objective was to investigate to what extent two targets of markedly noncircular form are more or less detectable than circular targets of equal area. A long thin rectangle and a cross produced from two long thin rectangles were selected for study on the basis of earlier studies in the present series. Background luminance was varied over a considerable range, as were target duration, spectral composition and retinal location. Detection thresholds were measured by the temporal forced-choice procedure. (See also PB 143 442)

Vision Research Labs., U. of Michigan, Ann Arbor.
THE EFFECTS OF TARGET SIZE AND SHAPE ON VISUAL DETECTION: IV. SOME RELATIONS WITH PREVIOUS INVESTIGATIONS, by H. Richard Blackwell. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Feb 59, 24p. 12 refs. Rept. no. 2144-335-T.
Order from LC mi$2.70, ph$4.80 PB 143 441

The basic approach of the present report is to reanalyze data from the earlier reports in the series to facilitate comparison with the data of earlier investigators. An investigation has been made of the adequacy of the perimeter theory of Lamar, et. al., in rectifying data from the previous papers in this series. This formulation is shown to have considerable predictive success with the data of Kristofferson and Blackwell. However, it is believed that the formulation cannot be supported in detail, and that the empirical and theoretical formulations offered in earlier papers in the present series represent refinements on the perimeter theory. (See also PB 143 444)

Biochemistry

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE EFFECT OF AN EXCESS OF VITAMIN A ON OXYGEN CONSUMPTION AND I^{131} METABOLISM IN RATS, by Gisle Bang, Delilah Metz, and Kaare Rodahl. Aug 57, 21p. 9 refs. Technical rept. 57-39.
Order from LC mi$2.70, ph$4.80 PB 143 529

The effects of excess of vitamin A--both single doses and repeated doses over prolonged periods--on the energy metabolism and the I^{131} metabolism in rats have been studied. It may be concluded that the feeding of an excess of vitamin A has no effect on the resting metabolism, the thyroid uptake of I^{131}, the plasma I^{131}, the PBI^{131}, or the conversion ratio in normal male rats under the conditions studied.

Army Chemical Corps., Fort Detrick, Md.
RECOMMENDED PROCEDURES FOR THE IDENTIFICATION OF SELECTED PATHOGENIC MICROORGANISMS: BACTERIA, FUNGI, AND ANTIBIOTIC SUSCEPTIBILITY DETERMINATIONS, by Joshus M. Leise, Harold Friedlander and others. Second edition, rev. Mar 58, 105p. 48 refs.
Order from OTS $2.50 PB 161 063

The manual is organized in a sequence identical with that of the basic steps followed in identification procedures, with the sections on methods and materials placed at the end: Section I, Treatment of Unknown Samples, describes the concentration and fractionation procedures. Section II, Initial Identification Procedures, outlines the steps to be followed in identifying either mixed or pure cultures. Section III, Inoculation of Media, lists the various media which are to be inoculated with the unknown sample to insure the growth and subsequent identification of the unknown pathogenic microorganisms. Section IV, Colonial Descriptions of Pathogenic Microorganisms, describes the colonial appearance of selected pathogens on eight of the media listed in Section III. Section V, Group Identification, arranges the microorganisms into groups to facilitate tentative identification if one assumes that the organism in question is pathogenic. Section VI, Specific Microorganism Identification, contains descriptions of and identification procedures for each microorganism and toxin listed in the manual. Section VII, Determination of Antibiotic Susceptibility, gives directions for determining the antibiotic susceptibility of the isolated microorganism. Section VIII, Methods, comprises detailed descriptions of some of the procedures referred to in the text. Section IX, Materials, lists the formulas for some of the media and reagents referred to in the text, including the source of components.

California U., Los Angeles.
THE BINDING OF STEROIDS BY BLOOD PROTEINS, by B. H. Levedahl. Annual progress rept. for Jan 56-Jan 57 on Contract Nonr-233(39). 18 Dec 56, 5p.
Order from LC mi$1.80, ph$1.80 PB 130 572

The object of this program is to study the interaction of steroid hormones with serum proteins so that the mechanism of interaction of steroids and proteins can be accurately described.

Duke U. School of Medicine, Durham, N. C.
PHOTOGRAPHIC MEASUREMENT OF RETINAL VENOUS BLOOD OXYGEN; VALUES IN NORMAL SUBJECTS AND THE EFFECT OF CHANGE IN BODY POSITION AND IN THE INHALATION OF LOW AND HIGH OXYGEN MIXTURES, by John B. Hickam and Regina Frayser. Feb 59, 13p. 6 refs. AFSAM rept. 58-155.
Order from LC mi$2.40, ph$3.30 PB 143 745

A method is described for measuring by photographic means the percent oxygen saturation of retinal venous blood. In observations on 34 normal, seated subjects, the retinal venous blood oxygen saturation was estimated to be 57 percent. S.D. 11 percent. When the arterial blood oxygen is reduced by breathing a low oxygen mixture, the retinal venous blood oxygen falls, but less than the arterial oxygen, with a resultant decrease in the retinal arteriovenous oxygen difference. Presumably this is associated with an increased retinal blood flow, resulting from the visible dilatation of the retinal vessels. In 12 subjects, changing from the seated to the recumbent position caused an apparent small drop in retinal venous oxygen saturation, but the change was not statistically significant. In 17 subjects, breathing 100 percent oxygen caused an increase of 24 percent in the retinal venous blood oxygen saturation. This effect is much larger than anticipated and the mechanism of the increase is still obscure.

School of Aviation Medicine, Randolph AFB, Tex.
AORTAL CHOLESTEROL CONCENTRATIONS AFTER LINODOXINE ADMINISTRATION IN DOGS, by Lawrence J. Milch, Lesly G. Robinson and others. June 59, 5p. 5 refs. Rept. 59-73.
Order from LC mi$1.80, ph$1.80 PB 143 375

Linodoxine was added to the diet of 6 dogs fed excess fat, cholesterol, and propylthiouracil over a 9- to 11-week period. Administration of this drug mixture was associated with significantly ($P < .05$) decreased concentrations of aortal cholesterol as compared to a simultaneously maintained group of dogs fed the same diet containing a placebo mixture of coconut oil in place of Linodoxine. Linodoxine was also associated with a significant shift of serum β-lipoproteins toward classes of higher density, a reversal of the trend noted in the placebo-fed group of dogs.

Texas U. Medical Branch, Galveston.
PROPERTIES OF ERYTHROCYTES WHICH MAY INFLUENCE THE CONVERSION OF PROFIBRINOLYSIN TO FIBRINOLYSIN, by S. N. Kolmen, M. Mason Guest and D. R. Celander. June 59, 9p. 15 refs. AFSAM rept. 59-72.
Order from LC mi$1.80, ph$1.80 PB 143 376

Evidence is presented that erythrocytes adsorb urokinase, a urinary activator of plasma profibrinolysin, and that in the adsorbed state urokinase not only remains active but is "protected" from factors normally present in plasma. When washed red cells, devoid of components of the fibrinolytic system, are exposed to plasma they acquire simultaneously inhibitors to urokinase and an agent capable of lysing a fibrin clot. Evidence is presented that these acquired properties are the result of adsorption to the erythrocyte of factors present in plasma and that this adsorption is affected by the fibrinolytic status of the animal from which the plasma and erythrocytes are obtained. The significance of the erythrocyte in the development of in vivo fibrinolytic activity is discussed.

Medical Specialties and Equipment

Microwave Lab., Stanford U., Calif.
DEVELOPMENT OF A LINEAR ELECTRON ACCELERATOR FOR MEDICAL AND RADIOGRAPHICAL PURPOSES. Final rept. for 1 Mar 52-31 May 58 on Contract Nonr-225(06). May 58, 38p. 5 refs. ML rept. no. 518.
Order from LC mi$3.00, ph$6.30 PB 142 959

A sealed-off linear electron accelerator for medical use has been developed, and its operation for routine cancer therapy has proved very satisfactory. The construction of more compact accelerators operating at shorter wavelengths has been shown to be feasible. The major cost of such accelerators is in the rf power supply and the mechanical mounting, and it is in these components that further development is required if the overall cost is to be significantly reduced. This final report summarizes the individual aspects of the contract research, and also contains a list of the Technical Reports that have been issued. A reprint of a summary paper on "The Stanford Medical Linear Accelerator," not previously issued, is also included.

School of Aviation Medicine, Randolph AFB, Tex.
CLINICAL EVALUATION OF DEVICES AND TECHNICS FOR THE REMOVAL OF TOOTH STRUCTURE, by Jack L. Hartley and Donald C. Hudson. Mar 59, 22p. 121 refs. Rept. 58-103.
Order from LC mi$2.70, ph$4.80 PB 143 382

Dental handpieces utilized for the removal of tooth structure have been evaluated. A clinico-laboratory study was made of all currently available handpieces, the newer concepts of operative and crown and bridge procedures, and the necessary armamentarium. The studies indicated that instruments which produced the ultrahigh speeds (180,000 to 225,000 r.p.m. and above) resulted in maximum cutting effectiveness, minimal pulpal trauma, reduced operator fatigue with optimum control, low patient annoyance, and increased life of cutting instrument. At present, these speeds are attained by the air turbine handpieces.

School of Aviation Medicine, Randolph AFB, Tex.
A CLINICAL EVALUATION OF THE CAVITRON PORTABLE PROPHYLAXIS UNIT, by Clarence M. McCall and Lucian Szmyd. July 59, 13p. 4 refs. Rept. 59-86.
Order from LC mi$2.40, ph$3.30 PB 143 379

A clinical evaluation of the ultrasonic scaling technic was carried out on 240 military subjects. The ultrasonic technic was found to be as effective as the conventional scaling method in the removal of calculus while the conventional oral prophylaxis technic was superior to the ultrasonic method in the removal of stain. Most of the subjects preferred the ultrasonic method of oral prophylaxis over the conventional scaling technic. No statistical difference in tooth sensitivity or tissue trauma was noted between the two scaling technics.

School of Aviation Medicine, Randolph AFB, Tex.
FREE 17-HYDROXYCORTICOSTEROID LEVELS IN PAROTID FLUID, SERUM, AND URINE FOLLOWING THE ORAL ADMINISTRATION OF SYNTHETIC ANALOGS OF HYDROCORTISONE, by Ira L. Shannon and John R. Prigmore. May 59, 4p. 3 refs. Rept. 59-79.
Order from LC mi$1.80, ph$1.80 PB 143 743

In a study of free 17-hydroxycorticosteroids, measurable levels were consistently found in human parotid fluid. Under the influence of synthetic adrenocortical analogs, altered parotid steroid levels closely paralleled changes evidenced in serum and urine 17-OHCS concentration. These findings suggest that steroid values in parotid fluid can be used as an indicator of adrenocortical status.

School of Aviation Medicine, Randolph AFB, Tex.
THE INFRARED SPECTRAL CHARACTERISTICS OF HUMAN WHOLE STIMULATED SALIVA COLLECTED FROM INDIVIDUALS CLASSIFIED AS TO DENTAL CARIES EXPERIENCE, by Norman O. Harris, Arnold Swanson, and Vincent Segreto. June 59, 8p. 35 refs. Rept. 59-60.
Order from LC mi$1.80, ph$1.80 PB 143 372

Infrared spectral curves (2-16 μ) were accomplished on the saliva of 398 United States Air Force enlistees, who were classified according to dental caries status. Slight variations in the characteristic absorption spectra of human saliva appeared correlated with the carious surface score. Infrared scores, based on spectral curve characteristics, were inverse to 24-hour bacterial turbidity readings and directly correlated to flow rate. Infrared analysis presents a potential method for evaluating the immediate caries susceptibility status of an individual; however, this hypothesis needs confirmation in a time-function study.

School of Aviation Medicine, Randolph AFB, Tex.
SPECTROPHOTOMETRIC CHARACTERIZATION OF LIGHT-INDUCED CHANGES IN AUTOPOLYMERIZING RESINS. EFFECT OF ULTRAVIOLET LIGHT UPON PLASTIC SPECIMENS CONTAINING EXCESS LIQUID, by Bertram Eichel, Theodore E. Fischer and others. Nov 56, 6p. 4 refs. Rept. 56-124.
Order from LC mi$1.80, ph$1.80 PB 128 453

Nonpigmented Kadon and Fastcrown polymerized specimens into which excess liquid had been incorporated were characterized spectrophotometrically following their exposure to ultraviolet radiation. After long-wave ultraviolet radiation, Kadon exhibited increased visible and near ultraviolet absorption with increased liquid content. Short-wave ultra-violet radiation did not produce increased absorption effects with the increase in liquid. Fastcrown specimens containing excess liquid showed colored substance production following exposure to short-wave ultraviolet radiation and the S-1 lamp. With increase in liquid content, a parallel increase in absorption in the near ultraviolet region was clearly evident. Results suggest that the employment of excess liquid in the liquid-powder mix even at normal room temperatures is the responsible factor for the excessive color produced in plastics following their polymerization.

Microbiology

[Army Chemical Warfare Labs., Army Chemical Center, Md.]
AEROBIOLOGICAL STUDIES: SONIC-SPEED, LIQUID IMPINGER FOR COLLECTING SAMPLES OF MICROBIOLOGICAL MATERIALS FROM AEROSOLS, by C. E. O'Bryon. July 48, declassified 29 Aug 56, 35p. 32 refs. Special rept. no. 98.
Order from LC mi$3.00, ph$6.30 PB 143 722

A sonic-speed, liquid impinger used by the Aerobiology Branch in collecting samples of particulate matter (containing such materials as bacteria, dye tracers, toxins, and viruses) from aerosols is described. This sampler consists of a 125-ml. filtering flask containing an intake tube held in place by a rubber stopper with the lower end of the tube 5 mm. from the floor of the flask. The intake tube is a tube 1 cm. in diameter having a piece of capillary tubing sealed to its lower end. The diameter of the capillary tube or orifice is such that the maximum flow, or the flow at which the velocity of air through the orifice is the same as that of sound, is the desired sampling rate. Twenty-five ml. of a liquid suitable for holding the particulate matter to be sampled is used in the impinger. Sampling efficiency was found to be high (well over 90 per cent) by material-balance and series-sampling procedures.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATIONS ON THE RELATION, IF ANY, BETWEEN VIABILITY AND ELECTRIC CHARGES ON AIR-BORNE MICROORGANISMS OR PARTICLES CONTAINING SUCH MICROORGANISMS, by Clyde Orr, Jr., and Margaret C. Kordecki. Final rept. on Contract DA 18-064-404-CML-39. 30 June 55, 87p. 13 refs.
Order from LC mi$4.80, ph$13.80 PB 143 535

The principal results obtained are: (1) There is little or no relation between the charge on an air-borne microorganism and viability or nonviability. (2) Wet and dry dispersions revealed no significant differences in regard to the relation between charge and viability. (3) Atmospheric conditions have no significant effect on the relation between charge and viability. (4) Temperature and humidity have little or no effect on the charging of microorganism aerosols. Radiation and ionization, on the other hand, tend to increase the charging. (5) Radiation and ionization, probably through a lethal agent such as ozone, decrease viability. (6) No additives were found which produced significant changes in the charge-viability relationship. (7) Ordinarily, the charges on aerosol particles contribute little to the loss of the particles on surfaces, etc. (8) Viable, air-borne microorganisms can be collected and cultured using thermal precipitation. (9) Serratia marcescens cell size and density vary in a definite fashion with relative humidity, a maximum density occurring at a relative humidity of about 40 per cent.

Illinois U., Urbana.
INVESTIGATION OF THE EFFECTS OF SALTS AND LIMITATION OF MOISTURE CONCENTRATIONS ON THE GERMINATION OF SPORES, by H. O. Halvorson. Rept. no. 3 (Final) for 1 Jan-31 Dec 56 on Contract DA 19-129-567. 1 Jan 56, 5p. 2 refs. QFCIAF File no. M-204; AD-128 285.
Order from LC mi$1.80, ph$1.80 PB 138 910

Pathology

Army Chemical Warfare Labs., Army Chemical Center, Md.
SOME EFFECTS OF CERTAIN CHEMICAL AGENTS ON MOTOR AND MENTAL PERFORMANCE, by Earl Davy and George Grosser. Mar 59, 27p. 4 refs. CWL Special Pub. 2-20.
Order from LC mi$2.70, ph$4.80 PB 143 717

The effect of sublethal concentrations of GB on humans were experimentally investigated following whole-body exposure of human subjects to GB at a concentration of 2 mg/m^3 for 2 minutes. Subjects were exposed to GB and post-exposure performance on a battery of tests was compared with performance during the final pre-exposure session. The battery of tests, related to steadiness, dexterity, addition ability, reaction time, and eye-hand coordination, was administered during three pre-exposure and three post-exposure sessions. Performance was not severely impaired by GB exposure at the Ct employed. Improved performance was noted in many tests. While hand steadiness may be slightly impaired in proportion to cholinesterase activity decrement, the extent of cholinesterase inhibition was found to be unrelated to the extent of either an impairment or an improvement of performance on the other tests.

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
THE TOXICOLOGY OF FIRE, by John A. Zapp, Jr. Apr 51, declassified 29 Jan 56, 119p. 50 refs. Medical Div. Special rept. no. 4.
Order from LC mi$6.00, ph$18.30 PB 143 732

An investigation into the casualty producing factors in flame attack. The experiments first carried out were designed to measure quantitatively and continuously before, during and after flame attack the air temperature and the concentration of various gases in the atmosphere (O_2, CO, CO_2, and hydrocarbons) which might contribute to the production of casualties. The methods finally adopted are described. Problems of protection against flame attack were also studied.

Army Medical Research and Nutrition Lab., Denver, Colo.
THE LOW INCIDENCE OF ACUTE REACTIONS IN HUMANS TO AN INTRAVENOUS FAT EMULSION, by Allan L. Forbes, Mayna R. Allen and Hugh F. Gray. Rept. on Metabolism and Nutrition. 8 Oct 58, 28p. 13 refs. Rept. no. 227.
Order from LC mi$2.70, ph$4.80 PB 138 599

The administration of 868 units of an intravenous fat emulsion to 204 subjects resulted in definite acute toxic reactions in 7.8% of subjects; clearly defined febrile reactions occurred in 4.9%. Chills occurring in 2.5% of subjects were the only serious reactions. If acute toxic reactions were going to occur during a series of infusions, they appeared with few exceptions on the first infusion. Tolerance developed to febrile reactions on serial infusions. The rate of administration did not affect materially the incidence of reactions within reasonable limits; a 600 ml unit could be administered safely in 1.75 hours. The majority of acute toxic reactions appeared to represent hypersensitivity phenomena. The fat emulsion studied is considered an acceptable preparation for clinical use from the point of view of infrequency of acute toxic reactions. The importance of turning primary attention to possible chronic toxicity problems is emphasized.

Army Medical Research Lab., Fort Knox, Ky.
THE EFFECTS OF INTENSE VIBRATION, by A. J. Riopelle, Marion Hines (Emory U.) and Merle Lawrence (U. of Michigan). Rept. on Task, Noise, and Vibration Problems, Contracts DA 49-007-MD-(535, 634). 10 Oct 58, 63p. 16 refs. Rept. no. 358; AD-203 637.
Order from LC mi$3.90, ph$10.80 PB 143 264

The primary effects of vibration are physiological and anatomical in nature. Behavioral decrements are secondary and probably a consequent of these changes.

Audiology Lab., Northwestern U., Evanston, Ill.
SOME FACTORS AFFECTING THE SPONDEE THRESHOLD IN NORMAL-HEARING SUBJECTS, by Tom W. Tillman and James F. Jerger. May 59, 6p. 3 refs. AFSAM rept. 59-69.
Order from LC mi$1.80, ph$1.80 PB 143 378

This experiment was designed to investigate the effects of (1) knowledge of test vocabulary and (2) practice in responding to spondee words at threshold intensities on the spondee threshold in normal-hearing subjects. Results of this experiment were: (1) practice in responding to spondee words at threshold intensities does not influence the spondee threshold in normal-hearing subjects, and (2) normal-hearing subjects given prior knowledge of the test vocabulary yield spondee thresholds 4 to 5 db lower than those yielded by subjects not given such knowledge.

Brooke Army Medical Center, Fort Sam Houston, Tex.
RADIATION AND THERMAL BURNS, by Duane L. Larson, Charles R. Baxter and others. Annual research progress rept. on Proj. no. 6-59-12-028. 30 June 59, 138p. 47 refs.
Order from LC mi$6.90, ph$21.30 PB 143 605

Contents:
Biochemical alterations:
Relationship of dark urine to septicemia
Acute cardiopulmonary response to extensive thermal trauma

Metabolic responses:
- Wound management and nitrogen metabolism in burned rats
- The effect of varying the calories on the nitrogen balance of burned patients
- Absorptive capacity of the small intestine during the course of a severn burn .

Infection and immunologic studies:
- Evaluation of the use of gamma globulin in the severely burned patient
- Immuno-electrophoretic studies of serum globulins in thermal injury
- Studies of urinary tract infections in burned patients
- Serologic demonstration of existence of "burn toxin" in the serum of newly burned individuals and the antibody of this toxin in convalescent burned patients
- The use of pooled antigen to induce antibody paralysis in neonatal rats
- Antiseptic effect of PVP-I and bis quaternary compounds on selected bacteria inoculated to the burned skin surface of rats

Clinical management:
- Clinical operation, burn center
- Early excision of extensive areas of full-thickness burns
- The effects of environmental conditions upon the response to thermal trauma in rats
- Environmental factors in burns. I. O_2 utilization vs. ambient temperature

Central Tuberculosis Lab., Southwest Florida Tuberculosis Hospital, Tampa.
A BACTERIOLOGIC STUDY OF RESECTED LUNG TISSUE, by Robert Cacciatore and Frank P. Dunbar. Apr 59, 6p. 9 refs. AFSAM rept. 58-120.
Order from LC mi$1.80, ph$1.80 PB 143 748

During the 17-month period from July 1956 through November 1957 all resected lung tissues were examined by bacteriologic procedures designed to investigate some of the problems of isolating and determining the drug-susceptibilities of cultures of Myco, tuberculosis. This report presents the results of the study.

Duke U. Medical Center, Durham, N. C.
THE INFLUENCE OF VENOUS INFUSION OF GASEOUS CARBON DIOXIDE ON OXYGEN SATURATION OF ARTERIAL BLOOD AND CARDIAC OUTPUT IN THE ANESTHETIZED DOG, by F. G. Hall and John Salzano. Rept. on Physiology of Flight, Contract AF 33(616)3821. July 59, 9p. 4 refs. WADC Technical rept. 59-378.
Order from OTS $0.50 PB 161 074

The formation of gas bubbles in the blood stream has been a problem of high-altitude flight. When gaseous bubbles of oxygen and nitrogen are infused into the venous system, profound injury results. Gaseous CO_2 however may be infused at rates of 100 ml. per minute without irreversible damage. A notable feature of the procedure is reduction of arterial oxygen saturation of hemoglobin. Cardiac output was measured in dogs before, during, and after intravenous infusion of gaseous CO_2. Slight decreases in output occurred but not great enough to indicate a significant impairment in blood flow through the pulmonary system. Infused CO_2 moves rapidly into the expired gas. Lowered oxygen saturation of blood following infusion of CO_2 can be explained in part by Bohr effect. However, this does not account entirely for level of oxygen unsaturation and something more than Bohr effect seems involved.

Harvard U. [Cambridge, Mass.]
THE STUDY OF FATIGUE IN NORMALS AND PATIENTS WITH NEUROLOGICAL AND PSYCHIATRIC DISORDERS, by Robert S. Schwab and Mary A. B. Brazier. Final rept. for 1947-1957 on Contract N5ori-76/08. Oct 58, 22p.
Order from LC mi$2.70, ph$4.80 PB 143 395

The normal subject shows better motor performance than patients with psychiatric fatigue but the differences are not very marked nor are they consistant. There is a marked difference, however, between the motor performance between the normal subject and those suffering from myasthenia gravis. The difference in training, general physical tone of a person not in the hospital or not ill, might account for some of the minor discrepancies. We have confirmed previous observations that neostigmine or other anticholinesterase drugs do not improve the muscular performance of normals or patients with psychiatric fatigue, and in the figure one can see a slight decrement in the performance after the injection of such a drug. In both examples shown there was a slight increase in the blood lactic acid after the injection of neostigmine, in normals, and psychiatric fatigue. In patients with myasthenia gravis, however, there is a marked increase in motor performance as well as increase in lactic acid after the injection of neostigmine. We are impressed with the striking and objective difference between the ordinary test situation where motivational levels were not altered and the increase in motor performance following a strong suggestion and urging, and even more impressive improvement in motor performance with a finite reward such as five dollars. It was agreed that usually in the ordinary testing of average subjects, particularly if they have repeated tests several times under the same laboratory conditions and personnel, that representative values are not too difficult to find. In any individual situation the motivational level may be of extreme importance in the differential diagnosis or in the concept of the dynamics in the fatigue and impaired state.

Hospital Henri-Rousselle, Paris (France).
RELATION OF THE VISCERAL AFFERENTS ON THE ACTIVITY OF THE BRAIN STEM RETICULAR FORMATION, by P. C. Dell. Technical rept. on Contract AF 61(052)45. [1959] 17p. 8 refs. AFOSR-TR-59-93; AD-219 422.
Order from LC mi$2.40, ph$3.30 PB 143 587

This report comprises two parts: 1/ a preliminary study on the arousing potentiality of afferent impulses in connection with the cortical control of reticular activity 2/ a study of the effects of the humoral changes induced by hypoxia on the reticulo-cortico-reticular system.

Karolinska Institutet, Stockholm (Sweden).
RESEARCH REPORT FOR 1958, by Arne Engstrom. Rept. on Contracts AF 61(052)21 and AF 61(052)15.

[1959] 27p. AFOSR-TN-340; AD-213 661.
Order from LC mi$2.70, ph$4.80 PB 143 071

The report is an account of the scientific activities at the Department of Medical Physics, Karolinska Institutet, during 1958. Several new techniques have been developed with the aim to be applicable to the study of the molecular structure of minute parts (on cellular level) of the nervous tissue. There is considerable work to formulate certain general theories regarding information transfer in minute structures and also to investigate carefully the physico-chemical aspects of tracer experiment for metabolic studies.

Neurological Research Unit., Medical Research Council (Gt. Brit.).
CORRELATION OF INTRACELLULAR POTENTIALS WITH ELECTRO-CORTICOGRAM. Final technical rept. no. 1, 1 Jan-31 Mar 59, on Contract DA 91-508-EUC-309. 23 Apr 59, 15p. AD 217 435.
Order from LC mi$2.40, ph$3.30 PB 143 390

The primary object of these experiments was the correlation of the activity of single cortical neurones (Betz cells) recorded with micropipettes, with the pattern of electrical activity recorded with larger electrodes. In particular, a correlation was sought between the membrane potential of Betz cells with the various clinical and electrical phases of a generalized seizure. From the results of the experiment during an induced seizure and a number of experiments during strychnine spikes it appears likely that the cortical neurones cease to discharge continuously during the clonic phase of the seizure. This appears to be associated with a hyperpolarization but there is not as yet sufficient evidence to make this a causal relationship. It is expected that in the following period of investigation the causal nature of this relationship may well be demonstrated and that the existence of a Golgi cell type of hyperpolarization-inhibition mechanism may be demonstrated. Such a demonstration would cast a rather different light on the Jacksonian concept of a seizure as an "uncontrolled" discharge of nerve cells.

School of Aviation Medicine, Randolph AFB, Tex.
AN EVALUATION OF PATIENTS SUSPECTED OF HAVING NOISE-INDUCED HEARING LOSS, by Ralph N. Kraus. June 59, 17p. 17 refs. Aeromedical Reviews no. 4-59.
Order from LC mi$2.40, ph$3.30 PB 143 367

The results of an evaluation of 77 U. S. Air Force flight-line personnel with defective hearing are reported. The evaluation revealed that 29 patients had a conductive-type, 7 had a functional-type, and 41 had a perceptive-type defect. Twenty-two of these perceptive cases were unilateral. In only 19 cases was noise exposure considered to be a possible cause of defective hearing. The difficulties encountered in attempting to determine whether defective hearing in a specific patient is caused or aggravated by noise exposure are discussed.

School of Aviation Medicine, Randolph AFB, Tex.
MIGRAINE IN ITS AEROMEDICAL ASPECTS, by Ellis R. Taylor. July 58, 23p. 24 refs. Aeromedical Reviews no. 8-58.
Order from LC mi$2.70, ph$4.80 PB 143 756

Problems in the disposition of migraineurs have become so difficult that a study of the general and aeromedical literature was made to provide a solid foundation for administrative guidelines as well as clinical management. The results of this study are presented along with a general discussion of the natural history of the disease.

School of Aviation Medicine, Randolph AFB, Tex.
THE RELATIONSHIP BETWEEN THE CONCENTRATIONS OF SERUM LIPOPROTEINS AND SERUM LIPIDS, by Bernard S. Schlessinger, Margaret F. Allen and others. Mar 59, 6p. 15 refs. AFSAM rept. 59-45.
Order from LC mi$1.80, ph$1.80 PB 143 369

These studies report (1) the extent of correlation between ultracentrifugally determined serum lipoproteins, (2) the errors of measurement involved in all determinations, and (3) age-specific values for all serum parameters in the same population. It was found that although a high correlation exists between a linear combination of ultracentrifugally determined lipoproteins and the serum concentrations of cholesterol and phospholipid, the prediction of lipoprotein levels from the purely chemical measurements is not entirely satisfactory. Therefore, for the time being at least, all measurements will have to be accomplished.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECT OF SODIUM DINITROCYANOMETHIDE ON ISOLATED CAT PAPILLARY MUSCLE, by Edmund F. Murtha. 6 Aug 57, 9p. 2 refs. Technical rept. CWLR 2154; AD-139 349.
Order from LC mi$1.80, ph$1.80 PB 130 726

Isolated cat papillary muscles were immersed in modified Locke's solution containing sodium dinitrocyanomethide in concentrations ranging from 0.13 to 4.00 mg./ml. Concentrations of or greater than 0.20 mg./ml. gradually reduced and in some experiments abolished the force of the isometric contractions of the muscle; these effects were sometimes accompanied by alterations in the electrogram, although in several experiments there was no evidence of effect on conductivity. The results of these studies agree in general with the findings of another recent investigation which suggests that cardiac depression may be one of the mechanisms of action in sodium dinitrocyanomethide intoxication.

[Army] Chemical Warfare Labs., Army Chemical Center, Md.
PHYSIOLOGICAL ACTIONS OF GB IN A WARM ENVIRONMENT, by H. M. Frankel and F. N. Craig. 4 June 56, declassified 28 Mar 58. 28p. 14 refs.

CWLR-2032.
Order from LC mi$2.70, ph$4.80 PB 143 527

GB was administered to Rhesus monkeys by either an intramuscular injection of an average of 30 γ/kg. or an exposure of the body, not including the head, to an average vapor concentration of 115 mg./m^3 for 30 minutes. Mortality increased when the environmental temperature was elevated. In each method of administration of GB, 4 out of 5 monkeys died at 100°F. At 77°F., one out of 5 died with intramuscular injection and none out of 5 died with body exposure. The loss of cholinesterase (ChE) activity in the red blood cells was more rapid in the monkeys that died than in the survivors. In preliminary experiments the method of restraint was found to influence survival in exposures to heat alone. Wher the monkeys were immobilized on an animal board, 5 out of 6 died in about 5 hours; when more freedom of movement was permitted all 5 survived the same exposure to 100°F.

Army Chemical Warfare Labs., Army Chemical Center, Md.
STUDIES ON THE STRUCTURE OF CLAM POISON, PART II, by W. A. Nevill and E. A. Metcalf. Rept. for 1 July 55-30 June 56. Apr 59, 31p. 13 refs. CWL Special Pub. 1-9.
Order from LC mi$3.00, ph$6.30 PB 143 716

The purpose of the work described in this report was four fold: to obtain a crystalline derivative of clam poison suitable for spectral and microanalytical studies, to isolate and to determine quantitatively the suspected fragments obtained from degradative experiments, to investigate the peroxide oxidation of the poison in greater detail and to synthesize compounds for use as models in determining the mode of attack of acids and oxidizing agents on the poison.

Army Chemical Warfare Labs., Army Chemical Center, Md.
SWIMMING OF ALBINO MICE, by Charles G. Wilber and Joseph B. Hunn. Technical rept. for 5 Jan-16 June 58 on Biological Sciences Research. Oct 58, 9p. 5 refs. CWLR 2248.
Order from LC mi$1.80, ph$1.80 PB 139 143

Albino mice were forced to swim to exhaustion in baths of different temperatures at various simulated altitudes up to 30,000 feet. Swimming time was influenced more by bath temperature than by simulated altitude. Crowding decreases the mean swimming time.

Army Medical Research and Nutrition Lab., Denver, Colo.
THE EFFECT OF SEX HORMONES ON ENERGY BALANCE AND BODY COMPOSITION OF RATS, by Robert A. Huseby and Harry J. Krzywicki. 17 Dec 58, 11p. 10 refs. Rept. no. 229.
Order from LC mi$2.40, ph$3.30 PB 139 174

The present study was undertaken to investigate the influence of the administration of an estrogenically active substance, diethylstilbestrol, at a more physiological level upon both the caloric and nitrogen balance and final body composition of young, actively growing, castrate male rats. The study was set up so that data obtained by metabolic balance techniques could be compared with those obtained by direct body composition analysis.

California U., Berkeley. Medical Center, San Francisco.
THE EFFECT OF DEPRESSANT DRUGS AT ALTITUDE, by John E. Preston. Rept. on Contract Nonr-222(29). [1958] 14p. 37 refs.
Order from LC mi$2.40, ph$3.30 PB 143 875

The effects of two Central Nervous System depressant drugs (PBS and Codeine HCl) were studied in vivo and Pentobarbital Sodium effects were studied in vitro. In vitro studies showed a progressive inhibition of oxygen and, to a slightly greater degree, inorganic phosphate uptake by brain homogenate as the concentration of PBS was increased. The effect of PBS on the respiration (P/O values) with various added substrates was studied. In vivo toxicity studies were made using two strains of rat, Sprague-Dawley females and Long Evans males, and determining the LD_{50} values for each drug by two methods, Thompson and Weil and Litchfield-Wilcoxon. The LD_{50} values for PBS in the two strains of rat were not significantly influenced by altitude nor did acclimatization to altitude affect the value appreciably. Codeine HCl in rats was almost twice as toxic at altitude (12,470 feet) as indicated by a LD_{50} value roughly one-half (52.0 mg/Kg) than at sea level (101.1 mg/Kg). Also acclimatization to altitude did significantly decrease the toxic effect of Codeine HCl in rats as indicated by the LD_{50} value of 63.0 mg/Kg.

Medical Coll. of Virginia, Richmond.
HEALTH HAZARD OF MILITARY CHEMICALS, by J. H. Weatherby. Final rept. for 1 Nov 55-30 June 58 on Contract DA 18-108-405-cml-31. 1 July 58, 18p.
Order from LC mi$2.40, ph$3.30 PB 143 783

Progress is reported on studies on toxicity of pentaborane, with special reference to alterations in liver function.

Pharmakologisches Institut der Universität, Frankfurt (Germany)
SNAKE VENOM, by Peter Holtz. Final technical status rept. for Dec 58-Feb 59 on Contract DA 91-508-EUC-291. 21 Apr 59, 15p. AD-217 433.
Order from LC mi$2.40, ph$3.30 PB 143 389

Freshly gained, lyophilized venom of Naia nivea was dialysed exhaustively. The lyophilized dialysate was split into three fractions (α, β and γ) by adsorption on a column of alkaline aluminum hydroxyde and elution with buffers of different molarities. By using sublimable buffers, it was possible to obtain polypeptide fractions free from salt. The lyophilized crude venom, the dialysate, the residue of the dialysis and the fractions α, β and γ of the dialysate were investigated with regard to (1) their toxicity, (2) their inhibitory actions on muscle and neuromuscular transmission, and (3) their cardiovascular effects. By ultrafiltration and dialysis it was possible to separate the fibrinogen coagulating activity of the venom from the constituents responsible for the formation of bradykinin. Apart from the formation of bradykinin, the dialysate contained esteratic activity (hydrolysis of the benzoyl-arginine-methyl-ester), but no tryptic activity; it did not split benzoylargininamid. Tryptic and coagulating activity remained in the residue of the ultrafiltration or of the dialysis.

Radiobiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
RADIATION HAZARDS OF PRIMARY COSMIC PARTICLES, by Rudolf A. Hoffman. July 59, 40p. 84 refs. AFMDC-TR-59-32.
Order from LC mi$3.00, ph$6.30 PB 143 682

The studies encompassed in this task were primarily designed to determine the biological effects of the primary cosmic particles and more specifically, the heavy primary particles (nuclei ≧ 6).

Aviation Medical Acceleration Lab.; Naval Air Development Center, Johnsville, Pa.
PRELIMINARY STUDIES ON THE MECHANISM OF RADIATION DAMAGE TO OXIDATIVE PHOSPHORYLATION IN SPLEEN MITOCHONDRIA, by B. David Polis and Freeman W. Cope. Rept. no. 6 on Proj. NM 11 01 12.7. 9 July 59, 11p. 12 refs. NADC-MA-5908.
Order from LC mi$2.40, ph$3.30 PB 143 426

Whole-body X-irradiation of rats strongly inhibits oxidative phosphorylation of spleen mitochondria. The addition of serum albumin to the reaction mixture to a great extent reverses this inhibition. The inference is drawn that X-irradiation increases the permeability of spleen mitochondria, allowing the leakage of a heme protein, called mitochrome, which was recently isolated in this laboratory. The inhibitory effects of mitochrome on X-irradiated mitochondria are counteracted by serum albumin in-vitro, so that a partial recovery from the changes caused by irradiation is attained. The data further suggest the possibility of reversing the effects of X-radiation on mitochondria by cofactor replacement, with the implication that resolution of the components involved might be of therapeutic value in irradiation sickness.

California U. School of Medicine, Los Angeles.
LATE EFFECTS OF TOTAL-BODY ROENTGEN IRRADIATION, by Baldwin G. Lamson, Marta S. Billings, and Leslie R. Bennett. May 59, 15p. 7 refs. AFSAM rept. 59-33.
Order from LC mi$2.40, ph$3.30 PB 143 381

Two hundred forty-two female Wistar rats were observed throughout their life span following 1,000 r hypoxic total-body or partial-body irradiation. Hypoxic radiation with superimposed anesthesia resulted in 67 percent 30 day mortality, compared to 9 percent mortality without anesthesia. Selection of the colony by acute postirradiation deaths did not influence the magnitude of late radiation sequelae as measured by life-shortening. Growth retardation during the second postirradiation year was well correlated with life-shortening. Life-shortening was observed after partial-body irradiation to an extent approximately proportional to the weight of radiated tissue. Nephrosclerosis was not observed unless the upper abdomen was included within the radiation field. Other than nephrosclerosis, a similar incidence of disease was observed at death in control and irradiated rats whether partial-body or total-body irradiated.

Oak Ridge National Lab., Tenn.
CHEMICAL PROTECTION OF THE MOUSE AGAINST LEUKEMIA INDUCTION BY X-RAYS, by A. C. Upton, D. G. Doherty, and G. S. Melville, Jr. Apr 59, 5p. 18 refs. AFSAM rept. 59-64.
Order from LC mi$1.80, ph$1.80 PB 143 373

Administration of mercaptoethylguanidine shortly before a single whole-body exposure to 150 or 300 r of x-rays inhibits the induction of granulocytic leukemia and prevents the induction of thymic lymphoma in RF mice. Mice treated with the drug also exhibit less shortening of the life span by radiation than do untreated controls.

Radiobiological Lab., U. of Texas, Austin.
RADIATION-INDUCED GASTROINTESTINAL DEATH IN THE MONKEY, by Stephen G. Wilson, Jr. June 59, 18p. 19 refs. AFSAM rept. 59-77.
Order from LC mi$2.40, ph$3.30 PB 143 582

This report describes the unique changes produced in the gastrointestinal tract of Macaca mulatta monkeys by supralethal doses of gamma radiation and discusses some of the inferences which may be made concerning the probable mechanism of the observed intestinal ulcers.

Radiobiological Lab., U. of Texas, Austin.
TOXIC EFFECTS OF S, 2-AMINOETHYLISOTHIURONIUM DIBROMIDE, by George S. Melville, Jr. and Thomas P. Leffingwell. Aug 59, 8p. 4 refs. AFSAM rept. 59-75.
Order from LC mi$1.80, ph$1.80 PB 143 583

The toxicity and pathologic effects of S, 2-aminoethylisothiuronium dibromide (AET-DiBr), a radioprotectant compound, have been studied in rats. The compound is highly toxic to these rodents when given in acute doses, either orally or intraperitoneally. The chronic toxicity and pathology of AET-DiBr has been examined by means of serial intraperitoneal injections. At low doses, large total amounts of the drug can be tolerated. The acute and chronic effects of sodium chloride, sodium bromide, sodium acetate, and sodium nitrate have been tested. Neither the anions nor the cation appears to contribute to the toxicity of isothiuronium salts.

School of Aviation Medicine, Randolph AFB, Tex.
NEUTRON ACTIVATION OF GOLD DENTAL RESTORATIONS IN SMALL PRIMATES, by Robert W. Zellmer, Jack L. Hartley and others. July 59, 6p. 6 refs. AFSAM rept. 59-68.
Order from LC mi$1.80, ph$1.80 PB 143 377

Dental gold alloys of various kinds were used to cast inlays which were placed in the molars of 10 small primates. These primates were then exposed to the neutron flux of an atomic detonation. The inlays were removed and the neutron-induced activity of the gold was measured in a scintillation counter. Calculation of the total activity showed a correlation with the neutron dosages received by the primates.

School of Aviation Medicine, Randolph AFB, Tex.
THE RADIOBIOLOGY OF THE CANCER CELL, by A. C. Upton (Oak Ridge National Lab.). Jan 59, 22p. 176 refs. Rept. 59-22.
Order from LC mi$2.70, ph$4.80 PB 143 072

Through study of the effects of ionizing radiation, fundamental information has been gained about the biology of normal and neoplastic cells and about the process of neoplasia. A variety of disturbances have been observed in irradiated cells, including alterations in metabolism, growth, and differentiation, but existing evidence suggests that the most significant primary action of radiation is on the genetic apparatus of the cell. That radiation-induced genetic effects may initiate tumor formation is highly conceivable; however, some other mechanism seems to be involved in certain instances of radiation carcinogenesis. Whatever the mechanism, the development of malignancy appears to be a complex, multistage process. The material basis for the large variation in radiosensitivity that exists among cells of different types is still poorly understood; however, with increasing knowledge of the mode of action of radiation and of the factors influencing the radiosensitivity of the cell, ways are being found to increase, decrease, and repair radiation injury. These advances hold promise of providing means of enhancing the effectiveness of radiotherapy in the treatment of cancer and of reducing the hazard of radiation as a carcinogenic agent.

School of Aviation Medicine, Randolph AFB, Tex.
USING Co^{60} TO DETERMINE THE $LD_{50/30}$ FOR THE RAT, by Robert E. Tatsch, John C. Tourville, and Loren C. Logie. Apr 57, 3p. 4 refs. Rept. 57-89; AD-136 187.
Order from LC mi$1.80, ph$1.80 PB 129 388

When Co^{60} was used at a dose rate of 500 r/minute, an $LD_{50/30}$ of approximatley 950 r was found for female Sprague-Dawley rats. Two methods of analysis were used to determine the $LD_{50/30}$. Results were compared with those of other experiments using 250 kv. p. x-rays.

Uppsala U. (Sweden).
RESEARCH ON LOCALIZED RADIO-LESIONS, PART II. EFFECT OF HIGH ENERGY PROTONS ON THE BRAIN OF THE RABBIT, by Bror Rexed, William Mair and others. Technical rept. no. 1, App. 4 on Contract AF 61(514)1247. 1 May 59, 18p. 7 refs. AFOSR-TN-59-976.
Order from LC mi$2.40, ph$3.30 PB 143 586

The present report deals with the effect of high energy protons on the brain of rabbits. One of the reasons for this investigation was the possible application of high energy heavy particles to stereotaxic radiosurgery in man: It is therefore essential to know their effect on the central nervous system. Irradiated brains were examined histopathologically, up to about one year after irradiation. There was destruction of nerve cells, myelin sheaths and axons. Thick walled capillaries, small perivascular haemorrhages and macrophages appeared in the early stages of the lesion. There was proliferation of astrocytes. Astrocytes with nuclei three or four times the normal size appeared at 4 weeks and subsequently giant cells with one or more nuclei were frequently seen but always within the irradiated region. No large haemorrhages were ever seen. The need for studies on the central nervous system at much later periods after irradiation is stressed.

CHEMISTRY

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by W. C. Schumb and C. N. Satterfield. Quarterly periodic Status rept. on Contract Nonr-1841(11). 31 Mar 58, 15p.
Order from LC mi$2.40, ph$3.30 PB 138 605

Contents:
Stability studies
High pressure ignition limits of hydrogen peroxide vapor
Heterogeneous catalysis in liquid hydrogen peroxide
Hydrogen peroxide decomposition flame
Heterogeneous catalysis of hydrogen peroxide vapor

Uppsala U. (Sweden).
ADDITION COMPOUNDS OF ANTIMONY CHLORIDES WITH SULFOXIDES AND SULFONES, by Ingvar Lindqvist. Technical note no. 1 on Contract AF 61(052)43. 20 Oct 58, 11p. 6 refs. AFOSR TN-59-116; AD-210 421.
Order from LC mi$2.40, ph$3.30 PB 138 712

The liquidus curves have been studied for the systems $SbCl_5$-$SO(CH_3)_2$, $SbCl_5$-$SO_2(CH_3)_2$, $SbCl_3$-$SO(CH_3)_2$ and $SbCl_3$-$SO_2(CH_3)_2$. The following new compounds have been prepared: $SbCl_5 . SO(CH_3)_2$, $SbCl_5 . SO(C_6H_5)_2$, $SbCl_5 . SO_2(CH_3)_2$, $SbCl_5 . SO_2(C_6H_5)_2$, $SbCl_3 . SO(CH_3)_2$ and $SbCl_3 . SO_2(CH_3)_2$. The melting point relations between these compounds have been discussed.

Analytical Chemistry

Fowles, G. W. A.
A STUDY OF THE CHEMICAL PROPERTIES OF THE COMPLEX NITROGEN, PHOSPHORUS, OXYGEN AND SULPHUR COMPOUNDS OF THE TITANIUM, VANADIUM AND CHROMIUM SUB-GROUP METALS, by G. W. A. Fowles. Annual rept. no. 1, 1 Apr 58-1 Apr 59, on Contract DA 91-508-EUC-307. [1959] 12p.
Order from LC mi$2.40, ph$3.30 PB 143 110

New York U. Coll. of Engineering, N. Y.
THERMAL ANALYSIS IN THE SYSTEM MAGNESIUM CHLORIDE-$TiCl_x$, by K. Komarek and P. Herasymenko. Technical rept. no. 3 on Thermodynamic Properties of Titanium Halides in Molten Salt Systems, Contract Nonr-285(13). Oct 56, 17p.
Order from LC mi$2.40, ph$3.30 PB 130 016

Thermal analysis of the mixtures of magnesium chloride and titanium chlorides fused in specially designed titanium metal crucibles was made in the range from 0 to 100 wt% $TiCl_x$. Chemical analyses of the solidified samples show that titanium dichloride is the prevalent species. The ratio, $\%TiCl_2/\%TiCl_3$ is fairly constant at all contents of magnesium chloride and is equal to about 7.7. Magnesium-chloride-free $TiCl_x$ has a melting point of 1025°C. The salt produced by fusion and solidification appears to be chemically less reactive than titanium dichloride obtained by disproportionation of solid titanium trichloride. The phase diagram of the system $MgCl_2$ - $TiCl_x$ derived from these measurements is of the peritectic type. The peritectic point lies close to the $MgCl_2$-side at about 0.35% $TiCl_x$. The peritectic temperature is 716°C. The solid solubility of $TiCl_x$ in $MgCl_2$ at the peritectic temperature is about 0.35% $TiCl_x$. The possibility is not excluded that the fused salt contains titanium di- and monochloride and that trichloride forms on cooling by disproportionation of monochloride. However, special experiments will be needed to prove or disprove the possibility of formation of monochloride.

Physical Metallurgy Lab., Calif. Inst. of Tech., Pasadena.
THE RESOLUTION OF ELECTRON PROBE MICROANALYZERS, by David B. Wittry. Technical rept. no. 8 on Contract N6onr-24430. Mar 58, 29p. 20 refs.
Order from LC mi$2.70, ph$4.80 PB 139 161

Organic Chemistry

California U., Los Angeles.
CHEMISTRY OF ALLENIC COMPOUNDS, by Thomas L. Jacobs and Ronald S. Bauer (Doctoral thesis). Technical rept. on Contract DA 04-495-ORD-527. June 58, 92p. 87 refs. AD-137 095.
Order from LC mi$5.40, ph$15.30 PB 142 948

This investigation was concerned with the synthesis and polymerization of allenes of the type $X_2C\ C\ CX_2$. Of particular interest in this study was the preparation of tetrafluoroallene and the polymer derived from it. Under autogenous pressure at room temperature tetrafluoroallene polymerizes to a white insoluble solid. An X-ray diffraction study of the polymer indicated that the material was a highly crystalline linear polymer. The polymerization is believed to occur by a free radical mechanism. Chlorotrifluoroallene was obtained from the reaction of 3-bromo-1, 1-dichloro-1, 3, 3-trifluoropropane with powdered potassium hydroxide.

Instituto de Quimica Fisica (Spain).
THERMOCHEMICAL INVESTIGATIONS ON METHYL-SUBSTITUTED BENZOIC ACIDS, by M. Colomina, R. Perez Ossorio and others. Final technical rept. for 1 July 58-30 June 59 on Contract DA 91-508-EUC-358. [1959] 41p. 30 refs.
Order from LC mi$3.30, ph$7.80 PB 143 450

The full series of the methylsubstituted benzoic acids-includes three mono-, six di-, six tri- three tetra-, and one pentamethylbenzoic acids. This report contains the thermochemical data for the first nine members of this series: the three toluic acids and the six dimethylbenzoic acids.

Kansas U., Lawrence.
ANODIC REDUCTIONS. V. THE REDUCTION OF DIKETONES BY UNIPOSITIVE MAGNESIUM ANODICALLY GENERATED, by William D. Hoffman, William E. McEwen, and Jacob Kleinberg. Technical rept. no. 9, 15 Oct 57-1 Aug 58, on Reduction of Organic Compounds by Lower Valent Species of Active Metals, Contract DA 23-072-ORD-1048. [1958] 21p. 27 refs. AD-203 798.
Order from LC mi$2.70, ph$4.80 PB 138 216

A series of diketones of the general formula $C_6H_5CO(CH_2)_nCOC_6H_5$ has been prepared and subjected to "anodic reduction" in sodium iodide-pyridine solution between magnesium electrodes. In every case hydrolysis of the anolyte following electrolysis yielded a 1, 2-diol as the reduction product, 1, 3-dibenzoylpropane (n = 3) and 1, 4-dibenzoylbutane (n = 4), gave cis-1, 2-diphenylcyclopentane-1, 2-diol and cis-1, 2-diphenylcyclohexane-1, 2-diol, respectively. There is a striking correlation between the initial mean valence number ($\underline{V}_i$) of the magnesium entering solution from the anode and the size of the ring; the lowest $\underline{V}_i$ values were obtained in those instances where the diketones originally in solution gave the most stable cyclic diols. Interpretations are offered for these results and for corrosion phenomena observed. (See also 140 946)

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by R. L. Wentworth. Quarterly periodic status rept. on Contract Nonr-1841(11). 31 Dec 56, 15p.

AD-122 932.
Order from LC mi$2.40, ph$3.30 PB 130 592

Contents:
Stability of hydrogen peroxide:
The effect of aluminum upon stability with tin
Stability measurements on shell hydrogen peroxide
Flame velocities in hydrogen peroxide vapor
Supercooling of liquid hydrogen peroxide
High pressure ignition limits of hydrogen peroxide vapor
Rate of solution of iron from stainless steel immersed in hydrogen peroxide
Literature dealing with hydrogen peroxide
Visitors
(See also PB 128 573)

New Hampshire U., Durham.
ELECTROPHILIC DISPLACEMENT REACTIONS INVOLVING ORGANOBORON COMPOUNDS, by H. G. Kuivila. Final rept. on Contract Nonr-806(01). 1 Dec 56, 7p. 10 refs.
Order from LC mi$1.80, ph$1.80 PB 130 566

This final report is presented in the form of a summary of the results obtained and conclusions drawn in the course of the research. References to more detailed reports or publications are given. Substantial progress has been made in revealing characteristics of electrophilic aromatic displacements involving organoboron compounds. The existence of linear correlations of the Hammett equation type among aromatic electrophilic displacements is indicated. It is shown that chelating agents play specific roles in catalyzing the reactions of areneboronic acids.

Texas U., Austin.
INTERACTIONS OF ACETYLENE AND AROMATIC HYDROCARBONS, by R. C. Anderson and Rita S. Wallace. Technical note no. 5 on Contract AF 18(603)142. June 59, 15p. 2 refs. AFOSR-TN-59-611; AD-217 398.
Order from LC mi$2.40, ph$3.30 PB 143 298

The earlier experiments of Stehling on thermal reactions of mixtures of acetylene with aromatic hydrocarbons have been extended to styrene-acetylene mixtures at temperatures of 600-800°C. The data are limited because of the high rate of polymerization of styrene, but they do offer a useful comparison with other hydrocarbon systems because styrene is a very reactive aromatic compound. Styrene was found to be quite reactive in polymerization even in gas phase at low pressure; but, like the other aromatic hydrocarbons it showed little decomposition up to 800°. With acetylene present, small amounts of addition products were observed; but the chief effects with all the hydrocarbons tested were enhanced production of decomposition products such as hydrogen and methane. The results indicate that acetylene supplies an activated molecule or diradical which can react so as to open or split the aromatic ring structure.

Washington U. [Seattle].
PREPARATION AND PROPERTIES OF PENTAFLUOROSELENIUM HYPOFLUORITE (F_5SeOF) AND BIS(PENTAFLUOROSELENIUM) PEROXIDE ($F_5SeOOSeF_5$) by Grihapati Mitra and George H. Cady. Technical rept. no. 20 on Contract Nonr-477(16). [1958] 12p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 143 244

The fluorination of selenium dioxide and of selenium oxychloride has been found to give rather small yields of the new compounds, pentafluoroselenium hypofluorite (F_5SeOF) and bis(pentafluoroselenium) perioxide ($F_5SeOOSeF_5$). The former is highly reactive. It boils at about -29° and melts at about -54°. The latter is relatively inert chemically. It melts at -62.8° and boils at 76.3°.

Physical Chemistry

Aberdeen Proving Ground, Md.
A STUDY OF THE MICELLAR SIZE OF AN ANIONIC-NONIONIC SURFACTANT COMBINATION, by A. Mankowich and C. F. Pickett. Progress rept. no. 11 on Investigation of Synthetic Detergents, Ordnance Proj. TB4-821E. 11 June 56, 18p. 10 refs. Engineering Labs. rept. no. 46.
Order from LC mi$2.40, ph$3.30 PB 138 948

To investigate by the light scattering technique the micellar size of the anionic-nonionic surfactant combination of sodium dodecylene benzene sulphonate and iso-octyl phenyl nonaethylene glycol ether (SDBS and IOPG, respectively) in aqueous solution. To evaluate the micellar size data from the standpoint of the known detergent synergism of the surfactant combination, as part of the program for developing a scientific method of selection of surfactants for specific detergent applications.

Amherst Coll., Mass.
THERMODYNAMIC PROPERTIES OF THE ELECTRICAL DOUBLE LAYER; SEARCH FOR SPECIFIC ADSORPTION OF CESIUM IONS IN THE ABSENCE OF SPECIFICALLY ADSORBED ANIONS, by F. R. M. Deane, A. E. Higinbotham, and D. C. Grahame. Technical rept. no. 7, second series, on Contract Nonr-2309(01). 14 Nov 58, 32p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 143 476

Three lines of evidence are presented tending to show that the cesium ion is not specifically adsorbed on mercury in the absence of specifically adsorbed anions. The potential of the e.c. max. in solutions of cesium fluoride is found to be constant at a value of 0.475 ± 0.003 v. relative to a normal calomel electrode. The behavior of the capacity of the double layer is normal in that it can be predicted almost quantitatively by a theory which assumes the absence of specific adsorption of both cations and anions and simple dependence of the capacity of the inner region upon the surface charge density, q, and not upon the concentration of the electrolyte. The slight dependence of the capacity of the inner region of the double layer upon the identity of the associated cation found by Damaskin, Nikolaeva-Fedorovich and Frumkin is confirmed but is explained in a manner which does not require their postulate of specific adsorption of cesium ions on positively charged mercury.

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
THE COMBUSTION OF BORON HYDRIDES, by W. G. Berl and W. Renich. Rept. on Contract NOrd-7386. July 58, 60p. 57 refs. CM-942; AD-207 027.
Order from LC mi$3.60, ph$9.30 PB 143 542

This report reviews the currently available information on the combustion of boron hydrides. A number of the more important combustion properties are listed, and the available published information is indicated by references. Although many of the pertinent physical combustion constants (flame speeds, heat release rates, etc.) are now being measured, the understanding of the underlying chemical reactions and mechanisms is still very limited. Likewise, the high temperature equilibria in the B-H-O-C system are far from satisfactorily explored, primarily because of the lack of definitive thermochemical data. In contrast to the C-H-O-N system, many more species (polymers, hydrates) are potentially stable at elevated temperatures and need to be considered.

Delaware U., Newark.
OPTICAL STUDIES OF THE STRUCTURE OF TURBULENT FLAMES, by Kurt Wohl and Rajah H. Atalla. Rept. on Contract Nonr-1858(25). Apr 58, 22p. 16 refs. Proj. Squid Technical rept. DEL-11-P.
Order from LC mi$2.70, ph$4.80 PB 142 956

Electrochemical Research Lab., Western Reserve U., Cleveland, Ohio.
THE ANODIC AND CATHODIC PROPERTIES OF THE CHLORINE ELECTRODE, by John Aylward, Ernest Yeager, and Frank Hovorka. Technical rept. no. 8 on Contract Nonr-581(00). 1 Feb 58, 58p. 23 refs.
Order from LC mi$3.60, ph$9.30 PB 138 779

The present investigation represents an attempt to obtain basic information concerning the chlorine electrode through the study of the anodic as well as the cathodic properties of the electrode. The anodic and cathodic polarization associated with the chlorine electrode has been measured on platinum, graphite, and carbon in concentrated hydrochloric acid and sodium chloride solutions.

Harvard U., Cambridge, Mass.
CHARACTERIZATION OF CELLULOSE AND POLYPEPTIDE POLYMERS, by Paul Doty. Final rept. for 1 June 52-31 Aug 56 on Contract N5ori-07654. 21 Oct 57, 6p. 19 refs.
Order from LC mi$1.80, ph$1.80 PB 138 885

The research is covered in 16 reports and 19 published papers. The latter are cited in this final report together with summaries of the findings.

Institute for Cooperative Research, Johns Hopkins U., Baltimore, Md.
QUARTERLY TECHNICAL STATUS REPORT NO. 14, by H. E. Hoelscher, Eric Weger, and W. C. Bastian. Rept. on Contract AF 18(600)1176. 12 Dec 57, 19p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 139 009

Contents:
Part 1. Flame studies in a flat flame burner, by William T. Biedler, III and H. E. Hoelscher
Part 2. Bunsen flame studies, by Eric Weger and Duane Levine
Part 3. Theoretical investigation of the flat flame, by W. C. Bastian

Istituto di Chimica Generale dell'Università, Palermo (Italy).
THERMODYNAMICS OF THE EQUILIBRIA BETWEEN Ni(DBH) AND ALKYL-AMINES AND -PHOSPHINES IN BENZENE, by Luigi Sacconi. Final technical rept. no. 1 on Contract DA 91-508-EUC-304. 30 Apr 59, 35p. 27 refs. AD-217 434.
Order from LC mi$3.00, ph$6.30 PB 143 050

Louisiana State U., Baton Rouge.
ADSORPTION KINETICS AND ELECTRODE PROCESSES, by Paul Delahay and Isaac Trachtenberg. Rept. no. 25 (Technical) on [Contract Nonr-300(00)]. Oct 56, 35p. 42 refs.
Order from LC mi$3.00, ph$6.30 PB 130 014

The kinetics of adsorption on electrodes is studied for substances which are not reduced or oxidized at the electrode. Adsorption rates are derived for the plane electrode with control by semi-infinite linear diffusion, the streaming mercury electrode, and electrodes in stirred solution. Adsorption at the dropping mercury electrode is also considered briefly. Implications are discussed for double layer capacity measurements, electrocapillary curves studies, electrochemical kinetics, and polarography. Experimental methods are discussed, and a simple and accurate bridge for differential capacity measurements without insulation transformer is described.

Metallic Surfaces Research Labs., Ltd., Uxbridge (Gt. Brit.).
THE EFFECT OF HIGH FREQUENCY HEATING ON THE DIFFUSION PROPERTIES OF ONE METAL INTO ANOTHER, by R. L. Samuel and J. D. Samuel. Annual technical rept. ATR 1, 1 Apr 58-1 Apr 59, on Contract DA 91-508-EUC-310. 10 Apr 59, 35p. AD-214 791.
Order from LC mi$3.00, ph$6.30 PB 143 291

Several methods have been devised for chromising under conditions of H.F. heating. (1) The active chromising agent is chromium fluoride contained in the melted flux. (2) The chromising agent is chro-

mium bromide, generated from chromium powder and ammonium bromide. (3) The test-pieces are electroplated with chromium (0.004") followed by nickel (0.004"). The adherence of the chromium is good, but the nickel, the purpose of which is to protect the chromium, exfoliates badly, and sometimes alloying of nickel and chromium occurs as an alternative to the chromising reaction. Uniform coatings, of normal structure, have an average chromium content of 23 - 27%. Graphs have been constructed from data obtained by the three methods, showing variation of coating thickness with time at various temperatures.

Michigan U., Ann Arbor.
THE CHEMISTRY OF BORON HYDRIDES AND RELATED HYDRIDES, by R. W. Parry, R. C. Taylor and others. Rept. on Contract AF 33(616)3343. May 59, 192p. 140 refs. WADC Technical rept. 59-207.
Order from OTS $3.00 PB 161 080

A microcrystalline form of $B_2H_6 \cdot 2NH_3$ has been obtained and the powder pattern is tabulated for ready compound identification. Relatively strong evidence against the structure $[HB(NH_3)_3](BH_4)_2$ has been accumulated. The so-called "diammoniate of diborane II" which was formerly assigned this structure has been shown to consist chiefly of the regular "diammoniate" with the structure $[H_2B(NH_3)_2]BH_4$. Improved methods for the synthesis of pure salts of the form $[H_2B(NH_3)_2]X$ have been developed. A complete single-crystal X-ray crystallographic study which established the structure of $[H_2B(NH_3)_2]Cl$ has been completed and the data confirm the above structure assignments in every detail. A nuclear magnetic resonance study of $[HB(NH_3)_2]I$ can best be interpreted in terms of the accepted structure of the cation $[H_2B(NH_3)_2]^+$. The "diammoniate of diborane," $[H_2B(NH_3)_2]BH_4$, has been prepared by metathesis, a fact which offers final and complete chemical support for the above structure. (See also PB 133 981)

Naval Radiological Defense Lab., San Francisco, Calif.
AN APPARATUS FOR THE CONTROLLED FLAME COMBUSTION OF FILTER PAPER, by M. Honma and A. E. Greendale. 20 Oct 58, 10p. 2 refs. Research and development rept. USNDRL-TR-285.
Order from LC mi$1.80, ph$1.80 PB 143 894

A new apparatus and technique is described for the controlled flame combustion of filter paper and cloth. The sample is burned in an atmosphere of oxygen at a reduced pressure within a pyrex glass cylinder. A detailed description is given of the operation of the apparatus. The numerous advantages of this system over previous methods are enumerated. The apparatus can be scaled up or down in size and can also be used with gases other than oxygen. Since it is possible to contain completely the sample during the combustion and to collect the products of combustion, it appears to be an extremely efficient system for quantitative determinations and for use with radioactive materials and toxic chemicals.

Northwestern U., Evanston, Ill.
THE STRUCTURE AND ACTIVITY OF CATALYTICALLY ACTIVE SOLIDS, by P. W. Selwood. Final rept. on Contract N7onr-45003. 1 Aug 56, 5p. 26 refs.
Order from LC mi$1.80, ph$1.80 PB 128 262

Brief summary of work on (1) The structure of supported catalytic oxides as deduced from magnetic susceptibility studies. (2) The use of nuclear magnetic resonance in the study of catalyst surfaces. (3) The mechanism of chemisorption. (See also PB 123 224)

Ohio State U. Research Foundation, Columbus.
ADIABATIC FLAME TEMPERATURES, COMBUSTION GAS COMPOSITIONS, AND EXPANSION RATIOS OF COMBUSTIBLE MIXTURES AT VARIOUS PRESSURES, by William A. Strauss and Rudolph Edse. Rept. on Contract AF 33(616)2833. July 59, 51p. 2 refs. WADC Technical note 59-49.
Order from OTS $1.50 PB 161 077

This paper contains calculations of adiabatic flame temperature, expansion ratio, and combustion gas composition expressed in partial pressures for hydrogen-oxygen, hydrogen-air, hydrogen - nitric oxide, carbon monoxide - oxygen, carbon monoxide - air, methane-oxygen, methane-air, ammonia-oxygen, ammonia-air, hydrogen-bromine, and cyanoaen-air mixtures at pressures from 1 to 90 atmospheres. Flame temperatures and expansion ratios increase at a decreasing rate as the pressure is increased. The oxygen and nitric oxide flames have a high flame temperature and show the largest change as the pressure is raised.

Rensselaer Polytechnic Inst., Troy, N. Y.
A RECORDING BECKMAN THERMOMETER AND DIFFERENTIAL POTENTIOMETER, by C. Solomons and George J. Janz. Technical note no. 3 on Contract AF 49(638)50. Aug 57, 13p. AFOSR TN-57-497; AD-136 487.
Order from LC mi$2.40, ph$3.30 PB 129 942

An apparatus is described by means of which accurate measurements and records of changing electromotive forces can be made. The apparatus is normally used to measure and record changes of temperature of 1 to 5°C. The principle of operation is such that small differences in emf. between a test source such as a thermocouple and a standard source such as a potentiometer is amplified by a means of a stable dc microvolt amplifier. A continuous-balance stripchart potentiometer recorder is used with the device.

Stanford Research Inst., Menlo Park, Calif.
DIFFUSION AND HETEROGENEOUS REACTION. I. THE DYNAMICS OF RADICAL REACTIONS, by Henry Wise and Clarence M. Ablow. Rept. on Project Squid, Contract Nonr-1858(25). Mar 58, 18p. 13 refs. Technical rept. SRI-1-P. AD-156 508.
Order from LC mi$2.40, ph$3.30 PB 139 187

The diffusion and heterogeneous reaction of labile species in a cylinder of finite length are examined. The effects of radial and longitudinal diffusion are included in the mathematical treatment. The results of this analysis are applied to published data of the recombination coefficients of oxygen and hydrogen atoms on the surfaces of various materials.

Sterling Chemistry Lab., Yale U., New Haven, Conn.
NUMERICAL CALCULATION OF THE ONSAGER-KIM THEORY USING AN ELECTRONIC COMPUTER, by Andrew Patterson, Jr. and Harlow Freitag. Technical rept. no. 4 on High Field Conductance Research, Contract Nonr-215(00). 15 May 58, 39p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 139 063

A program for calculating the Wien Effect for any binary strong electrolyte is given. The program is based on the Onsager-Kim theory of the Wien Effect, and is suitable for use on the IBM 650 data-processing machine. A brief exposition on the use of the machine is given, together with the method of programming used in this paper. A description of how the theory was translated is included, plus a computers' check-list, allowing use of the program without the necessity of previous programming experience.

Texas U., Austin.
CAPACITY OF THE ELECTRICAL DOUBLE LAYER AND ADSORPTION AT POLARIZED PLATINUM ELECTRODES, by Norman Hackerman and Pranjivan V. Popat. Technical rept. on Contract Nonr-375(02). 15 Mar 58, 31p. 25 refs.
Order from LC mi$3.00, ph$6.30 PB 139 197

The differential capacity of the electrical double layer at polarized platinum electrodes has been investigated as a function of the type and concentration of anions.

Vitro Labs., West Orange, N. J.
VAPOR PHASE CARBOTHERMIC REDUCTION OF MAGNESIUM OXIDE IN THE HIGH INTENSITY ARC, by S. Korman, A. Diniak, and C. Sheer. Technical note no. 6 on Contract AF 18(603)03. 22 Aug 58, 15p. 8 refs. KLX-10116; AFOSR-TN-58-498; AD-158 308.
Order from LC mi$2.40, ph$3.30 PB 143 656

A laboratory investigation of the vapor-phase reduction of magnesium oxide has been carried out in the tail flame of a d-c high intensity arc. Thermodynamic considerations were used to predict an approximate temperature-dependence for the homogeneous reaction, $MgO + C \rightarrow Mg + CO$, indicating this reaction goes to completion above 1800°C. Since the lowest recorded temperature in the flame was ~ 2000°C, it was assumed that the flame consisted predominantly of reaction products. This was verified by spectrographic observation. It was concluded that the reaction was a homogeneous one and that the high intensity arc technique offers interesting possibilities in the carbothermic reduction of stable metal oxides.

EARTH SCIENCES

Lamont Geological Observatory, Palisades, N. Y.
FINAL REPORT, by Paul W. Pomeroy. Rept. on Contract AF 19(604)1369. 9 Dec 58, 13p. 31 refs. CU-13-58-AF1369-GEOL; AFCRC-TR-58-292.
Order from LC mi$2.40, ph$3.30 PB 138 716

Development of the mathematical theory of normal mode propagation in stratified elastic media; experimental investigation by means of small scale models of naturally occurring wave guides; applications of the methods developed to the interpretation of seismological, acoustic and microbarometric data in terms of the dimensions and physical properties of the medium and the location and nature of the source.

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
PROJECT PRAIRIE GRASS, A FIELD PROGRAM IN DIFFUSION, VOLUME III, by Duane A. Haugen. June 59, 686p. 1 ref. Geophysical Research Papers no. 59; AFCRC-TR-58-235(III); AD-217 076.
Order from OTS $8.00 PB 161 101

Project Prairie Grass was a field program designed to provide experimental data on the diffusion of a tracer gas over a range of 800 meters. This, the third volume of the report on the project, contains descriptions of the fast-response instrumentation utilized for the measurement of wind fluctuations. The data reduction and analysis techniques are also presented along with tabulations of the results of the computations. (See also PB 151 424)

Allied Research Associates, Inc., Boston, Mass.
MODIFICATION OF FOG AND CLOUD PARTICLES IN THE ATMOSPHERE, by Robert B. Smith, Raymond Wexler, and Arnold H. Glaser. Final rept. Pt. 2, on Research Directed toward Contrail Elimination, Contract AF 19(604)3492. 31 Mar 59, 56p. 7 refs. AFCRC-TR-59-228, Pt. 2; AD-212 553.
Order from LC mi$3.60, ph$9.30 PB 143 200

Part II of the report deals with aspects of artificial fog and cloud modification. A number of studies and experiments on dry-ice crushing and disseminating equipment led to a suggested improved design. The possibility of the reduction or suppression of fogs by the use of hexadecanol to prevent evaporation from nearby free water surfaces is discussed. Evaporation of some fog and small clouds through the absorption of sunlight by pollutants added to the cloud seems possible on the basis of calculations of the effect of carbon black seeding, as well as more general theoretical considerations. (See also PB 143 201)

Allied Research Associates, Inc., Boston, Mass.
RESEARCH IN RADAR METEOROLOGY, by Roland J. Boucher and Raymond Wexler. Final rept., Pt. 3, 1 May-31 Nov 58, on Contrail Elimination, Contract AF 19(604)3492. 20 Mar 59, 15p. 3 refs. AFCRC-TR-59-228, Pt. 3; [AD-220 568].
Order from LC mi$2.40, ph$3.30 PB 143 543

A comparatively new technique for displaying precipitation echoes on radar, the Constant Altitude Plan Position Indicator display (CAPPI), is critically reviewed as to its possibilities as a research tool and as a means of presenting radar information for synoptic diagnosis and forecasting. Radar echo patterns along the vertical which indicate rapid changes in the wind profile aloft may be of significant use in forecasting weather conditions up to 12 hours. Radar detection of echoes associated with the sea breeze at Round Hill reveals some interesting micrometeorological aspects of the sea breeze. Research on the melting of hail indicates that along the 20°C wet adiabat hail of about 1 cm diameter at the 4 km level will completely melt by the time it reaches the surface.

Allied Research Associates, Inc., Boston, Mass.
A TEST OF THE FEASIBILITY OF THE USE OF JET ENGINE EXHAUST HEAT FOR FOG DISSIPATION, by Robert B. Smith and Raymond Wexler. Final rept. Pt. 1 on Research Directed toward Contrail Elimination, Contract AF 19(604)3492. 31 Mar 59, 27p. 4 refs. AFCRC-TR-59-228 Pt. 1; AD-212 553.
Order from LC mi$2.70, ph$4.80 PB 143 201

Measurements of temperature and wind speed in the exhaust plume of a jet aircraft operating on the ground were made to investigate the feasibility of the use of jet engine exhaust heat to dissipate fog from airport runways. A field test in a calm showed that temperature rises of 2°F above ambient reached 200 ft above the runway over a width of 200 ft at distances of 300-600 ft behind the tail pipe. Maximum induced wind speeds in this region were about 20 mph. Based on the results of this experiment a fog dissipation technique for airport runways using jet exhaust heat seems feasible for fogs warmer than about 30°F.

Army Signal Radio Propagation Agency, Fort Monmouth, N. J.
FORECAST OF IONOSPHERIC STORMS AND RADIO COMMUNICATIONS 1959 - 1962, by Luther C. Kelley. June 58, 20p. Proj. no. 636.
Order from LC mi$2.40, ph$3.30 PB 143 137

This brochure is designed to forewarn supervisory and operating personnel of the Army Command and Administrative Network of increased radio circuit outage during the downward trend of the current sunspot cycle. Long-range predictions indicate that severe disruptions of radio service will result from ionospheric storms during this period. Data of actual circuit performance illustrate the curtailment of radio communication with rising geomagnetic activity. Long-term forecasts are based on the correlation of geomagnetic activity with sunspot number observed for many years. Recommendations for the reduction of outage are included.

Florida State U., Tallahassee.
AN INVESTIGATION OF THE COMBINED INFLUENCES OF LARGE-SCALE DIFFERENTIAL HEATING AND OROGRAPHIC OBSTACLES IN CREATING QUASI-PERMANENT FORCED PERTURBATIONS OF THE CIRCUMPOLAR WESTERLIES, by Charoen Vadhanapanich. Technical rept. no. 10 on Contract Nonr-1600(00). 15 Mar 58, 71p. 23 refs.
Order from LC mi$4.50, ph$12.30 PB 139 195

The present results suggest that the statistical mean perturbations are only partially a result of steady forcing influences, and must also be, in part, a result of "preferred" behavior, i.e. development and movement, of individual day-to-day perturbations, which in turn is related to the fixed forcing effects. Further work on the problem should abandon the steady state approach in favor of a time dependent model which incorporates both factors.

Free U. of Berlin (Germany).
SHORT-RANGE WEATHER PREDICTION TECHNIQUES BY SPECIFICATIONS OF THE WEATHER ACCORDING TO THE FORECASTED PRESSURE DISTRIBUTION, RESEARCH ON, by D. Just, K. Sieland and G. Polster. Final technical rept. on Contract AF 61(514)946. 30 Nov 57, 186p. AFCRC TR-58-227; AD-152 508.
Order from LC mi$8.40, ph$28.80 PB 138 882

In the present research the relationship of the occurrence of fair, cloudy and overcast sky, of fog, precipitation and cloud height $h \leq 3$ to the surface- and 500-mb. pressure pattern is investigated. For the period 1950 - 1957 daily synoptic data, the respective pressure distribution, wind direction and pressure change were entered into key punched cards for three German, three English, and three Russian stations. Evaluating these punched cards, the frequency of the occurrence of the above-mentioned classes of sky and weather condition in connexion with different parameters of the pressure distribution was determined and summarized in the form of tables. For each class the mean value of occurrence, expressed as percentage, was computed, while for each combination with the different parameters the departure from the mean occurrence was calculated. As a means to assess the capability of individual parameters to exercise an influence on the occurrence of a certain class, a so-called departure factor ΔM was introduced. The best results were obtained for the occurrence of precipitation and of fair skies. As to the parameters, the pressure distribution gives better results than the pressure change and the wind direction. Especially good values were obtained for isobar curvature, high, low and trough at the surface, for high in 500 mb., wind speed = 50 knots in 850 and 500 mb., as well as for larger amounts of 3- and 24-hr. pressure changes. It can be definitely stated that in general the pressure distribution and pressure change at the surface exercise a stronger influence on sky and weather conditions than does the 500-mb. level.

Massachusetts Inst. of Tech., Cambridge.
MEAN TEMPERATURE FROM 1000 MB TO 500 MB AS A PREDICTOR OF PRECIPITATION TYPE, by A. James Wagner. Scientific rept. no. 2 on Contract AF 19(604)1305. May 57, 20p. 2 refs. AFCRC-TN-57-288; AD-117 176.
Order from LC mi$2.40, ph$3.30 PB 128 332

The frequency of occurrence of frozen precipitation forms relative to the frequency of occurrence of non-frozen forms is determined as a function of geographical location and of the mean temperature (or thickness) of the layer from 1000 mb to 500 mb. The results are derived from the data for a large number of stations in the United States during two winter seasons. A map of the thickness values for equal probability of occurrence of frozen and non-frozen forms illustrates the effects of altitude and continentality. It is found that the form of the precipitation can be specified with a confidence of 75% or more when the thickness value at a station is 100 feet or more from its "equal probability" value. Some refinements of the technique are discussed.

Naval Ordnance Test Station, China Lake, Calif.
AN INVESTIGATION OF RAWINSONDE DATA TECHNIQUES FOR COMPUTING WINDS ALOFT, by Royal C. Gould. 15 Sep 56, 23p. NOTS 1563; NAVORD rept. 5318.
Order from LC mi$2.70, ph$4.80 PB 130 430

A simplified and readily applicable technique, developed at the U. S. Naval Ordnance Test Station, for obtaining more accurate winds-aloft data based on Rawinsonde data is presented.

New York U. Coll. of Engineering, N. Y.
PROBABILISTIC DYNAMICS, by Max A. Woodbury. Rept. on Contract AF 19(604(3490. 30 Apr 59, 9p. AFCRC-TR-59-247; AD-216 319.
Order from LC mi$1.80, ph$1.80 PB 143 787

The model of the atmosphere provided by the Navier-Stokes equations of motions was greatly altered in application to weather forecasting by numerical means. The changes come about, partly at least, to remove from the model features of atmospheric motion which are irrelevant to the information available to the forecaster. Sound waves and other atmospheric motions which are small compared with the spacing between points at which data is available are eliminated from consideration. An avenue of approach is investigated which allows a unified viewpoint based on probabilistic notions rather than on a theory of approximation. A probabilistic dynamic system is characterized by a fairly rich structure compared with a dynamic system without probability elements, but much simpler in essence than many man-machine systems.

Pennsylvania State U. Mineral Industries Experiment Station, University Park.
PRELIMINARY MONTHLY MEAN 50 MB AND 100 MB CHARTS, APRIL-JULY, 1957, by Paul Julian. Scientific rept. no. 1 on Contract AF 19(604)2190. 31 July 59, 61p. 11 refs. AFCRC-TN-59-458.
Order from LC mi$3.90, ph$10.80 PB 143 591

Washington U., Seattle.
ARCTIC WEATHER STUDIES: SUMMER SEASON, by Richard J. Reed and Ronald K. Surface. Scientific rept. no. 5 on Contract AF 19(604)3063. June 59, 53p. 5 refs. AFCRC-TN-59-278, AD-214 889.
Order from LC mi$3.60, ph$9.30 PB 143 508

Aircraft reconnaissance reports and 3-hourly surface observations are used to study the relationship between various weather phenomena and features of the arctic circulation during a three-week period in July 1956. The reconnaissance reports were entered at appropriate positions on a large model containing surface fronts, 500-mb low center and 500-mb jet axis, and composites were drawn of average number of cloud layers, average total cloudiness, average cloudiness in the layers 0-5,000 feet, 5-10,000 feet, 10-15,000 feet, 15-20,000 feet and above 20,000 feet, and average winds and temperatures at 700 mb and 500 mb. The frequency of occurrence of turbulence and icing was also derived. The individual flight sections were studied in order to determine whether the middle and upper cloud masses were related to the frontal surfaces in the classical fashion. Turbulence was found to be very infrequent despite the above normal weather activity during the selected period. All reports of turbulence were made in or very near cloud layers. Icing was encountered in about one half of the cloud masses both at 700 mb and 500 mb. The frontal characteristics, as judged from the 3-hourly surface observations, were highly variable, and little attempt was made to generalize. (See also PB 139 559)

Washington U., Seattle.
AN ATTEMPT TO MEASURE THE WATER VAPOR DIVERGENCE OVER GREENLAND BY DIRECT APPLICATION OF RADIOSONDE DATA, by Richard Keith Wilson. Scientific rept. no. 3 on Contract AF 19(604)3063. May 59, 39p. 17 refs. AFCRC-TN-59-238; AD-211 111.
Order from LC mi$3.00, ph$6.30 PB 143 464

A resume of Greenland's geographical, topographical, and hydrological features is made to help evaluate the results of the computations of water vapor divergence. An equation suitable for the direct application of radiosonde data is developed from the equation of continuity and the divergence theorem. Six months of data were used in the computation of water vapor divergence. The months studied were: June, 1957; July, 1957; August, 1957; December, 1957; January, 1958; and February, 1958. The computations of water vapor divergence for Greenland through the direct application of radiosonde data are found to be unreliable. An investigation of the procedure used brings out three major factors which contribute to the unreliable values as mentioned above. These errors are: missing data, the condition known as motorboating, and the line integration technique which involves the assumption of linear variation of mean water vapor flux between stations. It was decided to prepare a series of daily 700-mb charts for December, 1957, to compare the water vapor divergence computations obtained by analyzed data to those obtained by the direct application of radiosonde data. The result suggests that meaningful information on the water vapor divergence of Greenland can be obtained from measurements taken from analyzed charts.

Washington U., Seattle.
RESULTS OF A SERIES OF DYNAMICAL PREDICTIONS FOR THE ARCTIC: SUMMER SEASON, by Richard J. Reed. Scientific rept. no. 4 on Contract AF 19(604)3063. Apr 59, 55p. 7 refs. Meteorology and Climatology Occasional rept. no. 12; AFCRC-TN-59-

246; AD-211 493.
Order from LC mi$3.60, ph$9.30 PB 143 509

Forecasts of 1000-mb and 500-mb heights were prepared for the arctic for a 20-day period in July, 1956. The forecasts were based on a two-level baroclinic model; solutions were obtained by both graphical and combined graphical and numerical integrations. The day-to-day performance of the method, as revealed by correlations between predicted and observed heights and root-mean square-errors, was slightly better than for a similar arctic series reported on by Estoque and somewhat worse than for comparable forecasts at middle latitudes. From the geographical distribution of correlations and errors, little evidence of important topographical influence was found. In general, the performance was best in regions where the synoptic activity was most pronounced. Generally speaking, the results confirm Estoque's conclusion that reasonably successful predictions should be possible in the arctic by dynamical methods once the data network is improved. Even with the present network, useful results are obtained on a considerable number of occasions.

Frost Science

American Geographical Society, New York.
GEOGRAPHIC STUDY OF MOUNTAIN GLACIATION IN THE NORTHERN HEMISPHERE. PART 4: NORTH ATLANTIC ISLANDS. Rept. on Contract DA 19-129-qm-409. Feb 58, 122p. 156 refs.
Order from LC mi$6.30, ph$19.80 PB 143 078

The North Atlantic Islands covered are: Greenland, Jan Mayen, Iceland, and Spitsbergen. (See also PB 143 079)

Bureau of Yards and Docks, Washington, D. C.
SNOW REMOVAL. 1 Oct 53, 60p. 7 refs. Technical pub. NAVDOCKS TP-Pw-29.
Order from OTS $1.50 PB 161 060

This publication has been prepared by the Bureau of Yards and Docks as a guide for naval and civilian personnel concerned with snow removal and snowdrift control operations. Presented herein are technical criteria and operational procedures to be used as a guide for snow and ice removal, and for snowdrift control operations to keep roads, airfields, and other areas open to traffic. Lists and illustrations of equipment are included, as well as detailed instructions concerning usage. Specific types of equipment best adapted for different snowfall areas are described.

North Pacific Div., Corps of Engineers, Portland, Oreg.
LYSIMETER STUDIES OF SNOW MELT. Research note no. 25 on Snow Investigations. 1 Mar 55, 61p. 16 refs.
Order from LC mi$3.90, ph$10.80 PB 128 397

Runoff from an unforested 600-square-foot snow-lysimeter area is used as a measure of snow-melt quantities. The component melts due to radiation, convection, and condensation are computed from measured meteorological parameters and compared with the gaged runoff. Radiation and condensation melts are independently determined, the former from radiometer measurements and the latter from special moisture-exchange experiments.

Geodesy

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
SHORAN PHOTOGRAMMETRIC MAPPING INSTRUCTIONS, by Archer M. Wilson. 15 May 50, declassified 5 Nov 53. 153p. Rept. 1168; supersedes rept. 1055.
Order from LC mi$7.50, ph$24.30 PB 127 704

This report is designed to provide a set of tentative operating instructions for use by Corps of Engineers personnel who may be required to employ Shoran-controlled photography in fulfilling current mapping assignments. The wording and layout have been written in the general form of a training manual so as to facilitate its later publication.

Rome Air Development Center, Griffiss AFB, N. Y.
ELECTRONIC COMPUTERS FOR RECONNAISSANCE FIELD UNITS, by Anthony A. Garra and Mary B. Erskine. June 59, 32p. RADC-TR-59-71; AD-215 440.
Order from LC mi$3.00, ph$6.30 PB 143 268

For several years the Air Force has been attempting to introduce automatic computational techniques and equipment to reconnaissance field units to speed up mathematical operations and reduce manpower requirements. This report describes the RADC development program to obtain a small reconnaissance computer to meet field requirements. The interim equipment procured and assigned to field units is described in detail. The equipment purchased to study programming techniques is also described. The experimental equipment designed specifically for field requirements is presented in detail and typical problems to be computed on the equipment are discussed. The effort to satisfy the operational requirement is about 80 percent complete. Several improvements to the computational equipment are recommended as a means of satisfying the existing requirement.

Stanford Research Inst., Menlo Park, Calif.
THE DETERMINATION OF THE EARTH'S POTENTIAL FIELD BY OBSERVATIONS OF SATELLITE ORBITS, WITH SPECIAL REFERENCE TO THE DETERMINATION OF THE THIRD HARMONIC, by J. L. Brenner, R. Fulton, and N. Sherman. Rept. on Contract AF 29(600)1773. 1 July 59, 39p. 4 refs. 2587-ITR-3; AFMDC-TR-59-29.
Order from LC mi$3.00, ph$6.30 PB 143 518

A theoretical analysis of the differential equations of motion of a near-earth satellite about a model earth having mass distribution which is symmetric with respect to its polar axis and its equatorial plane reveals that the satellite's orbit undergoes long-period changes not previously reported. Numerical integration of the equations of motion verifies this result. These changes are minute and definitely observable only if many observations are made during each revolution. On the other hand, a bias in the handling of the observations can override these changes, and introduce spurious secular (long-term) variations. The magnitudes and periods of typical spurious variations have been evaluated. The variation of the eccentricity agrees with that reported from the Vanguard computing center; hence its use in verifying the existence of a third harmonic in the earth's gravitational potential field is not justified.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
ANALYSIS OF STEAD DISTRIBUTION BY THE D-LINE METHOD, by Arthur F. Loeben. Technical rept. no. 6 on Contract Nonr-551(01). 1 Oct 58, 39p. 14 refs.
Order from LC mi$3.00, ph$6.30 PB 143 798

In this paper, interest and effort has been placed on developing a method of finding and generalizing such patterns. An attempt is made to define a useful unit of enumeration and to generalize its distribution. The concept of the stead is used as the basic unit, and the concept of a nucleated area as the first level of generalization. Beyond this, further generalization and development of patterns is accomplished by using the D-line method of agglomeration. Some aspects of scale and theoretical distributions are examined and used. The end product of the research is presented as three levels of generalization of the same data with the resulting differences in their patterns.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
DESCRIPTION OF A LAND-USE MAP OF PENNSYLVANIA, SCALE 1:250,000, by Lester E. Klimm. Technical rept. no. 2 on Contract Nonr-551(01). 1 Oct 58, 10p.
Order from LC mi$1.80, ph$1.80 PB 143 795.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
THE DISTANCE RELATIONS AND SOME OTHER CHARACTERISTICS OF CROPLAND AREAS IN PENNSYLVANIA, by James P. Latham. Technical rept. no. 4 on Contract Nonr-551(01). 1 Oct 58, 274p. 53 refs.
Order from LC mi$11.10, ph$42.60 PB 143 800

The conclusions of this study fall into two general classes. The first class results from the general finding that it is possible by the D-line method of analysis to regionalize an areal dispersant of extreme complexity, e.g., cropland, according to distance relations and to derive regions that are objectively located and bounded. The second class develops from the measurement of uninterrupted surface distances (intercepts) along rotated parallel traverses. Such measurement provides quantitative data for describing characteristics of regions and of the areal dispersants within the regions.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
MULTI-CATEGORY D-LINE ANALYSIS OF A DISTRIBUTION, by Lester E. Klimm. Technical rept. no. 5 on Contract Nonr-551(01). 1 Oct 58, 19p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 143 799

In previous papers the basic nature of the D-line method has been described and analyzed. There it was considered only as applied to the relations between patches of a single category of distribution--"islands," cropland areas, or "steads." Here it is proposed to examine its application to the analysis of the relations of two or more phenomena occurring within a complex landscape. For this purpose the section of The Land-Use Map of Pennsylvania showing the greatest complexity within a limited area was chosen. Its great complexity arises from the fact that it has small units of mining and urban use scattered through an area where the larger units of landscape are agricultural or in forest.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
SOME CONTRIBUTIONS TO PRINCIPLES AND METHODS OF DESCRIPTIVE GENERALIZATION IN GEOGRAPHY, by Lester E. Klimm. Final rept. on Contract Nonr-551(01). 1 Oct 58, 18p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 143 704

A summation of work completed under the contract.

Geography

Columbia U., New York.
QUANTITATIVE GEOMORPHOLOGY OF SMALL DRAINAGE BASINS OF SOUTHERN INDIANA, by Donald R. Coates. Technical rept. no. 10 on Contract N6onr-271, T. O. 30. 1958, 65p. 18 refs. AD-206 780.
Order from LC mi$3.90, ph$10.80 PB 143 654

Morphometric analysis of six small areas in the unglaciated part of southern Indiana provided data for determination of influence of lithology, per cent of unconsumed upland (stage of cycle), and regional relief upon scale and form properties of third-order drainage basins measured in the field and from topographic maps and air photos. Ten drainage basins in each of six different localities were compared with respect to length dimensions of area, perimeter, overland flow, stream lengths, drainage density, and local relief, and with respect to dimensionless form properties of valley-side slopes, stream gradients, hypsometric curve forms and integrals, bifurcation ratios, length ratios, circularity, and azimuth relations of slope and

channels. Differences between areas were tested for significance by the analysis of variance.

Sacramento State Coll., Calif.
GEOGRAPHY OF INDIAN COASTS, by David E. Sopher. Annual summary rept. for 1957 on Contract Nonr-2329(00). [1958] 24p. AD-153 106.
Order from LC mi$2.70, ph$4.80 PB 137 992

A cultural geographic reconnaissance of the east coast of India was made during the summer of 1957. The itinerary included a traverse of the coast between the Bengal-Orissa boundary, northeast of Balasora, and Cape Gomorin. A short tract on the west coast north of the Cape to Trivandrum, an extension of the Tamil language area on the Malabar side, was included in the survey. Because relevant cultural variations were found to occur within relatively short distances along the coast, the number of coastal sites visited was large and the time spent at each necessarily brief. The cultural aspects of maritime traffic are described in terms of the use of Tuticorin dhoni and Kakinada nava country craft, trade in the country craft, conditions affecting country craft traffic, ports, and seafaring as a way of life. The use and distribution of the various types of Catamaran and other types of sea fishing craft are presented; a few notes were gathered on fishing gear and marine fish resource. Consumer habits and marketing of fish and other sea food are outlined. Sea fishing and seafaring is exclusively the province of a small number of castes, some of whom, while retaining their caste identity are Moslem or Christian rather than Hindu. A varying degree of cultural unconformity is noted and shown to exist between the strand fishing population and the rest of the coastal populations. An aspect of the marked social separation of the strand population from the much more numerous agricultural and urban population of the coastal plain is the existence of important Hindu shrines, some of great antiquity, on the shores of the Bay of Bengal.

Oceanography

Bureau of Yards and Docks, Washington, D. C.
MARINE BORERS AND FOULING ORGANISMS IN 56 IMPORTANT HARBORS [AND] TABULAR SUMMARIES OF MARINE BORER DATA FROM 160 WIDESPREAD LOCATIONS. Apr 51, 324p. 26 refs. NAVDOCKS TP-Re-1.
Order from OTS $3.50 PB 161 061

PART A of this report comprises a narrative analysis of the data from each of the 56 harbors. These locations are widely distributed along our Atlantic and Gulf coasts; in Canada and Alaska; in various Caribbean islands; in Brazil, North Africa, Sicily, and Italy; and in the Pacific as far as Australia and New Zealand. Each analysis identifies the marine borers which attacked the test boards at a given station, summarizes the intensity of borer attack, and describes the kind and number of fouling organisms present. The depth of the test board and various hydrographic data also are reported. Additional data for 1948 and 1949, where available, are summarized under the heading "Recent Addenda." PART B is a tabular summary of test board data recorded during 1934-1942 at several hundred locations. The majority of these locations are in the Middle Atlantic harbors; the others are scattered along the South Atlantic and Gulf ports in the Caribbean islands; in Venezuela and Brazil; in Italy; along the Pacific coast southerly from Adak, Alaska; and in the Hawaiian and other Pacific islands, Australia, and New Zealand.

Florida State U., Tallahassee.
A SIMPLIFIED THEORY OF LONG WAVES ON A BAROCLINIC WESTERLY CURRENT, by Seymour L. Hess. Technical rept. no. 11 on Contract Nonr-1600(00). 1 May 58, 24p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 138 818

A simplified, quasi-geostrophic, baroclinic theory of long waves is presented. By elimination of the geopotential from the divergence equation it is possible to relate the three velocity components by three independent equations. No more are needed. Simple solutions are obtained at the price of losing instability of the waves. The vertical motion ties the waves together vertically. The relationship of vertical motion to the profile of the zonal wind is examined. Possible extensions to long-range forecasting are discussed.

Johnson, J. W., and Wiegel, R. L., Berkeley, Calif.
WAVES AT SUBIC BAY, PHILIPPINE ISLANDS, by J. W. Johnson and R. L. Wiegel. Rept. on Study to Determine Effect of Grande Island Breakwater upon Destructive Wave Action during Normal Storms in Subic Bay, P. I., Contract NOy-79349. 1 Dec 55, 96p. 9 refs.
Order from LC mi$5.40, ph$15.30 PB 130 022

A critical examination of all available wave data shows that both the monsoons and the typhoons in the South China Sea are responsible for high wave conditions at the entrance of Subic Bay. To aid in future planning operations and designing structures that are affected by wave action the complete analysis of wave conditions at Subic Bay, as determined by hindcasts from past weather charts of the South China Sea, is attached to this report as an Appendix.

Nebraska U., Lincoln.
CALCIFICATION IN MARINE MOLLUSKS, by Louise H. Jodrey and Joseph L. McDonald. Annual progress rept. for 1 June-31 Aug 56 on Contract Nonr-1801(00). 9 Dec 57, 3p. AD-150 634.
Order from LC mi$1.80, ph$1.80 PB 138 648

Certain aspects of respiratory metabolism of the shell-forming tissue of mollusks was one objective of this study. Other objectives included (1) the study of dependence of the shell-forming process on respiratory processes; (2) the action of phosphatase; (3) further studies on the participation of carbonic anhydrase in the deposition of shell; (4) the evaluation of bicarbonate and decarboxylations as alternative sources of shell carbonate; and (5) studies of the chemical reactions, including the site of carbonic anhydrase intervention, concerned in the final deposition of $CaCO_3$. The finding that diethyldithiocarbamate (D inhibited respiration of the mantle was confirmed. The decrease of O consumption was measured at 3 different concentrations of I, and salicylaldoxime. Tyrosine was used as a substrate for the suspected Cu-containing enzyme. The increase in O at pH of 9.5 was measured. At low concentrations where autoxidation was negligible, catechol enhanced the oxidation of tyrosine. Attempts to use ascorbic acid to enchance O consumption were unsuccessful. DOPA was oxidized by mantle homogenates without a Cu complexing agent.

Washington U., Seattle.
MIDWATER TRAWLING STUDIES IN THE NORTH PACIFIC OCEAN [AND] DESCRIPTIONS OF A NEW SPECIES OF STOMIATID AND AN UNIDENTIFIED LEPTOCEPHALUS, by William Aron and Peter McCrery. Technical rept. no. 58 on Contract Nonr-477(10). Feb 58, 71p. 12 refs. Reference 58-3.
Order from LC mi$4.50, ph$12.30 PB 139 194

A modified version of the Isaacs-Kidd midwater trawl was used for sampling in the North Pacific. Data from catches of each of 143 hauls are presented to show corrected plankton volumes; depth of fishing; dominant plankton; identity, size range, and number of fish and fish larvae; and date, time, and location of haul. There was a wide difference between day and night catches. Findings supported previous observations that the trawl results were consistent and that plankton patchiness plays a minor role in the trawl results. Limited work with the invertebrate portion of the catches shows the possibility of commerically exploitable shrimp populations near Kodiak.

Physics of the Atmosphere

Avco Corp., Wilmington, Mass.
SINGLE STATION AND SYNOPTIC ANALYSIS OF IONOSPHERIC DATA FOR THE ARCTIC, by G. Hill and R. Penndorf. Scientific rept. no. 3 on Research Concerning Forecasting Anomalous Propagation at High Altitudes, Contract AF 19(604)4092. May 58, 121p. 12 refs. Technical rept. RAD-TR-59-19; AFCRC-TN-59-365; AD-217 316.
Order from LC mi$6.30, ph$19.80 PB 143 206

Anomalous effects in the Arctic Ionosphere were examined from two approaches. First, the time dependance of sporadic E, spread F, E, and F2 critical frequency data were studied for individual stations. The E layer, as expected, was found to be very regular. The F2 layer showed strong seasonal, diurnal, and geographical variations. Near the pole during the winter erratic variations in the F2 critical frequency were found. Sometimes the foF2 changed as much as 10 mc/s within a few hours. These changes are related to certain spread F forms. The occurrence of sporadic E was found to be more intense and more frequent at night in the auroral belt than further north. The statistics for Es $\geq$10 mc/s also followed this pattern. The number of Es occurrences was grouped into frequency bands 2 mc/s wide. It was found that they decrease from one band to the next higher one by a factor of about three.

Deutscher Wetterdienst, Aachen (West Germany).
RESEARCH ON AIR-EARTH-CURRENT IN HIGH MOUNTAINS (A CONTRIBUTION TO THE INTERPRETATION OF ATMOSPHERIC-ELECTRICAL REGISTRATIONS IN THE ALPS) by A. Kunkis. Technical note no. 8 on Contract AF 61(514)640. 15 Apr 56, 70p. 25 refs. AFCRC-TN-57-213; AD-133 680.
Order from LC mi$3.90, ph$10.80 PB 143 652

In order to fulfill the task an easily transportable measuring apparatus for the measurement of the atmospheric electrical current was developed. The apparatus has proved true under diverse unfavourable conditions (in snow and at high air moisture). Controls of the apparatus which can be easily and quickly carried out permit to keep errors with regard to the measuring values within narrow limits ($\pm$3%) and this also under unfavorable conditions. For the measuring values of the potential gradient and the air-earth-current obtained at the stations reduction factors were determined. These reduction values permit to convert the relative values measured at the stations into absolute values. All measurements are carried out with one measuring apparatus and after one measuring method at measuring places at heights from 0, 2 to 4 km and at selected atmospheric electrically undisturbed weather conditions. The measuring values reveal a variation of the conductivity with height. The conductivity increases with height after a simple exponential function.

Durham U. (Gt. Brit.)
THE DOUBLE FIELD MILL, by J. A. Chalmers and M. Smiddy. Technical note no. 1, 15 Oct 55-14 Oct 56, on Measurement of Space Charge in the Lower Atmosphere, Contract AF 61(514)891. [1956] 18p. 5 refs. AFCRC-TN-56-885; AD-110 251.
Order from LC mi$2.40, ph$3.30 PB 130 761

In order to measure the potential gradient at a point in the atmosphere a few metres above ground level, a double field mill has been constructed. The theory of the instrument and the results of tests are described.

Massachusetts Inst. of Tech., Cambridge.
STATIC STABILITY AND ATMOSPHERIC ENERGY, by Edward N. Lorenz. Scientific rept. no. 9 on General Circulation Project, Contract AF 19(604)1000. 30 Apr 57, 44p. 19 refs. AFCRC-TN-57-298; AD-117 187.
Order from LC mi$3.30, ph$7.80 PB 128 119

The process primarily responsible for the release of kinetic energy in the atmosphere, a rising of warmer air and a simultaneous sinking of colder air, also increases static stability. Gross static stability, a weighted integral of static stability, may be defined in such a way that reversible adiabatic processes have equal effects upon kinetic energy and gross static stability. Simplified dynamic equations are developed, which properly describe the relations between total potential energy, kinetic energy, available potential energy, and gross static stability. These include three dimensional systems with the equation of balance or the geostrophic equation, and n-layer models. The two-layer model may be the simplest possible system with variable static stability. The simplified equations appear to be especially suitable for theoretical studies of the general circulation and similar circulations.

Michigan U. Coll. of Engineering, Ann Arbor.
A SIMPLIFIED FALLING-SPHERE METHOD FOR UPPER-AIR DENSITY. PART II. DENSITY AND TEMPERATURE RESULTS FROM EIGHT FLIGHTS, by J. W. Peterson, H. F. Schulte, and E. J. Schaefer. Final technical rept. on Contracts AF 19(604)999 and NSF Grant Y/10.20/249. May 59, 128p. 12 refs. 2215-19-F; AFCRC-TR-59-263.
Order from LC mi$6.30, ph$19.80 PB 143 040

The development and use of the small-sphere method for synoptic measurement of upper-air density and temperature is described. The results from flights carried out during the IGY program are given.

ENGINEERING

Army Engineer Research and Development Labs., Fort Belvoir, Va.
AIRFIELD ICE REMOVAL EQUIPMENT DEVELOPMENT, by Edward C. Kinker and John L. Terry. 10 Oct 58, 28p. Technical rept. 1547-TR; AD-207 024.
Order from LC mi$2.70, ph$4.80 PB 143 265

This report contains a history of the development, tests, and evaluation of airfield ice removal equipment. Several methods of ice removal were investigated such as pavement-type heaters; blow-torch-type heater to melt scarified ice; radiation heat from hot fluids in a tubular-type landing mat; radiant-type heating system embodying electrical conductors imbedded in concrete; and de-icing chemicals. Two machines are covered in this report: one, a rotary brush as a scarifier with a trailer-mounted heater to reduce the residue to water; the other, a drag-type ice removal unit. The report concludes that: (a) The rotary ice removal machine does not meet the requirements of the project but investigation should continue if some runway scarification can be tolerated; (b) the ice drag units do not meet the requirements of the project nor can they remove hard ice firmly bonded to the surface; therefore, no further tests are warranted; (c) radiant heat should be considered for new airport construction only; (d) the Bergquist device should be investigated; (e) research should be conducted on chemicals and an investigation should be conducted on metallic paint to provide an agent to break the bond between ice and pavement.

Material Lab., New York Naval Shipyard, Brooklyn.
RESEARCH AND DEVELOPMENT OF THE STUDY OF BRITTLE FRACTURE OF SHIP PLATE STEEL BY ELECTRON MICROSCOPY, by E. C. Haas. Final rept. on Lab. Proj. 5507. 7 Jan 58, 11p. 4 refs. AD-156 658.
Order from LC mi$2.40, ph$3.30 PB 143 255

An investigation was made of the applicability of electron microscopy in determining the relationship of the microstructure of ship plate steel to its brittle fracture transistion temperature. Replication techniques were developed for imaging fractured surfaces. The electron micrographs of fractured surfaces failed to reveal physical features which were characteristic or correlatable with the transition temperature of the metal specimen, but the use of polished and etched specimens extended the usefulness of standard metallographic techniques at lower magnifications. Electron microscope studies were continued on mechanically polished and nital-etched specimens, and a large group of photographs were taken of areas considered characteristic of the specimens so that an experienced operator could match photographs with specimens. Selected electron photomicrographs are presented of several specimens of ship plate steel chosen to cover a wide range of temperature of transition from predominantly ductile to predominantly brittle fracture. The significant difference in the structures of these specimens is the spacing of the cementite lamellae, with the specimens of higher transition temperature showing a greater spacing of these lamellae.

Naval Construction Battalion Center, Port Hueneme, Calif.
PROCEEDINGS OF SYMPOSIUM ON CONSTRUCTION COST REDUCTION THRU CREATIVE DESIGN AND ENGINEERING, 29-31 OCTOBER 1957. 527p. 17 refs. AD-207 687.
Order from LC mi$11.10, ph$80.40 PB 143 439

Aeronautical Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AIRCRAFT BREATHING OXYGEN REGULATOR TEST STAND CALIBRATION PROCEDURES, by James E. P. Davis. Rept. on In Service Test Apparatus. July 59, 22p. WADC Technical note 58-28.
Order from OTS $0.75 PB 161 075

This report gives a step by step description of the procedure for calibrating an oxygen regulator test stand. Included also are sample data sheets and a discussion of good calibrating procedures which should be used to obtain best results.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
SIMULATION OF EXTRA-COCKPIT VISUAL CUES IN CONTACT FLIGHT TRANSITION TRAINERS, by William A. Lybrand, M. Dean Havron and others. Feb 58, 346p. 211 refs. AFPTRC-TR-58-11; AD-152 123.
Order from LC mi$11.10, ph$53.10 PB 143 136

A comprehensive survey and analysis of research and operational evidence pertaining to visual cues utilized by pilots in performing the specified flight tasks was accomplished. This material was supplemented by: an analysis of the operational tasks involved and intensive interviews with pilots in transition training, instructor pilots, and test pilots; consultation with subject-matter experts in training, visual perception, and engineering areas; and inspection of existing trainers and simulators having visual capabilities.

Arnold Engineering Development Center [Tullahoma, Tenn.]
CRITICAL DISCUSSION OF EXPERIMENTS ON SUPPORT INTERFERENCE AT SUPERSONIC SPEEDS, by Jack D. Whitfield. Rept. on ARO, Inc. Contract AF 40(600)700 S/A 13(59-1). Aug 58, 51p. 14 refs. AEDC-TN-58-30; AD-201 108.
Order from LC mi$3.60, ph$9.30 PB 143 275

An experimental investigation of the effect of the sting support length on the drag of slender ogive-cylinder models, with and without afterbody boattailing, has been conducted. These tests were made at Mach numbers 3.00 and 3.98 over a unit Reynolds number range from 10^5 to 10^6 per inch. The critical sting length as well as the base pressure is shown to be strongly dependent on the transition location and the length Reynolds number. The often quoted rule-of-thumb geometry ratio of three base diameters for an allowable sting length was inadequate for this investigation. The range of critical sting lengths encountered during this study was from approximately 5.5 for $Re_L = 1 \times 10^6$ and $M = 4.0$ to approximately 1.0 for $Re_L = 7 \times 10^6$ and $M = 3.0$.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
EFFECTS OF BREAKOUT FORCE ON LONGITUDINAL HANDLING QUALITIES, by Fred Newell. Rept. on Contract AF 33(616)3990. Dec 57, 43p. 4 refs. WADC Technical rept. 57-155; AD-142 306.
Order from LC mi$3.30, ph$7.80 PB 138 670

The airplane used in the study was a JTB-26B equipped with variable longitudinal control and stability. The results of this evaluation indicate that control friction is an important factor in pilot's opinions of aircraft handling characteristics and that the effects of friction vary with aircraft dynamics and control force gradients. Also, the type of mission simulated affects the pilot's attitude and desires and hence, his opinions of the effects of breakout force.

Cornell Aeronautical Lab., Inc. [Buffalo, N. Y.]
AN EXPERIMENTAL INVESTIGATION OF THE H-5 VARIABLE STIFFNESS BLADE PROGRAM. PART 1. HARMONIC REDUCTION OF MEASURED BLADE BEAM BENDING-MOMENT DATA, by Harold Hirsch and James Kline. Rept. on Contract W33-038-ac-14248. Dec 51, 271p. 2 refs. AF Technical rept. no. 6329, Pt. 1; AD-8445.
Order from LC mi$11.10, ph$42.60 PB 143 767

A helicopter research program was conducted with the objective of determining the bending stresses and motions experienced, in flight, by articulated rotor blades; and, thereby, to explore possible causes of a number of unexplained rotor blade fatigue failures. Measurements made with a family of blades, similar in all respects except flapwise bending stiffness, disclosed, under certain flight conditions, a hitherto unsuspected phenomenon of large amplitude resonant bending in the higher modes. Based on an analysis of these results, the necessity of, and proposed procedures for, investigating higher mode bending effects in both the design and flight evaluation phases of blade development programs are discussed. The results of the program are reported in six volumes. In this, the first volume, blade beam bending moments, measured with three sets of C.A.L. rotor blades, possessing approximately 1/2, 1, and 2 times the bending stiffness of standard H-5 blades, are presented. The data cover a wide range of stabilized flight conditions; obtained by systematically varying advance ratio, helicopter center of gravity, and rotor speed.

Cornell Aeronautical Lab., Inc. [Buffalo, N. Y.]
AN EXPERIMENTAL INVESTIGATION OF THE H-5 VARIABLE STIFFNESS BLADE PROGRAM. PART 2. BLADE BEAM BENDING-MOMENT ENVELOPES, by Harold Hirsch and James Kline. Rept. on Contract W33-038-ac-14248. Jan 52, 78p. 2 refs. AF Technical rept. no. 6329, Pt. 2; AD-8444.
Order from LC mi$4.50, ph$12.30 PB 143 766

Blade beam bending moment envelopes obtained from flight test measurements made with three sets of C. A. L. fiber glass blades possessing approximately 1/2, 1, and 2 times the bending stiffness of standard H-5 blades are presented. The results cover a wide range of stabilized test conditions, obtained by systematically varying advance ratio, helicopter center of gravity, and rotor speed. Spanwise blade beam bending moment envelopes including (1) the sum of the first two and (2) the sum of the first ten terms of the harmonic representation of the measured bending moments, obtained from Part 1 of the report, are presented. The spanwise distribution of steady bending moment is also shown. (See also PB 143 767)

Cornell Aeronautical Lab., Inc., [Buffalo, N. Y.]
AN EXPERIMENTAL INVESTIGATION OF THE H-5 VARIABLE STIFFNESS BLADE PROGRAM. PART 3. EVALUATION OF ROTOR RESONANT BONDING EFFECTS, by Harold Hirsch and James Kline. Rept. on Contract W33-038-ac-14248. Jan 52, 88p. 13 refs. AF Technical rept. no. 6329, Pt. 3; AD-6265.
Order from LC mi$4.50, ph$13.80 PB 143 765

The bending moments and motions experienced in flight by articulated rotor blades were studied in an attempt to determine the causes of unexplained rotor blade fatigue failures. Blades with differing degrees of stiffness were instrumented so as to measure bending at 9 spanwise stations on each blade. A ground run-up made with medium-stiffness blades indicated that an 8/rotor revolution oscillation periodically occurred. Study of the blade deflection pattern identified the source of the oscillation to be in the third bending mode. Calculations were made which predicted that at least 1 particular combination of blade stiffness, mode shape, and rotor speed might produce a resonant condition corresponding to each harmonic order between 2 and 9. Experimental results verified the predictions. Methods suggested for avoiding one or another of the resonant points included the addition of concentrated masses to the blade to give the necessary frequency shifts, or modification of the blade stiffness. (See also PB 143 766)

Cornell Aeronautical Lab., Inc., [Buffalo, N. Y.]
AN EXPERIMENTAL INVESTIGATION OF THE H-5 VARIABLE STIFFNESS BLADE PROGRAM. PART 4.

HARMONIC REDUCTION OF MEASURED BLADE-MOTION AND CONTROL-FORCE DATA, by James Kline. Rept. on Contract W33-038-ac-14248. Apr 52, 147p. 2 refs. AF Technical rept. no. 6329, Pt. 4; AD-6161.
Order from LC mi$7.20, ph$22.80 PB 143 764

The blade motions and control forces measured with the three sets of C.A.L. test blades, possessing approximately 1/2, 1, and 2 times the bending stiffness of standard H-5 blades, are presented. The blade motions and control force data, measured simultaneously with the blade beam bending moments of Parts 1, 2, and 3, are presented in the form of harmonic components of the Fourier expansion derived from the cycles analyzed. The most informative cyclic harmonic motions and loads are presented as curves plotted versus tip speed ratio. As in the first three volumes, the data cover a range of stabilized flight conditions; obtained by systematically varying advance ratio, helicopter center of gravity and rotor speed. (See also PB 143 765)

Cornell Aeronautical Lab., Inc., [Buffalo, N. Y.]
AN EXPERIMENTAL INVESTIGATION OF THE H-5 VARIABLE STIFFNESS BLADE PROGRAM. PART 5. EVALUATION OF BLADE BEAM BENDING DATA MEASURED BY THREE HELICOPTER MANUFACTURERS, by James Kline. Rept. on Contract W33-038-ac-14248. June 52, 83p. 3 refs. AF Technical rept. no. 6329, Pt. 5; AD-6794.
Order from LC mi$4.80, ph$13.80 PB 143 763

The results of analysis of beam bending flight test data measured on three different blade designs are presented to substantiate that the resonance phenomenon disclosed with the C. A. L. fiber glass blades was not an isolated occurrence. These data which were supplied by three manufacturers cover a range of flight conditions at various advance ratios and rotor speeds. The results are presented in the form of harmonic components of the Fourier expansion in order to establish the occurrence of resonance in the higher modes and enable correlation with the variable stiffness blade beam bending results, as presented in Parts 1 and 3 respectively of this report. (See also PB 143 764)

Cornell Aeronautical Lab., Inc., [Buffalo, N. Y.]
AN EXPERIMENTAL INVESTIGATION OF THE H-5 VARIABLE STIFFNESS BLADE PROGRAM. PART 6. A TENTATIVE EMPIRICAL CRITERION FOR THE DESIGN OF ROTOR BLADES FOR HIGHER MODE RESONANCE, by Howard Doughaday and James Kline. Rept. on Contract W33-038-ac-14248. Nov 52, 87p. 10 refs. AF Technical rept. no. 6329, Pt. 6; AD-8443.
Order from LC mi$4.80, ph$13.80 PB 143 762

A possible empirical approach to the problem of predicting higher order bending moments is presented. Since the tentative procedure is based on test results, it would increase in reliability as more data on different types of blades becomes available. The measured blade bending moments have been harmonically analyzed previously, so that the vibration amplitude for each order of rotor excitation is known for each test condition. Knowing this amplitude, the component of the total aerodynamic force or the generalized force necessary to produce the observed response is then calculated for the given order and a particular vibration mode. These generalized forces are plotted against advance ratio and order of excitation. From the generalized forces, a dimensionless generalized force coefficient computed which can be used to predict loads on other blades. The generalized force approach was adopted because if offers the most rational means that could be found for applying the higher harmonic data obtained in the program to the design of other helicopter blades. (See also PB 143 763)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
IMPROVEMENT OF FERRYING RANGE OF ARMY HELICOPTERS, by A. C. Adler, H. S. Holm and S. A. Harrington. Final rept. on Proj. 9-38-01-000 ST801, Contract DA 44-177-tc-441. July 59, 103p. 16 refs. Rept. no. BB-1187-H-2.
Order from LC mi$5.70, ph$16.80 PB 143 573

This investigation is an extension of previous studies of maximum ferry range for single rotor helicopters. The configurations evaluated include: tandem helicopters, single rotor and tandem helicopters with auxiliary wings (compound helicopters), single rotor helicopters with auxiliary wings and propulsion (gyrodynes) and towed systems (helicopter towing tanker-glider, airplane towing helicopter). Lift-to-drag ratios for these configurations were obtained over a wide range of parameters on an IBM-704 computer. Ferrying ranges were calculated for the more promising configurations. It was found that careful attention had to be given to programming the cruise altitude with the consumption of fuel and to the compromises between power plant and airframe performance. The most promising modification appears to be the single rotor compound helicopter with a range approximately double that of the unmodified helicopter. Although an equivalent gyrodyne attains a 10% increase in range over the compound helicopter at 30% higher cruise speeds, the increased complexity, weight, and cost weigh heavily against the gyrodyne for a "one-shot" ferrying mission. Towed configurations do not appear to offer any real promise.

Curtiss-Wright Corp., Santa Barbara, Calif.
FLIGHT TEST INSULATION STUDIES, by Allen G. Norem. Rept. on Aircraft Structural Research, Contract AF 33(616)5152. Feb 59, 71p. 6 refs. WADC Technical rept. 59-9; AD-208 326.
Order from OTS $2.00 PB 161 079

Model structures insulated by Refrasil B-100, phenolic CT-304 spray coated alumina, and Teflon were flight tested on a recoverable Materials Test Vehicle. The thermal response of the insulated model structures was recorded on a miniature tape recorder. It was demonstrated that the test vehicle and instrumentation used provided a suitable system for the gathering of flight test data on the effect of insulating and subliming materials in restricting heat flow into the base structure. It was also demonstrated that the simple methods of analysis presented in Reference 1 are adequate for the prediction of the thermal response of insulated structures.

Johns Hopkins U., Baltimore, Md.
MECHANICS OF STIFFENED PLATES AND SHELLS, by W. H. Hoppmann, II. Summary and Final rept. on Contract Nonr-248(12). Mar 58, 18p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 139 198

Definition of orthogonally stiffened structures; Equations of equilibrium and motion; Stress-strain relations for orthogonally stiffened plates and shells; Shear deformation and rotatory inertia; Boundary conditions; and Strains and stresses.

Princeton U., N. J.
AN INVESTIGATION OF THE FUNDAMENTAL PARAMETERS WHICH GOVERN THE AERODYNAMICS OF VARIOUS WING-PROPELLER COMBINATIONS AS RELATED TO VECTORED SLIPSTREAM AIRCRAFT, by Norman R. Augustine. Rept. on Contract Nonr-1858(14). Oct 58, 218p. 20 refs. Aeronautical Engineering Dept. rept. no. 437.
Order from LC mi$9.60, ph$33.30 PB 143 245

Experimental investigation of propeller slipstream interaction on a heavily flapped wing. Aspect ratio, propeller diameter, solidity, thrust axis position, and propeller plane are varied to investigate the fundamental parameters which govern the wing-propeller combination. A method for analytically determining the lift and drag of a wing propeller combination is also presented.

Chemical Engineering

American Potash and Chemical Corp., Henderson, Nev.
INDUSTRIAL PREPAREDNESS STUDY ON SYNTHETIC BATTERY GRADE MANGANESE DIOXIDE, by Jerome T. Muench. Quarterly progress rept. no. 4, 29 Mar-29 June 57, on Contract DA 36-039-sc-72715. [1957] 27p.
Order from LC mi$2.70, ph$4.80 PB 130 743

Manganese dioxide was produced in two semi-pilot plant runs by the chemical oxidation of manganous sulfate. The manganous sulfate was purified by the removal of potassium by two separate methods. The first run utilized manganous sulfate purified by the manganous sulfate purified by the manganous carbonate purification method. The second run was made from manganous sulfate that had the potassium content decreased by the precipitation of potassium perchlorate. The method of preparation of the manganous sulfate as well as the chemical analysis, physical properties and battery activity tests on the manganese dioxide produced are reported. Rho manganese dioxide was produced in both runs. (See also PB 129 661)

[Army] Chemical Corps Engineering Command, Army Chemical Center, Md.
A SIMPLIFIED PASSIVATION METHOD FOR THE E24 HEATER FOR SHORT TERM SERVICE, by Oscar I. Lessig. Sep 56, 10p. Engineering Command rept. no. 13.
Order from LC mi$1.80, ph$1.80 PB 143 261

The object of the work described in this report is the investigation of a simplified method of passivation of the inner surfaces of the E24 heater tank, a component of the E24 heater. The tests described include the exposure of metal surfaces to solutions of various acids and alkalies in different concentrations, for varying periods of time. It is concluded that the use of a nitric acid solution provides the simplest and most economical method of passivation. Degreasing and exposing the inner surfaces of the E24 heater tank assembly in a 15-percent solution of nitric acid for 15 minutes adequately met the user-service requirements for this item.

Army Chemical Warfare Labs., Army Chemical Center, Md.
EFFECTS OF METABOLIC LEVEL ON PENETRABILITY OF GB THROUGH THE SKIN OF PIGS, by Francis N. Marzulli and John F. Callahan. Technical rept. for Apr 55-Nov 56 on Toxicological Action of CW Agents. Aug 58, 13p. 7 refs. CWLR 2240.
Order from LC mi$2.40, ph$3.30 PB 139 140

Swine were exposed to GB by two routes, (1) skin application and (2) subcutaneous injection. The study was predicted on metabolic activity (as induced by seasonal changes) and its relation to GB susceptibility. No effect due to raised metabolic level was found regardless of the route of administration of GB. The inhibition of red blood cell cholinesterase from a small subcutaneous dosage of GB had no predictive value regarding susceptibility to lethal effects from a larger successive dosage for any one individual animal; this may be of some value for larger groups.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
PRODUCING PERMANENTLY HYDROPHYLIC SURFACES ON PLASTIC FILMS FOR SOLAR STILLS, by Robert A. Erb. Final rept. for 14 Nov 58-31 Aug 59 on OSW Contract 14-01-001-168. Sep 59, 29p. Research and Development progress rept. no. 29.
Order from OTS $0.75 PB 161 064

Two principal means of producing permanent, transparent hydrophilic surfaces on a variety of plastic films for solar still condensing surfaces were investigated on this project. One involves the vacuum deposition of silicon monoxide on the surfaces; the other involves the chemical deposition of titanium dioxide on the surface via the hydrolysis of tetraalkyl orthortitanates. Both have proved to be technically feasible for producing hydrophilic permanent surfaces over the plastic substrates. However, the titanium dioxide process is the present process of choice for large scale film treatment because of lower cost (both for capital equipment and operation) and ready adaptability to a large scale operation.

I. G. Farbenindustrie, A. G., Ludwigshafen (Germany).
HYDRAZINHYDRAT-ANLAGE. May 46, 5p.

BIOS/DOCS/2082/829/101; FD 2380/46. Text in German.
Order from LC mi$1.80, ph$1.80 PB 143 571

Institute of Tech., U. of Minnesota, Minneapolis.
INVESTIGATION OF FREEZING AS A MEANS OF OBTAINING FRESH WATER FROM SALT WATER, by Emory N. Kemler, Millard H. LaJoy and others. Progress rept. no. 1 on Contract NOy-73248. 15 July 54, 19p.
Order from LC mi$2.40, ph$3.30 PB 139 168

The tests described in this progress report were designed to give general information on the conditions which exist during the freezing of salt water.

Institute of Tech., U. of Minnesota, Minneapolis.
INVESTIGATION OF FREEZING AS A MEANS OF OBTAINING FRESH WATER FROM SALT WATER, by Emory N. Kemler, Millard H. LaJoy and others. Progress rept. no. 2 on Contract NOy-73248. 15 Sep 54, 41p.
Order from LC mi$3.30, ph$7.80 PB 139 167

This report describes the experimental results of tests on salt content of ice formed from sodium chloride solutions by freezing on a flat surface. An analytical study of rate of ice formation with experimental verification is also included. The tests showed that the salt content of ice frozen on a flat surface from a saline bath was significantly lower than the concentration of the brine solution. (See also PB 139 168)

Electrical and Electronic Engineering

Air Force Armament Center, Eglin AFB, Fla.
AFAC NAVIGATION SYSTEMS FLIGHT TEST RANGES. Armament Test note. Sep 57, 47p. AFAC-TN-57-53; AD-135 965.
Order from LC mi$3.30, ph$7.80 PB 142 903

The AFAC Navigation Systems Flight Test Ranges, formerly known as the AFAC Inertial Guidance Systems Flight Test Ranges, were established to fulfill a requirement for the testing of long-range navigation systems. The three ranges extend over a variety of topographical features and constitute a flexible all-weather, long-range test facility. These ranges are available to any agency engaged in the testing of navigation systems and require only that the test aircraft be capable of taking vertical aerial photographs and/or radar-scope photographs. Range No. 1, which is approximately 1030 nautical mi in length, extends from Eglin AFB, Fla., L. G. Hanscom Field, Bedford, Mass. Range No. 2, extending from Ramey AFB, Puerto Rico, to Mountain Home AFB, Idaho, is approximately 2865 naut mi in length. Range No. 3 extends from Eglin AFB, Fla., to Holloman AFB, New Mexico and is approximately 1010 naut mi long. The course center line, or axis of strength, of each range is a geodesic computed on the Clarke Spheroid of 1866 as referenced to the 1927 North American Datum. Bands of checkpoints, both visual and radar, located 35 to 70 mi apart and extending 25 mi to either side of the range center line, are used to obtain positional information along the ranges. Reduction of the photographic position data is facilitated by the use of a Laborde Grid overlay on each range whereby any position on the range corridor can be located by a set of X and Y coordinates as well as by latitude and longitude. A discussion of geodesy with particular emphasis on computational techniques and on error study are available as a supplement.

Air Force Cambridge Research Center, Bedford, Mass.
EXPERIMENTAL STUDY OF A DIFFRACTION REFLECTOR, by Joseph H. Provencher. Apr 59, 33p. 3 refs. AFCRC TR-59-126; AD-212 926.
Order from LC mi$3.00, ph$6.30 PB 142 998

A microwave antenna has been designed and constructed on the principles of parageometric optics formulated by Toraldo di Francia and on principles similar to those of Fresnel rings and the diffraction grating. Its surfaces are all zones of cones and simple to construct. The chosen design parameters were incorporated in two K-band ($\lambda = 1.24$ cm; $\lambda = 1.22$ cm) models. Experimental results show good agreement with theory. Scanning characteristics are superior to those of the paraboloidal or spherical reflector, and spherical aberration and coma are minimized, and the effects of astigmatism are minimized by using a "compromise focus."

American Electro Metal Div., Firth Sterling, Inc., Yonkers, N. Y.
RESEARCH ON THERMIONIC EMISSION OF BORIDES, by R. Steinitz. Final rept. on Contract AF 18(600)1504. 1 May 57, 36p. 27 refs. AFOSR-TN-57-312; AD-132 383.
Order from LC mi$3.00, ph$6.30 PB 143 513

Thermionic emission measurements were performed on most of the transition metal diborides, gadolinium hexaboride, and dense and porous tungsten cathodes. With the exception of the dense tungsten, which was used to standardize the test equipment, all samples were prepared by powder metallurgical techniques. The necessary vacuum system and electrical circuits were constructed to fit the requirements. The emission constant and work function for each of the above metals has been calculated from the emission data. However, in view of the above discussion, the reliability of the data is questionable. A simple solution to most of these problems has been planned for the future.

Antenna Lab., Ohio State U. Research Foundation, Columbus.
POLARIZATION DEPENDENCE OF RADAR ECHOES, by J. N. Hines, and J. A. McEntee. Rept. on Echo Area of Acute-Angle Dihedral Corner Reflectors, Contract AF 30(635)2811. 31 Oct 56, 23p. 2 refs. Rept. 612-13; AD-114 242.
Order from LC mi$2.70, ph$4.80 PB 138 993

To add to the available information on corner reflectors, patterns of acute-angle dihedral corner reflectors were recorded, for different included angles, as a function of the azimuth angle. The responses to both linear polarizations, and also to circular polarizations, are presented.

Armco Steel Corp., Middletown, Ohio.
DEVELOPMENT OF MAGNETIC MATERIALS. Final rept. for 1 July 47-30 June 51 on Contract NOas-8944. 31 July 51, 26p.
Order from LC mi$2.70, ph$4.90 PB 143 865

Improved core material for 400-cycle airborne power transformers; Vicalloy; Orthonik; Hiperco; Ultra thin magnetic material; Alperm.

Armour Research Foundation, Chicago, Ill.
DESIGN DATA FOR CRYSTAL OSCILLATOR CIRCUITS, by Harold E. Gruen and Alan O. Platt. Rept. on Contract DA 36-029-sc-64609. Aug 57, 160p. 1 ref. AD-151 454.
Order from LC mi$7.50, ph$24.30 PB 143 562

This manual provides the information necessary to select a crystal oscillator design for operation at frequencies throughout the 0.8 to 150 mc range, and indicates methods of predicting the performance characteristics of these circuits under wide variations in operating conditions. In general, output voltage predictions are within 20 per cent of the values indicated for specific oscillator circuit designs. Crystal drive prediction accuracy is within 30 per cent. This latter figure is based on measurements of crystal voltage and assumed resistive operation of the crystal.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
WEATHER RESISTANCE OF RUBBER SHEETS AND RUBBER COVERED CABLES, by Philip Mitton and Frank E. Rupert. 10 July 58, 41p. Technical rept. 1535-TR; AD-204 008.
Order from LC mi$3.30, ph$7.80 PB 143 266

This report covers an investigation to determine the weather-resistant properties of commercial and military cables in order to provide performance standards for use in future procurement. Samples of rubber sheets were tested for physical properties (tensile strength, ultimate elongation, tensile strength at 200 percent elongation) and low temperature properties (torsional stiffness ratio, tension recovery, and brittleness). Comparison of materials after tests revealed that physical characteristics indicated by weatherometer exposures differ markedly from physical characteristics after exposure in the ozone chamber and outdoors. The discussion of test results includes comment on the effect of exposure on test materials.

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
INVESTIGATION OF GABRIEL AT-781/U ANTENNA, by Kenneth L. White, Charles R. Wise, and Harvey G. Lassiter. 29 July 59, 146p. AFC rept. # ANT-29-7-59.
Order from LC mi$7.20, ph$22.80 PB 143 416

Results are presented on an investigation of the Gabriel Company, AT-781/U Antenna. The electromagnetic reception characteristics of the antenna for linearly polarized signals, i.e., horizontal, vertical, and $\pm 45^{o}$, were determined in the azimuth plane for effective elevation angles of 0, 30, 60, 75 and 90^{o}; elevation patterns were also made. The reception characteristics of the antenna were tested and patterns made at 409, 417, 440, 515 and 540 MCS. The VSWR of the antenna was less than 1.66 throughout the frequency range of 400 - 550 MCS.

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
LABORATORY INVESTIGATION OF GILFILLAN BROS., INC., MODEL IIA TELEMETRY TRANSMITTER, by Virgilio Cisneros, William Castilo, and Mervin Olson. 27 July 59, 48p. AFC rept. # TM-27-7-59-T.
Order from LC mi$3.30, ph$7.80 PB 143 417

Results of a Laboratory Investigation, concerning the Gilfillan Bros., FM Telemetry Transmitter Model IIA, are given. Operational characteristics, such as frequency stability, power output, and modulation sensitivity were examined against the parameters of voltage variation, operating time and simulated altitude. Interference characteristics (spurious emissions, both antenna conducted and case radiated) were also examined. Frequency stability was $\pm$ 0.007% (within the required 0.01% as per WSMR Reg Nr 600-3-58) for all tests except prolonged exposure to simulated altitude(s) in which the case temperatures were below 0^{o} C; for normal missile and rocket applications (15 minutes or less in duration) this situation would not arise. Spurious emissions (antenna conducted) met the above regulation requirement(s) however, it is expected that careful alignment and a rigid quality control system will be necessary to assure that proudction items also meet this requirement.

[Army Signal] Radio Propagation Agency, Fort Monmouth, N. J.
RADIATION FROM ANTENNAS IN THE 2 TO 30 MEGACYCLE BAND. Revised May 58, 323p. 20 refs. Technical rept. no. 2.
Order from LC mi$11.10, ph$50.10 PB 143 147

This report shows graphically the sky-wave and ground-wave radiation in the 2 to 30 megacycle frequency band from the following antennas: Ground-Based Vertical, Ground-Based Inverted "L", Horizontal Half-Wave, and Horizontal Rhombic. The curves of this report are based mainly on theoretical calculations for assumed current distributions on thin wires. The ground system and antenna heat losses are accounted for by efficiency factors ob-

tained from field measurements. The calculations consider the effects of the type of ground over which the antenna is erected in the ground reflection factors and antenna radiation resistances. It is assumed that the transmission lines are properly matched and that the antenna reactances are tuned out.

[Army Signal] Radio Propagation Agency, Fort Monmouth, N. J.
GROUND WAVE FIELD INTENSITIES INCLUDING GROUND WAVE FIELD INTENSITIES WITHIN THE LINE OF SIGHT. Rev. June 49, Second printing Apr 56, 234p. 13 refs. Technical rept. no. 3.
Order from LC mi$10.20, ph$36.30. PB 143 148

This report was prepared to show in a graphical form the expected ground-wave field intensities for vertical polarization for frequencies from .1 to 300 megacycles per second. The field intensities for elevated antennas within certain distance limitations are obtained by multiplying values obtained for antennas located at the ground by height gain factors. These ground-wave field intensities are based mainly on theoretical calculations for transmission over smooth spherical earth. The curves of this report are applicable over a wide range of distances for frequencies from .1 to 300 megacycles, provided the antenna heights are not too great. Ground-wave field intensities are given within the line of sight for antennas of low electrical heights. The ground-wave curves of this report are drawn for average atmospheric conditions. The curves are based on standard atmosphere in which the index of refraction decreases linearly with height at a rate of $.039 \times 10^{-6}$ per meter.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
CALIBRATION PROCEDURE FOR 254 JAN DROP TESTER, by Royce D. Loveland. 15 May 58, 24p. USASRDL Technical rept. 1969.
Order from LC mi$2.70, ph$4.80 PB 138 636

The 254 JAN Drop Tester is a shock machine designed to subject small electronic components to shock impacts up to 1500 g for a time duration of approximately one millisecond. Included in this manual are drawings for the construction of a 254 JAN Drop Tester and information regarding maintenance procedures and techniques used for the calibration of the Drop Tester.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
400-MEGACYCLE SUPERREGENERATIVE CIRCUITRY, by Robert W. Callinan. 1 Oct 58, 26p. USASRDL Technical rept. 1985.
Order from LC mi$2.70, ph$4.80 PB 139 077

An investigation was conducted to devise 400-mc superregenerative circuitry capable of detecting modulations which have comparatively high-frequency components. The detection of one to two microsecond pulses and also 80 kilocycle sine waves was of particular interest. Numerous forms of detectors were devised and tested. Performance was evaluated where possible at different operational modes. Of the circuits tested, a plate-quenched, logarithmic-mode type appears best for most applications. Two megacycles appears to be the highest practical quench frequency for operation at 400 megacylces. This limits sine wave detection to a maximum frequency of 200 kilocycles and the efficient detection of pulses to those with a duration of at least five microseconds.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
RADIO SET AN/VRC-24(XC-2) by Michael Kaluzienski. Jan 58, 191p. Engineering rept. no. E-1228 AD-201 812.
Order from LC mi$8.70, ph$3.30 PB 142 673

Radio Set AN/VRC-24(XC-2) is an amplitude modulated receiver transmitter designed to operate in the frequency range of 225.0 to 399.9 mcs providing 1750 crystal controlled channels with a spacing of 100 kc. The selection of any of 19 preset channels may be made from the front panel of the radio set or from a remote control position. Any one of the total number of channels available may be directly set up by manual tuning at the front panel. The same basic receiver transmitter unit is designed for vehicular, semi-fixed and fixed station applications.

Assistant Secretary of Defense, Research and Development, Washington, D. C.
SYMPOSIUM ON ELECTRONICS MAINTENANCE [NO. 2]: DESIGN FOR EASE OF MAINTENANCE. 8-11 May 56, 208p. 28 refs. PPT 202/5.
Order from OTS $3.50 PB 161 107

Contents:
Session 1. What role do you see for human engineering in improving the maintenance problem now?
Session 2. Looking ahead to an era of miniaturization, unitization and automation, what future do you see for human engineering?
Session 3. What engineering techniques and practices are available in designing equipment to reduce the maintenance job?
Session 4. Logistics has become an integral part of the maintenance problem; what do you see as the engineer's problem? the human engineer's problem?
Session 5. How can engineers and human engineers together improve the design for equipment maintenance?

The symposium covers ways and means of ensuring that electronic equipment is designed initially so that the functions of trouble shooting, maintenance records, calibration, replacement and repair are simplified and geared to the military personnel and training subsystem. In the area of designing for maintenance, much progress has been made in recent years, but still greater progress is required. This report will serve to stimulate further research and application in this vital field.

Ateliers de Construction Electriques de Charleroi (Belgium).
THEORETICAL CALCULATIONS OF CAPACITIES AND INDUCTANCES OF PRINTED CIRCUITS, by Ph. Passau and A. Lion. Rept. on Contract AF 61(514)921. 14 Feb 58, 355p. 17 refs. AFCRC TR-58-136; AD-152 389.
Order from LC mi$11.10, ph$54.60 PB 142 952

Contents:
Capacity of printed capacitors
Losses in printed capacitors
Susceptance or printed inductors
Losses in printed inductors
Experimental confirmation of the theoretical results

Avion Div. [American Car and Foundry Co.] Alexandria, Va.
ELECTROPHOTOGRAPHIC VIEWER AN/GSQ-14-14-(XW-1), SHAPE DETECTION PHASE, by Horace M. Joseph and Donald L. Feller. Final engineering rept. for 19 Dec 57-13 June 58 on Contract AF 30(602)1499. 23 June 58, 86p. RADC-TR-58-103; AD-148 832.
Order from LC mi$4.80, ph$13.80 PB 143 497

The program of investigation and study to determine the feasibility of automatic "photo-reading" was continued. Basic and Automation experimentation was performed which verified the soundness of the conceptual methods of shape finding and comparison. Additional conceptual designs for shape comparison and analog methods for the mathematical computations derived from curve following information are presented. The development of a complete shape detection system including contrast processing for utilizing any source of two-dimensional input information is recommended.

Bureau of Yards and Docks, Washington, D. C.
RADIO COMMUNICATION FACILITIES (SHORE-BASED). 1 May 53, 58p. Technical pub. NAVDOCKS TP-Pw-20.
Order from OTS $1.50 PB 161 059

This publication provides guidance for Bureau personnel concerned with the planning, site selection, design, construction, and maintenance of buildings, together with related services and installed facilities and/or radio towers, for shore-based radio communications at naval shore activities. Part A presents the authority and responsibilities of this Bureau for providing the public works and public utilities that form the nonelectronic part of the Navy's shore-based radio communications, and defines related terms. Part B covers general and specific site planning for the various types of radio communication stations. Part C deals with radio receiver buildings, Part D with radio transmitter buildings, and Part E with radio communication centers and terminal equipment buildings. Part F covers radio direction finder facilities, Part G control link facilities, and Part H antenna and ground systems.

California Inst. of Tech. [Pasadena].
EXPERIMENTS IN VERY LOW-FREQUENCY RADIO PROPAGATION, by Roger M. Golden. Technical rept. no. 5 on Contract AF 18(600)1552. 26 June 59, 129p. 37 refs. AFOSR TN-58-583; AD-217 030.
Order from LC mi$6.30, ph$19.80 PB 142 987

Propagation in the presence of the ionosphere is considered in the theoretical form of propagation in a homogeneous gyroelectric medium. The results of this analysis are tabulated in graphical form so that the dispersive qualities of the medium can be readily examined. With the aid of these results, an examination of the natural phenomena of whistlers is presented in order to determine the feasibility of generating gyroelectric-echoes. Reflection and transmission coefficients are presented for vertical incidence in order to ascertain the order of magnitude of such an echo. Experiments thus far performed have not yielded echoes but with modifications in the transmitting and receiving equipment, echoes may be detected. A complete description of the experimental equipment used is given along with a proposal for a more sophisticated receiving system.

Chicago Midway Labs., U. of Chicago, Ill.
SEMICONDUCTORS AND PHYSICAL ELECTRONICS. Final rept. for 1 Jan 56-30 June 58 on Contract AF 18(603)09. 30 June 58, 19p. 18 refs. CML-TR-P108-18; AFOSR TR-58-137; AD-204 556.
Order from LC mi$2.40, ph$3.30 PB 138 623

Abstracts of papers published elsewhere by the authors on preparation of large InSb and InAs crystals, secondary electron emission, an image amplifier, a thermal image tube, and infrared detectors. Growth of large single crystals by pulling from the melt has been on a routine basis. The purity of pulled crystals is always below that of the zone-refined material from which they are made. Distribution coefficients of four common impurities -- cadmium, zinc, selenium, and tellurium -- in single crystals of InSb pulled from the melt have been determined by electrical measurements.

Columbia U. School of Electrical Engineering, New York.
PULSE WIDTH CONTROL OF SAMPLED DATA SYSTEMS, by Winston L. Nelson. Technical rept. T-35/B on Contract AF 18(600)677. 6 July 59, 157p. 25 refs. CU-55-59-AF-677-EE; AFOSR-TN-59-609; AD-217 396.
Order from LC mi$7.50, ph$24.30 PB 143 175

The use of pulse width control for the on-off regulation of systems subject to sampled data is investigated in this paper. The pulse width controller is considered to effect control of a linear n^{th} order plant by applying to the plant during each sampling period an input signal, selected from the restricted class of pulse width control signals, and based on the state of the plant at the sampling instant. The basic capabilities of this type of control are investigated in relation to simple on-off, or relay, control and in relation to pulse amplitude control. General methods for achieving both stable and optimal control are developed and practical design applications are considered. Examples and experimental evaluation of the design methods are also given.

David Sarnoff Research Center, Princeton, N. J.
STUDY OF PHOTOEMISSIVE SURFACES, by A. H. Sommer and W. E. Spicer. Final rept. for 1 July 55-31 Dec 57 on Contract DA 44-009-eng-2515. [1957] 29p. 1 ref. AD-203 475.
Order from LC mi$2.70, ph$4.80 PB 143 325

Heretofore the silver-oxygen-cesium (Ag-O-Cs) cathode has been the only known photoemitter with appreciable response to infrared radiation. During the last 25 years much work was done to improve infrared sensitivity as well as to understand the mechanism of electron emission of this material, but in both directions only minor results were obtained.

Diamond Ordnance Fuze Labs., Washington, D. C.
FREQUENCY-MODULATED ACOUSTIC FLOWMETER AND METHODS OF MAKING IT FEASIBLE, by James C. McDade. 15 Dec 58, 11p. 3 refs. Technical rept. TR-660.
Order from LC mi$2.40, ph$3.30 PB 139 145

The existing acoustic flowmeter is frequency modulated to eliminate the effect of leakage in thick-walled steel pipes. A delay line which presents a time delay equal to that in the sound path is used in conjunction with the sound path to cancel the effects of the FM at the phasemeter. A method was devised for eliminating the need for the delay line. This method consists in choosing the modulation frequency such that the two signals arrive at the phasemeter in phase(except for the effects of flow) because the sound signal is delayed by a time equal to the modulation period.

Diamond Ordnance Fuze Labs., Washington, D. C.
MICROELECTRONICS: AN INTRODUCTION AND A STATUS REPORT, by T. A. Prugh. 1 Nov 57, 11p. 3 refs. TR-536.
Order from LC mi$2.40, ph$3.30 PB 143 566

Two techniques have been developed for constructing small electronic transistorized modules. The first uses etched wiring boards and standard subminiature components. The second technique gives a greater than ten to one volume reduction over the first by incorporating an uncased transistor directly into a printed circuit ceramic plate. The degree of reduction is such that optical aids must be used in constructing and inspecting the circuitry; a new term, microelectronics, has been selected to embrace the latter technique and related efforts in system design, power supplies.

Diamond Ordnance Fuze Labs., Washington, D. C.
MICROPHONISM IN MICROWAVE CRYSTAL MIXERS, by William K. Saunders. 10 July 56, 13p. Technical rept. no. TR-363.
Order from LC mi$2.40, ph$3.30 PB 127 980

The microphonic effects noted in a microwave crystal mixer subjected to vibration are investigated. The experimental procedures and results are presented in detail. The conclusion is that the catwhisker of the type 1N23 crystal is mechanically resonant at some frequencies of vibration; another type of crystal is found to perform satisfactorily under the same conditions.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ACTIVE NETWORK SYNTHESIS BY LATTICE REDUCTION, by R. E. Thomas. Technical note no. 8 on Contract AF 49(638)63. 15 May 59, 100p. 25 refs. AFOSR-TN-59-584; AD-217 031.
Order from LC mi$5.40, ph$15.30 PB 143 515

The standard lattice synthesis technique is extended to active networks in which the available network elements are positive and negative resistors and capacitors. The designation of the immittances of the arms of the active lattice as "single NIC realizable" is shown to be useful and to lead to a variety of lattice realizations including the constant-resistance lattice. The general method described for synthesizing the active lattice requires the introduction of a surplus factor with real, simple and negative zeros. Several procedures are given for reducing the active lattice to an unbalanced equivalent two port made up of resistors, capacitors and negative impedance converters. Both reciprocal and non-reciprocal reductions are obtained. NIC biasing provisions and termination conditions are met by inserting appropriate immittances into the lattice at an appropriate stage of the reduction process.

Electrochemical Research Lab., Western Reserve U., Cleveland, Ohio.
A REVIEW OF THE STATE OF THE ART AND FUTURE TRENDS IN FUEL CELL SYSTEMS, by Ernest Yeager. Technical rept. no. 10 on Contract Nonr-2391(00). 1 Dec 58, 57p. 30 refs.
Order from LC mi$3.60, ph$9.30 PB 143 567

This report summarizes the present status of various fuel cell systems including the low and high temperature hydrogen-oxygen cells, hydrocarbon consuming cells, and the alkali metal amalgam continuous feed cell. The specific features of these systems are considered in terms of small and large scale power generation. Cells of the fuel cell type also offer promise as components of closed cycle systems in which the cell reactants are regenerated from the cell products by such means as photochemical, radiochemical, electrolytic, and thermal dissociation.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
AN EXTENSION OF STOKES' EQUATIONS AND ITS APPLICATION TO THE REFRACTIVITY OF THIN FILMS, by Arthur Wickersham. Rept. on Contract DA 36-039-sc-73170. 4 Oct 57, 25p. 12 refs. Technical memo. rept. no. EDL-M118; AD-148 175.
Order from LC mi$2.70, ph$4.80 PB 138 564

A point of view is developed in which the refractivity of periodic structures is ascribed to a mechanism related to surface waves. The results of such development are compared with data taken at microwave frequencies.

Electronics Research Lab., Stanford U., Calif.
A CIRCUIT FOR SELECTING AND AMPLIFYING WITHOUT TUNING ADJUSTMENT A REDUCED CARRIER IN THE PRESENCE OF VOICE SIDEBANDS AND NOISE, by Robert C. Morwood. Technical rept. no. 10 on Contract W28-099-ac-131. 31 Aug 53, declassified 22 Sep 54, 29p. AD-22 022.
Order from LC mi$2.70, ph$4.80 PB 143 757

A circuit for selecting and amplifying without tuning adjustment. A reduced carrier in the presence of voice sidebands and noise.

Electronics Research Lab., U. of California, Berkeley.
LINEAR ANALYSIS OF CONTROL SYSTEMS WITH MAGNETIC AMPLIFIERS, by T. T. Kadota. 11 Nov 58, 68p. 18 refs. Series no. 60, issue no. 216.
Order from LC mi$3.90, ph$10.80 PB 139 062

Dyanmic representation of a control system, which includes a magnetic amplifier as its component, is essentially a problem of incorporating a discrete system (the magnetic amplifier) with a continuous system (the remainder of the control system). The intrinsic difficulty of the problem lies in the fact that the magnetic amplifier is a pulse-width modulating system, which makes unfeasible direct application of the modified z-transform and the P-transform methods. By appling the technique of "multipole expansion" in electromagnetic theory with proper treatment of Dirac delta-function, however, we can obtain both a general dynamic representation of such a control system and its linear approximation in terms of the modified z-transform. Since in practice the condition for the linear approximation is usually met and the modified z-transform method is readily available, the latter is immediately applicable for the analysis and synthesis of mixed systems which include pulse-width modulators such as the magnetic amplifier. The general representation, on the other hand, is primarily of theoretical value in that it not only gives explicitly the criterion for validity of (or the error involved in) the linear approximation but also sets the z-transform theory on a more rigorous mathematical basis. This report presents the detailed derivation of these representations and illustrates their theoretical and practical applications.

Georgetown Coll. Observatory, Washington, D. C.
A TIME SIGNAL FILTER AND AMPLIFIER FOR RECORDING WWV, by F. J. Heyden and Leland LeFevre. Technical rept. no. 5 on Contract AF 19(604)2229. May 58, 5p. Georgetown Observatory Mono. no. 10; AFCRC TN-58-420; AD-152 587.
Order from LC mi$1.80, ph$1.80 PB 138 713

The National Bureau of Standards Radio Station, WWV, broadcast standard time signals. This signal consists of five cycles of a one-thousand cycle sine wave occurring on the second, with the fifty-ninth second of each minute being omitted. Also present are standard musical notes, voice frequencies and C. W. Code. To utilize accurately the time signals, all interfering signals must be eliminated. An electronic filter has been designed for that purpose.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
ESTIMATION OF THE FREQUENCY OF A PERIODIC SIGNAL CONTAINING NUISANCE PARAMETERS IN THE PRESENCE OF NOISE, by John H. MacKay. Final technical rept. on Contract Nonr-991(04). 15 May 58, 46p. 39 refs.
Order from LC mi$3.30, ph$7.80 PB 138 815

For a stationary Gaussian process superimposed on a single trigonometric term, the main problem considered is that of estimating the frequency of the periodic component. Estimates consistent for all values of the nuisance parameters are obtained. Crude upper bounds are given for the sample sizes (observation periods) necessary in order that the estimates be close to the true value with high probability. Various estimation schemes which have been proposed are discussed and objections to them are recorded. No completely satisfactory (theoretical) solution to the problem is yet available; some of the reasons for this situation are outlined. Criteria for choosing good estimates are discussed and some properties of a priori distributions and bayes solutions outlined. Methods of attack which might lead to additional information about the problem are given.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATIONS OF PRECISION FREQUENCY CONTROL TECHNIQUES, by Samuel E. Meek and Samuel N. Witt, Jr. Quarterly rept. no. 3, 1 Oct-31 Dec 55, on Contract DA 36-039-sc-64597. [1955] 43p. 2 refs.
Order from LC mi$2.30, ph$7.80 PB 139 088

The individual elements of the short-term frequency measuring system are described and the complete system is evaluated theoretically. Under certain assumptions, a sensitivity of 0.0637 mv/cycle of frequency change is indicated. This represents the available i-f voltage input to the i-f amplifier where a maximum additional gain of 140 db is available. Data are presented on the long-term performance of an invar cavity-controlled oscillator immersed in a temperature regulated oven. Constructional details of this oscillator are illustrated. Results of measuring the temperature-frequency characteristics of silver-plated Stupalith cavities are given.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY OF THE EFFECTS OF PROCESSING TECHNIQUES AND MATERIALS ON AGING OF QUARTZ CRYSTAL UNITS, by Richard B. Belser and Walter H. Hicklin. Quarterly rept. no. 6, 15 Aug-15 Nov 56, on Contract DA 36-039-sc-64613. [1956] 179p.
Order from LC mi$8.40, ph$27.80 PB 138 824

A new frequency measuring technique, based on the balanced-bridge circuit has been adapted to use on this project provided accurate and rapid frequency measurement.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY OF THE EFFECTS OF PROCESSING TECHNIQUES AND MATERIALS ON AGING OF QUARTZ CRYSTAL UNITS, by Richard B. Belser. Quarterly rept. no. 7, 15 Nov 56-15 Feb 57, on Contract DA 36-039-sc-64613. [1957] 128p. AD-131 436.
Order from LC mi$6.30, ph$19.80 PB 138 823

Frequency measurements of 91 gold-plated resonators have been continued. The number of units and the types of containers were as follows: 16 units in nickel-silver HC-6/U cans, double-electrocleaned; 19 units in nickel-silver HC-6/U cans, hydrogen-fired; 15 units in copper HC-6/U cans, double-electrocleaned; 5 units in copper HC-6/U cans, hydrogen-fired; 19 units in copper HC-6/U cans, enamel-lined; 12 units in glass containers, evacuated; and 5 units in glass containers, argon filled. Of the 91 units, 76 were stable and drifted less than 0.00005 percent in the last 60 day period of test; only 15 were unstable. Ten of these latter were in the hydrogen-fired groups. All units mounted in glass were stable. However, exceptionally stable frequencies were observed for the majority of units in each type of container. Unstable units gave frequency measurements typical of leakers. The incidence of failure was greater in hydrogen fired containers, and the number of failures appeared to be related to sealing difficulties encountered with containers receiving the hydrogen firing treatment. Fabrication and measurement techniques by the new balanced bridge method have been greatly improved as demonstrated by the data presented. A major problem still remaining to be studied is the aging effect introduced by overcoating resonators to frequency. (See also PB 138 824)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
TRANSISTOR OSCILLATORS OF EXTENDED FREQUENCY RANGE, by B. J. Dasher, D. L. Finn and others. Quarterly rept. no. 1 on Contract DA 36-039-sc-42712. 30 Sep 53, 34p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 138 196

Some basic factors that determine the frequency stability of series-mode oscillators are reviewed. It is shown that frequency stability with respect to an unstable impedance, Z_2, depends on the ratio $(\partial X_1/\partial Z_2)/(\partial X_0/\partial Z_2)$, in which X_0 is the reactance of the resonator and X_1 is the reactance of the circuit external to the resonator. First-order effects of nonlinearity are investigated, and attention is called to the fact that L/C is fundamentally more important than Q as a figure of merit of the resonator in this type of oscillator.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
TRANSISTOR OSCILLATORS OF EXTENDED-FREQUENCY RANGE, by B. J. Dasher, D. L. Finn and W. B. Jones, Jr. Quarterly rept. no. 2 on Contract DA 36-039-sc-42712. 31 Dec 53, 43p. 10 refs.
Order from LC mi$3.30, ph$7.80 PB 138 197

The operation of series-mode oscillators of the negative-resistance type is discussed in detail. The relation between amplitude stability and distortion is considered, and it is shown that distortion is necessary to amplitude stability in this kind of oscillator. Frequency "pulling" due to distortion can be computed by means of Groszkowski s equation. Tests on simple transistor oscillators at 1,000 cps show a fairly good agreement between computed and measured frequency. Frequency stability is also considered from the point of view of linear circuit theory. (See also PB 138 196)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
TRANSISTOR OSCILLATORS OF EXTENDED FREQUENCY RANGE, by B. J. Dasher, W. B. Jones, Jr. and S. N. Witt, Jr. Quarterly rept. no. 3 on Contract DA 36-039-sc-42712. 31 Mar 54, 30p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 138 198

The results of a series of experiments performed for the purpose of finding out whether Groszkowski's equation gives sufficiently accurate results to be useful in computing the frequency pulling due to distortion in transistor oscillators are described. These tests were made on series-mode oscillators at 1,000 cps. When the pulling is of the order of 0.5 per cent, the theory accounts for about four-fifths of it. The cause of the remaining discrepancy has not been determined. Evaluation tests on several transistor-oscillator circuits have been made. (See also PB 138 197)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
TRANSISTOR OSCILLATORS OF EXTENDED FREQUENCY RANGE, by B. J. Dasher and S. N. Witt, Jr. Quarterly rept. no. 4 on Contract DA 36-039-sc-42712. 30 June 54, 32p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 138 199

An analytical treatment of two-terminal oscillators is begun in this report. The analysis is based on a Fourier series representation in which the nonlinear negative resistance characteristic is approximated by means of straight-line segments. Instead of assuming the characteristics to be nearly linear the oscillation is assumed to be nearly sinusoidal. In the case of a series-mode oscillator this assumption implies a sinusoidal current which permits the voltage to be expressed as a Fourier series. The ratio of the fundamental component of voltage to the fundamental component of current is the effective input resistance which, when considered as a function of the current amplitude, permits the amplitude of oscillation to be determined for a specified external circuit. (See also PB 138 198)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
TRANSISTOR OSCILLATORS OF EXTENDED FREQUENCY RANGE, by B. J. Dasher, D. L. Finn and others. Quarterly rept. no. 5 on Contract DA 36-039-sc-42712. 30 Sep 54, 53p.
Order from LC mi$3.60, ph$9.30 PB 138 200

The analysis of two-terminal oscillators begun in Quarterly Report No. 4 is continued. Curves relating the pulling factor, P^2, and the resistance ratio, $-R_1/R_0$, have been computed for more general types of negative-resistance characteristics. The theory has been applied to the design of a parallel-mode oscillator at 1000 cps. By actual performance tests the theory predicted the frequency stability with respect to supply voltage variations to within a factor of about three and the amplitude stability to within a factor of less than two. Since the measured frequency stability was approximately 15 parts in 10^7 for one per cent change in supply voltage and the analysis involves several approximations, these results are considered to be very good. (See also PB 138 199)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
TRANSISTOR OSCILLATORS OF EXTENDED FREQUENCY RANGE, by B. J. Dasher, D. L. Finn and others. Quarterly rept. no. 6 on Contract DA 36-039-sc-42712. 30 Dec 54, 32p. 15 refs.
Order from LC mi$3.00, ph$6.30 PB 138 201

A laboratory-constructed temperature test chamber is described, and some data on temperature stability of transistor oscillators, obtained by making use of the test chamber, are presented herein. The best temperature stability obtained is 4 parts in 10^8 for 1°C temperature change, with an oscillator having a voltage stability of 1 part in 10^8 for a 1 per cent voltage change. This oscillator makes use of a point-contact transistor. Circuit schematics are presented for junction-transistor oscillators having similar orders of stability. (See also PB 138 200)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
TRANSISTOR OSCILLATORS OF EXTENDED FREQUENCY RANGE, by B. J. Dasher, S. N. Witt, Jr. and W. B. Warren, Jr. Quarterly rept. no. 7 on Contract DA 36-039-sc-42712. 31 Mar 55, 43p. 16 refs.
Order from LC mi$3.30, ph$7.80 PB 138 202

In order to facilitate comparisons among oscillator circuits, the term stability has been defined as a numerical quantity which increases as a circuit is made more stable. Stability may be expressed as a function of any variable parameter, such as voltage or temperature. The use of impedance inversion to obtain crystal control of point-contact oscillators has been found to be impractical in most cases. A transistorized Meacham bridge oscillator has been developed which has performance comparable to a similar oscillator using vacuum tubes. The best stability obtained was approximately 2 parts in 10^9 frequency variation for one per cent voltage change. A design procedure is described which provides a method for obtaining best stability for most feedback-type oscillators. Data are given on a novel method of stabilization of junction-transistor oscillators using distortion control. The problems involved in measuring frequency stability are discussed. (See also PB 138 201)

Goodrich, B. F., Co., Brecksville, Ohio.
NEW POLYMERIC INSULATING MATERIALS, by J. E. Jansen, C. S. Schollenberger and others. Annual summary rept. for 1 Oct 54-30 Sep 55 on Contract DA 36-039-sc-64534. 30 Sep 55, 73p. 8 refs.
Order from LC mi$4.50, ph$12.30 PB 139 008

The present WD-1 twisted pair infantry field wire is fabricated of several strands of wire insulated electrically with polyethylene and covered with an outer jacket of nylon. It is desirable to provide other sources of insulating or jacketing materials equivalent to or superior to the present composition. The purpose of this work is to examine likely polymers as replacements and to investigate the field of polyurethanes in particular. Polyurethane VC-1A, a tough, rubbery, thermoplastic polyesterurethane is under intensive investigation as a candidate.

Hoffman Labs., Inc., Los Angeles, Calif.
TRANSISTORIZED MODIFICATION, AN/PRC-14. Final engineering rept. for 1 Mar 56-28 Feb 57 on Contract AF 30(602)1477. [1957] 93p. 8 refs. RADC-TR-58-35; AD-148 646.
Order from LC mi$5.40, ph$15.30 PB 143 514

The feasibility of replacing certain vacuum tube circuits in the AN/PRC-14 with transistor circuits has been proven. Virtually 100 percent compatibility of circuitry was achieved (except for the AGC circuit compromise). System gain, audio response, power output, bandwidth and shape factor were equal to or better than those of the original equipment employing all vacuum tubes. Some conservation of space was achieved, and a 16 percent reduction in battery power was experienced. Maximum utilization of printed circuitry techniques made possible a unique i-f stage package. Operation at elevated temperatures was satisfactory. A high degree of reliability was demonstrated by the fact that no failures of transistors occurred under normal operating conditions during the program. All factors considered indicate the desirability of transistors in the portable equipment applications, where weight, space and supply power must be restricted to a minimum. Continuing developments in the transistor field indicate that many more functions in equipment such as the AN/PRC-14 (XW-2) may be performed by transistors.

Hughes Aircraft Co., Culver City, Calif.
STUDY OF ATOMIC AND MOLECULAR RESONANCES FOR MICROWAVE GENERATION AND AMPLIFICATION, by R. Hellwarth, R. Hoskins and R. Pastor. Quarterly progress rept. no. 2, 15 Mar-15 June 58, on Contract DA 36-039-sc-74967. [1958] 12p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 139 226

By use of the ordered operator formalism for analyzing solutions to Shroedinger's equation, a quantum theory of linear dissipative networks is outlined. An operator functional describing a network is defined, and certain of its properties are noted. In tuning the zero-field splitting of a paramagnetic ion by chemical means, a basis for the choice of the complex and host lattice is given. The present activity is centered on Cr^{+3} in two host lattices, viz., the double metal nitrates and the hexacyano complexes. It is found that Cr^{+3} can be substitutionally incorporated in the double metal nitrates with a partition coefficient about an order of magnitude poorer than that for Gd^{+3}. The latter is known to have a partition coefficient which is at least an order of magnitude different from unity. Preparative procedures that have been tried in the

synthesis of the hexacyano complexes are given, and their advantages and disadvantages are discussed. Experimental work has been initiated on the inversion of electron spin populations by pulse methods in order to gain information on relaxation times and saturation behavior.

Hycon Eastern, Inc., Cambridge, Mass.
FREQUENCY TRANSLATOR WITHOUT SYNTHESIZER, by Richard L. Smith. Monthly progress rept. no. 1, 15 Mar-15 Apr 57, on Contract DA 36-039-sc-73191. 30 Apr 57, 14p.
Order from LC mi$2.40, ph$3.30 PB 139 096

Work to date has been limited and largely related to general system design consideration. Conclusions indicate soundness of the basic design as proposed. Procurement has been started on some long delivery components.

Hycon Eastern, Inc., Cambridge, Mass.
FREQUENCY TRANSLATOR WITHOUT SYNTHESIZER, by Richard L. Smith. Monthly progress rept. no. 2, 15 Apr-15 May 57, on Contract DA 36-039-sc-73191. 30 May 57, 13p.
Order from LC mi$2.40, ph$3.30 PB 139 097

Results of study to optimize system parameters on a squelched phase-locked klystron for use in the translator are reported. Progress on construction and test of system components is reported. (See also PB 139 096)

Hycon Eastern, Inc., Cambridge, Mass.
FREQUENCY TRANSLATOR WITHOUT SYNTHESIZER, by Richard L. Smith. Monthly progress rept. no. 3, 15 May-15 June 57, on Contract DA 36-039-sc-73191. 30 June 57, 10p.
Order from LC mi$1.80, ph$1.80 PB 139 098

Progress is reported on construction and test of the squelched phase-locked klystron, frequency multipliers, intermediate frequency amplifier, and crystal discriminator. (See also PB 139 097)

Hycon Eastern, Inc., Cambridge, Mass.
FREQUENCY TRANSLATOR WITHOUT SYNTHESIZER, by Richard L. Smith. Monthly progress rept. no. 4, 15 July 57, on Contract DA 36-039-sc-73191. 31 July 57, 10p.
Order from LC mi$1.80, ph$1.80 PB 139 099

Results of a study on the use of a squelched phase-locked klystron as local oscillator in the translator and progress on other system components is reported. (See also PB 139 098)

Hycon Eastern, Inc., Cambridge, Mass.
FREQUENCY TRANSLATOR WITHOUT SYNTHESIZER, by Richard L. Smith. Monthly progress rept. no. 5, 15 July-15 Aug 57, on Contract DA 36-039-sc-73191. 31 Aug 57, 8p.
Order from LC mi$1.80, ph$1.80 PB 139 100

Progress is reported on circuit development and test of this frequency multiplier, servo amplifier, and the 5 Mc/s crystal oscillator for use in the translator. (See also PB 139 099)

Hycon Eastern, Inc., Cambridge, Mass.
FREQUENCY TRANSLATOR WITHOUT SYNTHESIZER, by Richard L. Smith. Monthly progress rept. no. 6, 15 Aug-15 Sep 57 on Contract DA 36-039-sc-73191. 30 Sep 57, 9p.
Order from LC mi$1.80, ph$1.80 PB 139 105

Progress is reported on the development of a revised system for the Translator which eliminates the necessity for a synchronized local oscillator klystron. (See also PB 139 100)

Hycon Eastern, Inc., Cambridge, Mass.
FREQUENCY TRANSLATOR WITHOUT SYNTHESIZER, by Richard L. Smith. Monthly progress rept. no. 7, 15 Sep-15 Oct 57, on Contract DA 36-039-sc-73191. 31 Oct 57, 11p.
Order from LC mi$2.40, ph$3.30 PB 139 094

A final design-approach proposal for the translator is presented and progress on breadboarding of system components is reported. (See also PB 139 105)

International Resistance Co., Philadelphia, Pa.
RESISTORS, FIXED, HIGH STABILITY, INSULATED, by Sidney J. Stein, John J. Bohrer and others. Quarterly progress rept. no. 2, 15 July-15 Oct 55, on Contract DA 36-039-sc-64665. [1955] 41p.
Order from LC mi$3.30, ph$7.80 PB 129 892

The investigation of materials and methods believed to be capable of leading to low cost, insulated, fixed resistors of high stability was continued. Resistors of the "semi-precision" type having resistance values exceeding the contract requirements in both the high and the low ranges have been made as a result of work conducted to increase the range span of resistance values attainable. Preliminary performance testing results of resistors in the extreme ranges show indication of meeting or exceeding the contract requirements in most respects. In the "precision" phase, work has continued on improved protective coating, insulating molding materials, and termination systems. Contact effects have been reduced to an insignificant level enabling the attainment of stable resistors of lower ranges than were previously made. Temperature coefficients of less than 50 PPM were obtained for units of less than 200 ohms. (See also PB 129 894)

Lavoie Labs., Inc., Morganville, N. J.
THE DEVELOPMENT OF THE FREQUENCY METER AN/URM-80. Final rept. for 29 Feb 52-Jan 54 on Contract DA 36-039-sc-36527. [1954] 44p.
Order from LC mi$3.30, ph$7.80 PB 139 087

The report covers the development of a frequency meter covering from 10 to 100 megacycles, with an accuracy of 0.001%. During the development period,

new components were developed and techniques for calibration and temperature control established. A relatively new system of frequency measurement was applied to a single-unit instrument which resulted in a reduction of ambiguity to the vanishing point. By the use of individual subchassis, each comprising a major system element, manufacture and test of the instrument was simplified, and production lead time was reduced. The large number of calibration points required that standard mechanical calibration methods be discarded and a high speed continuous film strip calibrator be developed.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
STRAIGHT TAPERS IN RECTANGULAR WAVEGUIDES. A COMPARISON OF PRINCIPAL-MODE AND NONUNIFORM TRANSMISSION-LINE THEORIES, by T. J. Rey. Rept. on Contract AF 19(122)458. 10 Feb 58, 13p. 15 refs. Technical rept. no. 174. AD-110 041.
Order from LC mi$2.40, ph$3.30 PB 138 606

Straight tapers of the E-plane, H-plane and pyramidal types in rectangular waveguides are analyzed in terms of principal modes. Comparison with nonuniform transmission-line theory shows considerable agreement. Expressions suitable for numerical computation are presented.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
TRANSISTORIZED MATCHED FILTER FOR PULSED SINUSOIDS, by P. L. Fleck, Jr. Rept. on Contract AF 19(122)458. 12 Apr 57, 27p. 14 refs. Technical rept. no. 156; AD-147 492.
Order from LC mi$2.70, ph$4.80 PB 138 607

A matched filter for pulsed sinusoidal symbols has been designed and constructed in which transistors are used as the active elements. The filter has a gain variation of less than one db as a result of variation of component parameters, temperature, age, and supply voltages. The filter has a useful dynamic range of at least 80 db.

Litton Industries, College Park, Md.
SURFACE WAVE ANTENNA STUDY, by W. P. Hooper and E. A. Wolff. Final rept. on Contract AF 19(604)3457. 28 May 59, 29p. 2 refs. AFCRC TR-59-159; AD-217 074.
Order from LC mi$2.70, ph$4.80 PB 143 355

The purposes of the project were to study methods of increasing the efficiency of the dielectric image line antenna and the development of a method of launching the image transmission line mode with a flush launcher. Investigations were made to determine the efficiency of the antenna and ways of improving the efficiency. Also, methods of launching the transmission line mode with a flush launcher, which would eliminate the horn launcher, were investigated. A number of patterns for the flush launcher are included.

Mallory Battery Co., North Tarrytown, N. Y.
HEATING AND INSULATION OF ALKALINE DRY BATTERIES FOR LOW TEMPERATURE OPERATION, by Michael Firshein and Herman Schiebler. Final rept. pt. 1, 10 May 56-10 Feb 58, on Contract DA 36-039-sc-72372. [1958]. 71p.
Order from LC mi$4.50, ph$12.30 PB 139 060

The contract for the manufacture of alkaline dry batteries embodying the principles of heating and insulation for low temperature operation comprises six tasks. Task A, calls for a replacement for Battery BB-401/U. Task B calls for the manufacture of Battery Type 6 (Crash Locator Beacon). This Final Report #1 is limited to Tasks A and B.

Mallory, P. R., and Co., Inc., Indianapolis, Ind.
RESISTORS, FIXED, ULTRA-HIGH TEMPERATURE, RADIATION RESISTANT, by David R. Sivertsen. Rept. on Improved Electronic Components, Contract AF 33(616)3643. July 59, 47p. 3 refs. WADC Technical rept. 59-270; AD-215 857.
Order from OTS $1.25 PB 161 081

This report covers the development of a suitable design for a one watt resistor capable of operation at temperatures from -65°C to +500°C in nuclear radiation environments for extended periods of time. The work was devoted to refining the electrical properties and design of the resistor. It was demonstrated that high alumina ceramics were necessary to minimize large non-uniform resistance changes occuring over uniform temperature increments to +500°C. A number of terminal material compositions were examined for applicability in ultra-high temperature operation. Investigation of various metal oxide films revealed that a 7.5% Sb_2O_3: 92.5% SnO_2 composition possessed a near zero temperature coefficient of resistance over broad temperature range and the most desirable electrical characteristics. A suitable insulating coating, composed of flame deposited aluminum oxide, was utilized in this application without undesirable effects on resistor properties. Radiation tests were made on a variety of modified tin oxide resistors at +500°C for 1500 hours under high intensity nuclear radiation.

Michigan U. [Research Inst.] Ann Arbor.
PACKAGED ELECTRIC TUNED 35-200 MC PANORAMIC RECEIVER, by T. W. Butler, Jr. Technical rept. no. 71 on Contract DA 36-039-sc-63203. July 57, 81p. 12 refs. AD-141 657.
Order from LC mi$4.80, ph$13.80 PB 142 696

A method of utilizing the voltage tuning characteristics of ferroelectric capacitors in a packaged, wide-range, superheterodyne, electric-tuned, panoramic receiver is described. This receiver employs titanate ceramic capacitors as tuning elements in the tank circuits of the RF, mixer, and local oscillator stages. The capacity of the tuning elements is varied by changing the electric field applied to the capacitors. The receiver is designed for use in monitoring communication signals in the frequency range 35-200 Mc. This Packaged Electric Tuned Receiver PANoramic (Petr Pan) is the result of a development program designed to indicate the direction engineers can take in developing and packaging a dielectric tuned receiver suitable for operational use.

Michigan U. Research Inst., Ann Arbor.
STUDY OF CIRCUIT APPLICATIONS OF SOLID STATE DEVICES TO ECM EQUIPMENT, by T. W. Butler, Jr., H. Diamond and others. Progress rept. no 18, 1 July 56-1 Jan 57, on Contract DA 36-039-sc-63203. Feb 57, 32p. 5 refs. 2262-142-P; AD-135 755.
Order from LC mi$3.00, ph$6.30 PB 143 643

New ceramic compositions have been developed by the Solid State Devices Laboratory which have much higher Q's and better voltage breakdown characteristics than previously used compositions. Methods of prestressing or "polarizing" ferroelectric samples have been investigated.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
COUPLED LEAKY WAVEGUIDES I: TWO PARALLEL SLITS IN A PLANE, by S. Nishida. Rept. on Contract AF 19(604)2031. 14 May 59, 25p. 2 refs. Research rept. R-732-59; PIB-660; AFCRC TN-59-375; AD-217 855.
Order from LC mi$2.70, ph$4.80 PB 143 024

The longitudinally slitted rectangular waveguide, with radiation characterized by leaky waves, has already been investigated by employing a transverse network representation and a perturbation procedure to solve the resulting network resonance problem. The above investigation has been carried out for a single (isolated) leaky waveguide. In this paper, two coupled leaky waveguides carrying the H_{10} leaky wave are treated for the case where they are arranged in a plane and in parallel with each other.

Minneapolis-Honeywell Regulator Co., Minn.
POWER TRANSISTOR CIRCUITRY, by John T. Lingle. Final rept. for 15 Feb-15 May 57 on Contract DA 36-039-sc-71161. [1957] 124p. Serial no. 12355; AD-156 177.
Order from LC mi$6.30, ph$19.80 PB 143 304

Power transformers utilizing various core materials and cross-sectional areas were tested. Two identical transformers fabricated from 1-mil Deltamix failed to oscillate in the converter. Rapid switching was obtained with transformers fabricated from 2 toroidal core materials, grain-oriented silicon steel, and Ferramic H. Experimental results showed that the addition of secondary leakage inductance can improve the oscillator switching characteristics when the proper filter configuration is used. A large amount of secondary leakage inductance must be incorporated in the transformer for good switching characteristics. Some transformer core materials require a greater amount of secondary leakage inductance than others to obtain the desired short switching time. The effects were studied of leakage inductance in producing forward and inverse collector currents during switching. Initial current surges in the switching on transistor could occur when both transistors were conducting at the same instant. Capacitor input load filters produced better switching characteristics than did choke inputs. Determination of transistor output characteristic curves by a pulsing method revealed that the thermal irregularities found in previously determined characteristic curves were reduced by the pulsing method of testing.

Motorola, Inc., Phoenix, Ariz.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Final feasibility rept. on Contract DA 36-039-sc-72694. 6 June 57, 47p. AD-155 228.
Order from LC mi$3.30, ph$7.80 PB 128 771

Diffusion techniques were used in fabricating semiconductor devices for some specific applications. Diffused base-jet plated emitter and collector junction transistors were developed for meeting the requirements for a Ge transistor 12.5-mc amplifier and a Ge transistor video amplifier having a bandwidth of 6 mc. An analysis was made of the electrical characteristics of each transistor device. The units made by the diffused base-jet-etch process will meet the requirements. (See also PB 137 163)

Naval Civil Engineering Lab., Port Hueneme, Calif.
DEVELOPMENT OF A BRUSHLESS REGULATED AC GENERATOR OF RADIO-INTERFERENCE-FREE DESIGN, by A. Mason Brown. Final rept. 7 Sep 59, 58p. 3 refs. Technical rept. 032; AD-209 529.
Order from OTS $1.50 PB 161 104

This report describes the development of a generator of radio-interference-free design which produces a conventional voltage-regulated output without requiring brushes, commutator, or slip rings. There are no sliding or arcing contracts to initiate radio-interference. The unique feature developed is the manner in which regulated excitation is supplied to the rotating field. Acceptance tests showed that the generator compiled with Navy voltage regulation specifications. NCEL tests showed that it was radio-interference-free to MIL-I-16910 standards. Total running time to date logged on the generator is 1600 hours. It is concluded that brushless generators with standard performance characteristics can be built with all sliding, current-carrying surfaces eliminated. Such machines have inherent in their design prospects for a degree of highly reliable operation unattainable in conventional generators.

Naval Ordnance Lab., White Oak, Md.
BEHAVIOUR OF POWDERED AND FLAKE MAGNETIC CORES AT TEMPERATURES UP TO 500°C, by John F. Haben and Edmond Adams. 17 Oct 57, 22p. 5 refs. NAVORD rept. 5752; AD-149 999.
Order from LC mi$2.70, ph$4.80 PB 138 614

The magnetic characteristics of seven high permeability (55-300) powdered and flake core materials were measured at 50°C temperature intervals up to 500°C. None of the cores tested were stable for operation at elevated temperatures. The copper conductor material and its insulation appears to be the limiting factor for continuous 500°C operation.

Naval Ordnance Lab., White Oak, Md.
AN EXPERIMENTAL STUDY OF UNDERWATER ELECTRIC ANTENNA IMPEDANCES, by A. Silverstein and F. G. Salton. 16 Sep 58, 18p. 2 refs. NAVORD rept. 6064.
Order from LC mi$2.40, ph$4.40 PB 143 338

The input impedance of a variety of underwater electric antennas was measured in Chesapeake Bay and in a high conductivity salt pool over a frequency range of 5 - 70 KC. The results were compared with input impedances calculated from a theory based upon the transmission line approach. The deviation of the measured input impedances from the theoretical values is considerable, particularly for short antennas. A qualitative explanation is given for the failure of the transmission line theory. Recommendations are made for communication at increased depth.

Naval Research Lab., Washington, D. C.
A DIRECT-READING SIX-DECADE PRECISION FREQUENCY GENERATOR, by J. E. McGeogh and G. K. Jensen. Interim rept. 25 Nov 58, 12p. 7 refs. Rept. 5224.
Order from OTS $0.50 PB 151 158

The development of a direct-reading six-decade frequency generator to be used in conjunction with a previously reported direct-reading frequency meter has been satisfactorily completed. This new frequency generator has been made with unitized construction to overall dimensions of 12-3/4 x 14-1/2 x 5-3/4 in., or 0.615 cu ft, and utilizes miniature tubes, but the size could be reduced appreciably in a subsequent model. Each of 6 plug-in decade chassis has 3 tubes, for a total of 18 tubes, and the reference-frequency section, composed of 11 small plug-in chassis, has a total of 29 tubes. In the next model the number of tubes could be reduced to 6 and 20, respectively. All decades have identical schematic diagrams, but different tuning is necessary to operate in the three required frequency ranges. The mechanical construction is identical in all decades. The decade frequency generator is accurate to within about one part in 100 million when an external reference frequency of the same accuracy is available, or to one part per million when the reference frequency is internally generated by a temperature-controlled crystal oscillator with one part per million accuracy. The reduction in size from previous models of decade generators is accompanied by a reduction in weight and also by an appreciable reduction in power requirements, which further reduces the size and weight of the power supply. As a result of this development, the entire frequency meter, consisting of the direct-reading six-decade frequency generator, frequency multipliers, and comparison circuits and filters, may be contained in a unit of one cubic foot.

Navy Electronics Lab., San Diego, Calif.
DEVELOPMENT OF A 36-FOOT FOLDED PILLBOX INTERROGATOR ANTENNA FOR THE AIRWAYS MODERNIZATION BOARD, by B. T. Birkett. 5 Nov 58, 23p. 4 refs. Research and development rept. 878.
Order from LC mi$2.70, ph$4.80 PB 139 081

A folded pillbox antenna has been designed, built, tested, and sent to the CAA Technical Development Center, Indianapolis, Indiana, for further testing with other components of the Airways Modernization Board beacon system. The antenna is 36 feet wide, 3 feet high, and 10 feet deep. It weighs approximately 1000 pounds. The azimuth beamwidth is 2 1/4°, the wide-angle side lobes are below 29 db, and the gain is 26 db.

New York U. Coll. of Engineering, N. Y.
SEALING TECHNIQUES FOR WAVEGUIDE AND COAXIAL ROTARY JOINTS, by Milton M. Backman, Michael B. Maccarone and Fred H. Posser. Rept. no. 10 (Final) for 1 Aug 54-31 Mar 57 on Contract DA 36-039-sc-64476. [1957] 170p. 52 refs. AD-156 901.
Order from LC mi$7.80, ph$25.80 PB 143 303

This report contains information regarding all phases of the experimental work undertaken in the determination of a design criteria for development and application of sealing techniques to be applied to waveguide and coaxial rotary joints. The first part of this report is devoted to the results of experimental and development work performed in producing the final design and construction of sealed RG-52 waveguide rotary joints. The second portion of the report contains five Appendices. The first is devoted to the experimental work on the magnetic fluid and the magnetic mechanical seals. The second appendix is a history with recorded data of the experimental work performed in the development of the final design. Reference is made to the work with the first experimental mechanical seal and continues through to the final development results. The third appendix refers to publications, reports, lectures, and conferences associated with this study. In order to coordinate the design information obtained in this study the fourth appendix of this report presents the developed design criteria with a procedure for designing additional rotary seals with similar requirements to the RG-52 Sealed Rotary Joint developed in this study. The fifth and last appendix presents a major portion of the test data recorded during the final testing of the development models indicating various tests performed with the models including those required by the technical requirements.

Pickard and Burns, Inc., Needham, Mass.
THE IMPROVEMENT OF SIGNAL-TO-NOISE RATIOS OF THE COZI EQUIPMENT, by Walter Kostecki. Interim status rept. for 1 Dec 57-31 Mar 59 on Contract AF 19(604)1502. 30 Apr 59, 11p. P&B Pub. no. 528; AFCRC-TN-59-191; AD 215 623.
Order from LC mi$2.40, ph$3.30 PB 143 560

See also PB 136 212

Pickard and Burns, Inc., Needham, Mass.
THE IMPROVEMENT OF SIGNAL-TO-NOISE RATIOS OF THE COZI EQUIPMENT, by L. Dennis Shapiro. Final rept. on Contract AF 19(604)1502. 17 July 59, 20p. 1 ref. P&B Pub. no. 549; AFCRC-TR-59-175.
Order from LC mi$2.40, ph$3.30 PB 143 491

Philco Corp., Philadelphia, Pa.
RESEARCH AND EXPERIMENTAL WORK ON MICROWAVE TRANSISTORS, by R. L. Goldman, G. P. Oppo and others. Quarterly progress rept. no. 2, 15 Apr-15 July 58, on Theoretical and Experimental Investigation of New Semiconductor Devices for Operation in the 2 to 10 Kilomegacycle Range, Contract DA 36-039-sc-74988. [1958] 30p. 9 refs. Philco no. 2153-2.
Order from LC mi$2.70, ph$4.80 PB 139 065

Wafer-type depletion layer devices have been fabricated in order to investigate injection into the depletion layer. A theoretical analysis of both high- and low-frequency operation has been initiated to determine the feasibility of a depletion layer transistor as a high-frequency device. Results indicate that the fabrication problems will be the principal barrier to the development of a feasible device. The results of a study concerning the fabrication and evaluation of bar-type, wafer-channel, and surface-barrier analog devices indicate that the surface-barrier device has the most favorable and reproducible characteristics, and is the easiest to fabricate. A theoretical analysis has also been initiated to determine the feasibility of the analog transistor for high-frequency application. Early results indicate that the field-effect unipolar device is extremely flexible.

Puerto Rico U., Mayaguez.
CHARACTERISTICS OF A PECULIAR BACK-SCATTER ECHO OBSERVED AT A FREQUENCY OF 21.6 mc. p.s., by B. Dueno. Research rept. no. 1 on Contract AF 49(638)172. [1958] 27p. 2 refs. AFOSR TN-59-40; AD-209 212.
Order from LC mi$2.70, ph$4.80 PB 139 212

Inspection of records of a backscatter experiment performed at the University of Puerto Rico at Mayaguez has revealed a very interesting echo which as yet has not been observed at back-scatter stations located on higher latitude sites. This echo takes the form of a narrow thin line reflection extending in all directions with its slant range practically independent of its azimutal bearing. The bottom edge of the line is believed to be due to a focussing effect of the minimal time delay type proposed by A. M. Peterson in 1951 while the upper edge is due to a focussing effect between the skip distance rays and rays at greater angles of incidence having the same time delays as the skip distance rays. At the frequency of operation, 21.6 mc. it is observed by itself at times when the attenuation of the radio waves is at its highest. The range assumes values between 1000 and 2000 kilometers depending on time of the day and season.

Radio Corp. of America, Lancaster, Pa.
DEVELOPMENT OF A RUGGEDIZED VIDICON AND DEFLECTION COMPONENTS, by F. D. Marschka. Rept. on Electronic Tubes and Transistors, Contract AF 33(600)32346, July 59, 31p. WADC Technical rept. 59-329.
Order from OTS $1.00 PB 161 082

Extensive operational vibration and temperature-altitude tests along with non-operational impact shock and temperature-humidity tests led to the design and development of the RCA C73453D vidicon and RCA XD3010A deflection assembly. Results of these tests indicated compliance with the environmental requirements of the contract.

Research Lab. of Physical Electronics, Tufts [U] Medford, Mass.
STUDIES ON PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry and others. Quarterly rept. no. 2, 15 July-15 Oct 54, on Contract DA 36-039-sc-56764. 15 Nov 54, 23p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 694

Spectra of thickness-shear and flexural modes and the spectra predicted by an approximate theory. Methods of adjusting the experimental results to a basis comparable with the theoretical presentation.

Research Lab. of Physical Electronics, Tufts U., Medford, Mass.
STUDIES ON PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry and others. Final rept. on Contract DA 36-039-sc-56764. 1 Nov 55, 35p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 138 825

Explorations in frequency and dimension to obtain the experimental curves of flexural and thickness-shear modes of vibration in a piezoid having the form of a rectangular parallelepiped with very small tolerances, in order to establish the empirical functions against which theory must be checked.

Rome Air Development Center, Griffiss AFB, N. Y.
FEASIBILITY STUDY OF MONOLITHIC FOAM-IN-PLACE RADOME, by Joseph Schramp and Robert Curtis. Oct 58, 24p. 4 refs. RADC-TN-58-253; AD-202 094.
Order from LC mi$2.70, ph$4.80 PB 138 620

Equipment and procedures used in the erection at RADC of a monolithic foam-in-place radome are presented; problem areas are outlined and feasible solutions suggested. In the Appendix the results of a structural analysis of the monolithic foam shell are summarized.

Rome Air Development Center, Griffiss AFB, N. Y.
AN INTEGRATED APPROACH TO THE DESIGN OF MOBILE TACTICAL ELECTRONIC SYSTEMS, by Robert N. Skalwold and Maurice N. Scheiderich. Oct 58, 45p. RADC-TN-58-260; AD-148 917.
Order from LC mi$3.30, ph$7.80 PB 138 619

This report compares the complete conventional system weight of the lightest radar the state of the art has produced with the weight of a completely integrated system. The results show that the integrated system will weigh approximately one-third the weight of the conventional system. Recommendations for application to tactical ground electronics sub-systems are included.

Rome Air Development Center, Griffiss AFB, N. Y.
RADAR VISUAL INTERFERENCE TESTS, by Sheldon Kustin. Aug 57, 18p. 2 refs. RADC-TN-57-251; AD-131 173.
Order from LC mi$2.40, ph$3.30 PB 129 888

Presented in this report are various types of radar-to-radar visual interference, a description of tests performed, and some recommended solutions to the problem of visual interference.

Rome Air Development Center, Griffiss AFB, N. Y.
SEMI-AUTOMATIC SWITCHING FOR FLEXO-WRITER MACHINES, by James F. Greenly. Nov 58, 14p. RADC-TN-58-289; AD-148 957.
Order from LC mi$2.40, ph$3.30 PB 138 618

The equipment described in this report fulfills the requirement for switching multiple Flexowriter machines in a local network. Adequate circuits are provided to allow simultaneous communication between machines in a variety of switched combinations. Design considerations, power requirements, and operational features are discussed. Operation of line selection circuits is described in detail.

Scintilla Div., Bendix Aviation Corp., Sidney, N. Y.
IMPROVED CONNECTOR DESIGN: SERVICES, FACILITIES, AND MATERIALS TOGETHER WITH CONNECTOR SAMPLES, by L. J. Elliott. Final rept. for 15 Oct 50-15 May 54 on Contract DA 36-039-sc-42542. 15 June 54, 310p. 35 refs.
Order from LC mi$11.10, ph$37.10 PB 142 954

Exhaustive investigation of connectors designs incorporating the latest concepts in quick connect-disconnect features, positive contact action, miniaturization, watertightness, insert materials, aluminum finishes, and other factors which would augment their reliability in military service. Sufficient design criteria were to be established to replace the present AN connectors.

Speech Research Lab., U. of Michigan, Ann Arbor.
SEGMENTATION TECHNIQUES IN SPEECH SYNTHESIS (PART I) [AND] SEGMENT INVENTORY FOR SPEECH SYNTHESIS (PART II) by William S-Y. Wang, Gordon E. Peterson, and Eva Sivertsen. Rept. no. 1 on Contract Nonr-1224(22). May 58, 31p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 138 816

A basic method of speech synthesis is described in which discrete segments of recorded utterances are joined together to produce continuous speech. The method of synthesis described includes not only articulatory phones, but also intonation, stress, and duration. Various techniques of obtaining segments for speech synthesis are discussed. The inventory of segments required to synthesize an idiolect of American speech from recorded utterances has been partially investigated. A total of 43 phonetic units, including a unit of silence, is found essential. These units represent some of the major allophones of the phonemes of the idiolect. To obtain the segments, utterances are constructed with the desired sequence of the two phonetic units and with the proper intonation and stress environment. The utterances are recorded on magnetic tape, and the desired boundaries of the segments are determined by means of a technique employing a sound spectrograph. An attempt is made to match harmonics, formants, and amplitude envelopes between adjacent segments. To synthesize the idiolect it is estimated that an inventory of about 8,000 segments is required. A sentence synthesized from over 40 such segments is demonstrated.

Stanford Electronics Labs., Stanford U., Calif.
FREQUENCY MIXING IN MICROWAVE BEAM-TYPE DEVICES, by R. W. Degrasse. Rept. on Contract AF 19(604)1847. 28 July 58, 188p. 34 refs. Technical rept. no. 386-2.
Order from LC mi$8.40, ph$28.80 PB 139 124

This report is primarily concerned with the frequency mixing effects which occur in microwave electron-beam type devices. The theoretical portion of the study is devoted to obtaining a better understanding of the nature of the non-linear effects which can be introduced into or are already present in velocity-modulated electron beams.

Stanford Electronics Labs., Stanford U., Calif.
MULTI-STAGE, NARROW-BAND AMPLIFIERS EMPLOYING NON-UNILATERAL ELECTRON DEVICES, by M. Lim. Technical rept. no. 27 on Contract Nonr-225(24). 11 Feb 58, 121p.
Order from LC mi$6.30, ph$19.80 PB 138 708

This paper presents a method for the design of multi-stage, narrow-band amplifiers employing general active two-port devices as amplifying elements. The stability of the amplifier is controlled by means of its input and output conductance levels, rather than by neutralization. The main characteristic of this paper is a theoretical exposition of the functional dependence of the transducer gain of a multi-stage, narrow-band, iterative amplifier upon its interstage network, and upon the input and output terminations. A complete analysis of the transducer gain of the amplifier is presented.

Stanford Electronics Labs., Stanford U., Calif.
TWO WIDEBAND VIDEO TECHNIQUES FOR MICROWAVE DETECTORS, by J. C. de Broekert. Rept. on Contract DA 36-039-sc-73151. 27 Nov 57, 19p. Technical rept. no. 152-2; AD-149 509.
Order from LC mi$2.40, ph$3.30 PB 143 306

This report describes two techniques for achieving a wide video bandwidth in a microwave crystal detector and associated input video amplifier. In each case, forward current bias is used to reduce the crystal video resistance to a reasonably low value. The techniques differ in the manner in which a low effective interstage capacitance is achieved. In the guard-electrode mount, the interstage video capacitance is split into a three-capacitor delta configuration by modification of the detector mount. The additional node thus formed is driven with a near-unity-gain amplifier. Measurements of VSWR, video voltage, tangential signal sensitivity and bandwidth are presented for this mount before and after modification. The capacitance-

neutralized input circuit may be used with any crystal mount. A feedback amplifier is used to place an effective negative capacitance in parallel with the existing interstage capacitance. One secondary-emission tube is used in the feedback amplifier.

Stanford Research Inst., Menlo Park, Calif.
DESIGN DATA FOR ANTENNA-MULTICOUPLER SYSTEMS, by J. F. Cline. Scientific rept. 3 on Contract AF 19(604)2247. Sep 58, 24p. 5 refs. AFCRC-TN-58-139; AD-146 900.
Order from LC mi$2.70, ph$4.80 PB 138 601

This is the third in a series of reports on the design of antenna-multicoupler systems for use where several transmitters and receivers are operated simultaneously with a single antenna system. The design formulas for the two- and three-resonator, tunable, narrow-band, symmetrical, minimum-loss, capacitively coupled filters developed in the two previous reports are adapted to the design of inductively coupled filters in the present report. With either type of coupling, the way in which the filter element values must vary with frequency is shown to depend upon the method of tuning employed in the resonators. Three resonator tuning methods are considered, in which either C, L, or the ratio C/L is taken as a parameter. Tables of filter design formulas are given which apply when any of the three resonator tuning methods is used. Shorter, approximate filter design formulas are given which are reasonably accurate for minimum center-frequency insertion-loss values up to about 1 db.

Sylvania Electric Products, Inc., Bayside, N. Y.
HEATER-CATHODE LEAKAGE INVESTIGATION, by Julius Cohen and J. V. Florio. Final rept. on Contract AF 19(604)1734. 15 May 58, 163p. 33 refs. Rept. no. YD 57-5-8; AFCRC-TR-58-163; AD-152 448.
Order from LC mi$7.80, ph$25.80 PB 138 799

Syracuse U. Research Inst., N. Y.
EFFECT OF SURFACE REFLECTIONS ON RAIN CANCELLATION OF CIRCULARLY-POLARIZED RADARS, by Richard McFee and Thomas M. Maher. Task rept. no. 2 on Contract AF 30(602)1640. 5 Nov 57, 15p. 1 ref. SURI rept. no. EE492-4711T2; RADC-TN-58-51; AD-148 601.
Order from LC mi$2.40, ph$3.30 PB 143 488

Theoretical estimates of the reduction in cancellation are presented using acutal reflection coefficients of sea water at 500 and 3000 mc. Cancellation of rain returns of circularly-polarized ground-based radars did not exceed 15 to 18 db, with the 3-db point of the antenna pattern on the horizon and a 6^{o} vertical beam width, because of surface reflections. Cross-linear polarization cancellation is not disturbed by these reflections and offers these advantages: (1) the use of a power divider or a phase shifter is not required, (2) the radar duplexer may work at lower peak currents, (3) the means for switching from cross-linear to normal radar operation are easier, and (4) loss of target cross section is about 3 db less than that for circular polarization. The following techniques can help suppress return from rain: (1) narrower beamwidth, (2) shorter pulses, (3) lower RF, (4) velocity filtering of low speed returns, and (5) sensitivity time control.

Syracuse U. Research Inst., N. Y.
A STUDY OF MARKER INSERTION TECHNIQUES FOR PLAN POSITION INDICATORS, by G. M. Glasford, H. Hellerman and others. Final rept. on Contract AF 30(602)300. 1 Aug 54, 294p. 2 refs. RADC-TR-55-357; AD-71 405.
Order from LC mi$11.10, ph$45.60 PB 143 490

A detailed study of the problem of marker insertion in PPI displays has been carried out with particular emphasis on the long range system operating at low PRF and large sweep duty cycles. A basic analysis and comparison of PPI types is first made and the more conventional range and azimuth measuring techniques discussed. These techniques refer primarily to the electronic range strobe in combination with either electronic or mechanical azimuth cursors. Errors involved in both range and azimuth determination are analyzed. Techniques of sweep-time sharing for video and marker information are discussed and related both to the range strobe-azimuth cursor presentation and the presentation of single markers of circular or other shape. Problems of accuracy in the single marker type are analyzed. The flashing cursor and its limitations are discussed. Consideration is given to the use of the between-sweep interval for the insertion of markers of various types. Electronic switching arrangements for multiple markers were developed.

Syracuse U. Research Inst., N. Y.
STUDY OF PHASE-ERROR AND TOLERANCE EFFECTS IN MICROWAVE ANTENNAS, by David K. Cheng and Richard E. Gildersleeve. Final rept. for 10 Dec 53-31 Dec 55 on Contract AF 30(602)924. 31 Jan 56, 128p. 18 refs. SURI rept. no. EE276-564F; RADC-TR-58-50, AD-148 677.
Order from LC mi$6.30, ph$19.80 PB 143 496

The effects of different types of phase errors in the aperture plane on the characteristics of the radiation pattern are determined, and the geometrical deviations of the reflector are correlated with the phase errors. The general effects of aperture phase errors are to raise the side-lobe level, to widen the main-lobe beamwidth, and to reduce the antenna gain. A formula is presented for the maximum fractional reduction in gain when the peak phase error is known, but the exact amplitude or phase distribution function in the aperture is unknown. Another formula expresses the maximum change in beamwidth for rectangular and circular apertures when the exact phase distribution function is unknown and the peak phase error is known. The rise in the side-lobe level depends upon both the amplitude illumination function and the type of phase error. For the $\cos^{2}(0.375\pi x)$ tapered amplitude function, the rise in the side-lobe level for the rectangular aperture case is more than that for the circular aperture case for the same types of phase errors, although the first side lobes for the former case (25.90 db down) are higher than those for the latter case (28.00 db down) when there is no phase error.

Syracuse U. Research Inst., N. Y.
A STUDY OF TRANSISTOR LINEAR TIME DELAY CIRCUITS, by R. P. Nanavati. Final rept. on Transistor Circuit Applications, Contract AF 30(602)1626. Dec 57, 68p. 5 refs. SURI rept. EE 466-5712F; RADC-TR-58-70; AD-148 738.
Order from LC mi$3.90, ph$10.80 PB 143 526

This report concerns itself with the study of a transistor emitter-coupled monostable multivibrator the duration of whose output pulse can be controlled linearly by the setting of the potentiometer at the input. This circuit can be used as a linear delay circuit or as a gate in its own right. It can also serve as an important "building block" for linear time base circuits.

Syracuse U. Research Inst., N. Y.
TRANSISTOR VIDEO AMPLIFIERS, by Carl R. Zimmer. Final rept. on Transistor Circuit Applications, Contract AF 30(602)1026. Nov 57, 209p. 28 refs. SURI rept. EE466-5711F; RADC-TR-58-99; AD-148 816.
Order from LC mi$9.30, ph$31.80 PB 143 495

Basic low pass amplifier theory: Vacuum tube amplifiers, and 2- and 4- terminal interstage networks. Theoretical equivalent circuits: Fused-junction transistor, effect of the base spreading resistance, transistor parameters in the grounded-emitter connection, approximations for transistor parameters, relations among design and circuit parameters, fabrication of fused- and grown-junction transistors, and modified junction transistor designs. Measurement of transistor parameters: Simplified equipment for h-parameter measurements, measurement of transistor parameters using bridge techniques, and experimental results for the fused- and grown-junction transistors. Single stage amplifier: Simplified equivalent circuit, amplifier stage with resistive terminations, input circuit compensation (series peaking), effect of load capacitance, output circuit equalization, and compensation using local RC feedback. Multistage amplifiers: Shunt resistance interstage, shunt peaking (simple RL network), 4-terminal networks and all-pole transfer functions, and ultimate limitations of interstage compensating network. Large signal operation: Effect of the transistor output impedance, output circuit equalization, addition of feedback equalization, and experimental results using feedback equalization. Appendixes: Approximations for transistor parameters, measurement of circuit parameters for surface barrier transistors, and maximally flat transfer functions.

Mechanical Engineering

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 2. MOBILE EMERGENCY POWER PLANTS. 15 May 54, 70p. Technical pub. NAVDOCKS TP-Pu-3.
Order from OTS $1.75 PB 161 056

This Technical Publication gives technical criteria for mobile emergency power plants, including the maintenance and operation of these plants, emergency electric generator equipment, steam railway power plants, and mobile as well as portable diesel-electric generating plants.

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 3. FUELS. 3 June 59, 140p. 17 refs. Technical pub. NAVDOCKS TP-Pu-3; BUDOCKSINST 11310.16.
Order from OTS $2.75 PB 161 058

This Technical Publication is divided into three parts, namely, solid, liquid, and gaseous fuels. These are treated as they are utilized in the Shore Establishment and as existing and development policy influences their selection. Purely technical and detailed information is avoided, except in policy matters. (See also PB 161 054)

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 4. POWER PLANT WATER CONDITIONING. 15 Dec 53, 112p. 2 refs. Technical pub. NAVDOCKS TP-Pu-3; BUDOCKSINST 11310.4 CH1.
Order from OTS $2.50 PB 161 055

This Technical Publication covers the design, construction, operation, and maintenance of power plant water conditioning systems. The design and construction part covers in detail chemical analysis, feedwater treatment, treatment plants, secondary internal treatment, and laboratory and testing equipment. The operation and maintenance part includes external treatment plants, secondary treatment, chemical testing procedures, care of idle boilers, prevention of return-condensate corrosion, safety precautions, and records and reports. (See also PB 161 058)

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 9. DISTRIBUTION OF STEAM, HIGH-TEMPERATURE WATER, AND COMPRESSED AIR. 1 June 54, 33p. 9 refs. Technical pub. NAVDOCKS TP-Pu-3.
Order from OTS $1.00 PB 161 057

This Technical Publication covers the design, construction, operation, and maintenance of steam, high-temperature water, and compressed air distribution systems. The design and construction of each system are analyzed in separate parts of the chapter. Specific types of overhead and underground systems are discussed. Applicable load assemblies, routes, and pressures are presented. The discussion on maintenance and operation is primarily concerned with overhead and underground distribution systems, and with the traps, valves, fittings, and piping that make up these systems. Inspection and safety precautions are discussed as applicable. (See also PB 161 055)

Utah U. Coll. of Engineering, Salt Lake City.
A STUDY OF THICK-WALLED CYLINDERS AS TENSILE MEMBERS FOR HIGH PRESSURE VESSELS, WITH PARTICULAR ATTENTION TO STEELS AND THEIR HEAT TREATMENT FOR MAXIMUM PERFORMANCE, by William A. Boyd and S. S. Kistler.

Technical rept. 3 on Contract Nonr-1288(02). Mar 58, 109p. 24 refs.
Order from LC mi$5.70, ph$16.80 PB 139 183

Contents:
Experimental procedure
Steels used
Calculation of internal pressure from force on the arbor, arbor angle and coefficient of friction
Experimental results with 1-inch rings
Tests of thick rings

Ordnance, Missiles, and Satellite Vehicles

Air Force Missile Test Center, Patrick AFB, Fla.
IN-FLIGHT IMPACT AND APOGEE COMPUTATIONS FOR VANGUARD, by Hallett H. Germond. Rept. on Missile Test Project, Contract AF 08(606)1156. 25 May 59, 99p. 15 refs. RCA Data Processing Technical rept. no. 49; AFMTC-TR-9; AD-216 293.
Order from LC mi$5.40, ph$15.30 PB 143 020

The range, azimuth, and elevation of a Vanguard vehicle, as determined every 0.1 sec by one or another of 2 radars, are used as input to a computer. Every tenth of a second during the powered first and second stages of flight a prediction is made as to where the vehicle would impact if the thrust were to be terminated. This information is displayed continuously on a plotting board. After burnout or cutoff of the second stage, computations are made (every tenth of a second) of the time remaining before the vehicle should reach apogee. This and other information pertinent to the initiation of the third stage is displayed on a console.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
DRAG-CORD ANEMOMETER, by Raymond Bellucci. 15 Sep 58, 39p. 5 refs. USASRDL Technical rept. 1979.
Order from LC mi$3.00, ph$6.30 PB 139 076

An anemometer has been developed which provides a weighted integrated wind over a path. This development was necessitated by the requirement for a weighted, integrated wind measurement over the initial sensitive portion of a rocket trajectory. Two components of the wind force on a long length of stainless steel wire are obtained by measuring the displacement of the wire at one end while the other is held fixed. The wire is placed in a line parallel to the rocket trajectory. By this means the two components of the wind that are determined are the same two components that affect the rocket flight. The equipment has been tested by fixing it vertically at the Oakhurst tower where wind measurements were compared to those from a set of conventional anemometers.

Army White Sands Signal Agency, White Sands [Missile Range] N. Mex.
LABORATORY INVESTIGATION OF DOVAP TRANSPONDER T7-3-8 MISSILE UNIT (36.94 - 73.88 MCS), by Merwin A. Olson and Harvey G. Lassiter. 29 July 57, 31p. AFC rept. no. DOVAP-29-7-57-RT; AD-149 067.
Order from LC mi$3.00, ph$6.30 PB 138 629

Results are presented of a laboratory investigation of a Dovap transponder T7-3-8 missile unit. Special attention is given to the interference to the Dovap system from operations on 36.5 mc. The T7-3-8 is contained in a cylindrical metal case 3 1/4 in. in diameter and 12 1/4 in. long. It operates from a 6-v dc self-contained or external supply. Signals on 36.94 mc are received by the unit and amplified in 2 stages, then fed to a doubler stage which doubles the frequency to 73.88 mc. A driver and an output stage completes the line-up. The power output of about 0.7 w is realized from the unit for input signal levels of -60 dbm or higher. The ground equipment in the system compares the frequency of the signal received from the transponder with the double of the frequency sent to the unit; any difference is due to the Doppler effect and can be used to calculate the component of velocity normal to the ground station. Results indicate that if the interference signal could be reduced sufficiently before the signals reach a nonlinear circuit (where mixing action could occur), this effect might be eliminated. The recommendations suggest operation of the first 2 stages as near linear as possible with the current high enough to prevent nonlinear operation caused by limiting action. Possibly more tuned circuits should be employed in the first stages to reduce the interference signals as much as possible before they reach the double stage.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
CHRONOGRAPH ERROR IN DRAG MEASUREMENTS, by G. D. Kahl and F. D. Bennett. Aug 58, 13p. 2 refs. Memo. rept. no. 1161.
Order from LC mi$2.40, ph$3.30 PB 138 616

The precision of the least squares method of fitting time-distance data from an observed trajectory is considered for the case where time is assumed to be a polynomial in distance. A relation between the variances of time and distance errors, assumed in a previous work, is derived. With this relation and a model of digital chronographs, the variance of the timing error is found for selected chronograph arrangements; in a favorable arrangement, this variance is only one-twelfth as large as the squared counter resolving time. A comparison of time and distance errors is made.

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK. Quarterly rept. no. 1 on Contract AF 04(647)59-3. [Jan 60] 22p.
Order from OTS $0.75 PB 161 093

This handbook of data on solid materials at low temperatures deals with physical properties of certain metals and non-metals over the temperature range minus 423°F to plus 500°F. The materials selected for inclusion in the handbook are limited to aluminum, cobalt, copper, iron, nickel, titanium, carbides, nonmetals, and miscellaneous metals and alloys. The materials are mostly those in current use for missile applications at cryogenic temperatures, but a few have been included because of their potential for such uses. This compilation of some of the mechanical properties of materials should assist the designer by making available in one publication reliable data which have appeared in the literature or which have not yet been published.

Defense Research Lab., U. of Texas, Austin.
A CRITIQUE OF ACOUSTIC MINE DETECTION METHODS, by Joseph F. Mifsud. Rept. on Contract DA 44-009-eng-2073. 27 Oct 55, declassified 13 Mar 58, 24p. 12 refs. DRL-A-95.
Order from LC mi$2.70, ph$4.80 PB 143 729

The purpose of this paper is to summarize the work accomplished in acoustic mine detection and to suggest some of the areas of research that need yet to be explored in order that a more efficient acoustic detector of land mines can be designed.

Defense Research Lab., U. of Texas, Austin.
A SUMMARY OF THE MINUTES OF THE PANEL ON ACOUSTIC DETECTION OF BURIED LAND MINES [MEETING NO. 1] 27-28 OCTOBER 1955, AUSTIN, TEXAS. Rept. on Contract DA 44-009-eng-2073. 21 Dec 55, declassified 3 Mar 58, 22p. DRL Acoustic rept. no. 98.
Order from LC mi$2.70, ph$4.80 PB 143 728

Defense Research Lab., U. of Texas, Austin.
A SUMMARY OF THE MINUTES OF THE PANEL ON ACOUSTIC DETECTION OF BURIED LAND MINES [MEETING NO. 2] 29 APRIL 1956, WASHINGTON, D. C. Rept. on Contract DA 44-009-eng-2073. 11 July 56, declassified 12 Mar 58, 18p. DRL Acoustical rept. no. 107.
Order from LC mi$2.40, ph$3.30 PB 143 727

See also PB 143 728

Defense Research Lab., U. of Texas, Austin.
A SUMMARY OF THE MINUTES OF THE PANEL ON ACOUSTIC DETECTION OF BURIED LAND MINES [MEETING NO. 3] 15 JULY 57, MONTEREY, CALIF. Rept. on Contract DA 44-009-eng-2875. 18 Sep 57, declassified 14 Mar 58, 35p. 3 refs. DRL-Acoustical rept. no. 127.
Order from LC mi$3.00, ph$6.30 PB 143 725

See also PB 143 727

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
ANALYSIS OF HMX/RDX MIXTURES BY ISOTOPE DILUTION AND SPECTROPHOTOMETRIC PROCEDURES, by Frederick S. Holahan, Ruth N. Shelley and others. July 59, 15p. 15 refs. Technical rept. 2625; AD-215 863.
Order from LC mi$2.40, ph$3.30 PB 143 286

This report describes two methods for the quantitative assay of HMX in mixtures of HMX and RDX: (a) an extension of the Holston Ordnance Works' method (which is based on a colorimetric reaction specific for RDX and a determination of HMX content by difference) by which mixtures containing more than 95% HMX can be analyzed; and (b) an isotope dilution technique in which a known amount of pure carbon-14 labeled HMX is added to the mixture and the radioactivity of a fraction of pure HMX isolated from the mixture is determined. The HMX content is calculated from the reduction, or dilution, of the radioactivity of the isolated HMX. The method is considered absolute since the HMX is determined directly and there is no interference from impurities.

[Feltman Research and Engineering Labs.] Picatinny Arsenal, Dover, N. J.
AN EMISSION SPECTROGRAPHIC METHOD FOR THE ANALYSIS OF ZINC-BASE DIE CASTINGS, by Seymour Lader. June 58, 18p. 11 refs. Technical rept. 2528.
Order from OTS $0.75 PB 151 175

An accurate spectrographic method of analysis has been developed for the determination of the following elements in zinc-base die castings: aluminum 0.4-4.3%, copper 0.04-1.30%, cadmium 0.002-0.01%, magnesium 0.015-0.08%, tin 0.002-0.01%, lead 0.002-0.01%, iron 0.015-0.10%. These specified ranges are appropriate for the analysis of zinc-base die castings meeting the requirements of Specification QQ-Z-363, Compositions A and B.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
INVESTIGATION OF THE MAXIMUM ALLOWABLE TORQUE FOR ROTARY SELECTOR KNOBS, by Peter F. Worms and C. Thomas Goldsmith. Nov 58, 15p. 3 refs. Technical rept. 2551; AD-201 105.
Order from LC mi$2.40, ph$3.30 PB 138 638

When rotary selector knobs are used on missiles, their setting may be altered by in-flight vibrations. The probability of a setting being changed is reduced as torque on the selector shaft is increased. It was the purpose of this study to determine the maximum torque which can be used with varying sized knobs. A previously recommended resistance for rotary selector knobs was 48 ounces. This study evaluated resistances well above this figure.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PREPARATION AND PHYSICAL PROPERTIES OF DI-AND TRINITROTOLUENE ISOMERS, by Cornelius Conklin and Frank Pristera. July 58, 26p. Technical rept. 2525.
Order from LC mi$2.70, ph$4.80 PB 138 925

This report includes detailed methods for the preparation of all commercially unavailable isomers of DNT and TNT. In addition it includes the melting points, infrared spectrograms, X-ray diffraction data, and some solubility data on the TNT and DNT isomers.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PROPOSED SHELL LOADING STANDARDS BASED ON A STATISTICAL STUDY OF SETBACK SENSITIVITIES, by Samuel D. Stein and Martin J. Margolin. Nov 58, 61p. 16 refs. Technical rept. 2563; AD-202 576.
Order from LC mi$3.90, ph$10.80 PB 138 637

A statistically designed test program was conducted using a laboratory-scale device which simulates the setback pressures developed when shell are fired from guns. The following conditions increase the probability of premature initiation when HE-loaded shell are fired under the present normal setback pressures: (1) Grit at the interface of the explosive charge and the base of the shell; (2) A separation of more than 1/16 inch between the explosive and the base of the shell; (3) A cavity at the base of the explosive charge; and (4) A gouge on the interior surface of the base of the shell. On the basis of these and other results, it was possible to propose relaxed and simplified requirements as revisions to Specification MIL-L-20336A. In general, the relaxed cavitation requirements should vastly facilitate the mass production loading of high explosive shell.

Flight Control Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SOME FLIGHT CONTROL PROBLEMS OF A CIRCUMNAVIGATING LUNAR VEHICLE, by George Xenakis. Mar 58, 34p. 12 refs. WADC Technical note 58-82; AD-151 111.
Order from LC mi$3.00, ph$6.30 PB 138 851

Some problems of flight control for a vehicle required to pass around the moon and return to a braking ellipse in the earth's atmosphere are investigated. It is shown that reliability will be an extreme problem for this mission. The need for velocity vector control for the mission is established and a method for accomplishing it is presented. In addition, velocity vector tolerances for successful recapture are investigated along with some brief considerations of landing at a preselected earth site and of flight in non-terrestrial atmospheres.

Naval Ordnance Lab., White Oak, Md.
EFFECTS OF ELEVATED TEMPERATURES ON ELECTRICAL INITIATORS AND COMPONENT PARTS, by H. S. Leopold. 1 Apr 59, 69p. 4 refs. NAVORD rept. 6267.
Order from LC mi$3.90, ph$10.80 PB 143 335

A study has been made of the effects of elevated temperatures on the XE-16A Actuator, XE-54B Primer, XE-57A Primer, XE-69A Primer, Mk 115 Mod O Primer, and the Mk 121 Mod O Primer, and on their inert component parts. It has been found that graphite bridges and bridges attached to bakelite initiator plugs by the spray metal method have poor thermal resistance. Ceramic initiator plugs with the bridge wire swaged into welded nickel tabs, and glass kovar initiator plugs with the bridge wire soldered with lead (m.p. 621°F) have good thermal resistance.

Naval Ordnance Test Station, China Lake, Calif.
AXIAL DECELERATION AT OBLIQUE WATER ENTRY OF 2-INCH-DIAMETER MODELS WITH HEMISPHERE AND DISK-CYLINDER NOSES, by G. G. Mosteller. 12 Feb 57, 48p. 7 refs. NOTS-1687; NAVORD rept. 5424; AD-140 642.
Order from LC mi$3.30, ph$7.80 PB 143 256

Axial deceleration-time records have been made in the NOTS Variable-Angle Variable-Pressure Launching Tank at trajectory angles of 15, 30, 45, 60, and 75 degrees for hemisphere and disk-cylinder noses, at 90 degrees for the hemisphere nose, and at entry velocities of 25, 50, and 75 fps. Methods for using these data for the prediction of axial acceleration-time function of other missiles are given. These records are compared with theory and results of other experiments.

Naval Propellant Plant, Indian Head, Md.
A RAMP-TYPE TESTING CIRCUIT FOR ELECTRIC EXPLOSIVE DEVICES, by A. H. Klein and T. D. Phillips. 3 Nov 58, 18p. Memo. rept. no. 155.
Order from LC mi$2.40, ph$3.30 PB 139 157

A circuit has been designed for the determination of the relative sensitivity to electrical initiation of a squib or ignition element in comparison to similar squibs or ignition elements. In this circuit, the squib or other electric explosive device is fired by sending through its bridge wire a current which increases with time along an established curve. The position on the current-time curve at which firing occurs is the datum observed. The circuit is particularly useful in experimental work in which the items to be tested cannot be produced in sufficient quantity to supply a test of the "fire-or-fail" type.

Picatinny Arsenal, Dover, N. J.
METHOD OF CALCULATION OF INTERIOR BALLISTIC PROPERTIES OF PROPELLANTS FROM CLOSED BOMB DATA, by Arnold O. Pallingston and Murray Weinstein. June 54, 52p. 10 refs. Technical rept. 2005.
Order from LC mi$3.60, ph$9.30 PB 139 185

This report covers the methods of calculation of relative force, relative quickness and linear burning rate for artillery propellants. It describes devices which have been developed to simplify and make more accurate the information which can be obtained from oscillograms of closed bomb tests giving dP/dt vs P. It gives the methods by which linear burning rates of propellants are derived. The methods described are essentially for use with experimental propellants and are not intended for production or quality control.

Picatinny Arsenal, Dover, N. J.
UTILIZATION OF BY-PRODUCT ISO-TRIOIL RESULTING FROM NITRIC ACID PURIFICATION OF CRUDE TNT, by J. A. Cussen. Jan 59, 9p. Technical rept. DB-TR:15-58.
Order from LC mi$1.80, ph$1.80 PB 139 082

This report covers studies conducted relative to establishment of Ordnance uses for Iso-Trioil, a by-product resulting from the purification of crude TNT by recrystallization from nitric acid.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
DEVELOPMENT OF DISINTEGRATING WATER PROJECTILES FOR RECOILLESS RIFLES, by A. Levine. June 58, 23p. 6 refs. Memo. rept. MR-675.
Order from LC mi$2.70, ph$4.80 PB 139 080

Disintegrating water projectiles, consisting of water-filled cylindrical cardboard containers, were developed to simulate the interior ballistics produced in recoilless rifles by firing standard projectiles.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
SEALING STUDIES ON CARTRIDGE ACTUATED DEVICES, by J. F. Clark. Sep 58, 33p. Rept. no. R-1469.
Order from LC mi$3.00, ph$6.30 PB 138 726

Investigations were conducted using quad rings, O-rings, silicone rubber washers, and Teflon rings as sealing media. Each of these products was found to be effective in specific applications; however, the O-ring was particularly adaptable to existing cartridge actuated devices and was used almost exclusively in the modifications made under this program.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
SIMPLIFIED EXTERIOR BALLISTIC EQUATIONS, by R. R. Rhodes. May 58, 13p. Memo. rept. MR-672.
Order from LC mi$2.40, ph$3.30 PB 139 146

The principal problem in accuracy firings is the determination of the angle of elevation necessary to hit the target at a given range, with a given projectile, launched at a given velocity. A simple method for calculating this parameter for angles less than five degrees and other data useful in test firing are presented. The formulae developed are tabulated in the appendix and a nomogram was contructed to permit their graphic solution. By these means, the probability of first round hit for any accuracy study is greatly increased.

Radio Corp. of America, Moorestown, N. J.
MINSTREL: A STUDY OF THE OPTIMUM SYSTEM FOR MISSILE INSTRUMENTATION BY ELECTRONIC MEANS, by N. N. Alperin, K. E. Andrews and others. Task rept. no. 1 on Contract DA 36-039-sc-74853. 24 Jan 58, 103p. 26 refs. AD-155 240.
Order from LC mi$5.70, ph$16.80 PB 143 305

This report discusses various coordinate systems which can be applied to the data acquisition and range safety problems at White Sands Proving Grounds. The distortions and assumptions that characterize each are also discussed. For safety purposes, the data output and displays must be on a real time basis. The Transverse Mercator map presently in use at the White Sands Proving Ground is satisfactory for the present range. However, for a 1500-mile range, the problems of display warrent the use of a different system. Stereographic projection is recommended for the following reasons: (1) It is conformal, (2) Its distortion is low, (3) The angle between two lines on earth are carried to the plane of the map as an equal angle, (4) It requires little scale factoring. The coordinate conversions required for the two systems above are presented.

Rock Island Arsenal Lab., Ill.
CHARACTERISTICS OF VIC MATERIALS WHEN APPLIED AS PACKAGING MEDIA, by F. H. Wayne. 18 Feb 59, 15p. Rept. no. 59-464; AD-216 699.
Order from LC mi$2.40, ph$3.30 PB 143 440

This report covers results observed during the examination of Cal. .30 M1 carbines. These weapons had been in unheated warehouse storage for four years, plus a two year period in open exposure (tarpaulin covered). These carbines were packaged with four different types of volatile corrosion inhibitors used as the preservative medium. The four different types of inhibitors furnished adequate protection to the carbines and component parts during the exposure period. There was no visible evidence of rust on any of the metallic surfaces of the carbines, slings, magazines or the oilers. The gummy substance did not cause any damage to the wood stock.

Rock Island Arsenal Lab., Ill.
TEFLON PACKINGS WITHOUT CUP RINGS FOR 105 MM HOWITZER RECOIL MECHANISMS, by L. R. Raisbeck. 11 May 59, 25p. 2 refs. Rept. no. 59-1270; AD-215 627.
Order from LC mi$2.70, ph$4.80 PB 143 427

Four types of experimental Teflon packings without supporting cup rings were evaluated on the basis of their efficiency in transmitting axial load supplied by the Belleville springs to radial pressure against the cylinder walls. Evaluations were made with packings for the 105 MM Howitzer Recoil Mechanism Floating Piston at sub-zero, normal and elevated temperatures using a conventional floating piston and a special radial pressure transducer. Results of tests indicated that the axial loads were not as efficiently transmitted to radial pressure at sub-zero temperatures as at normal and elevated temperatures by any of the packings. Results also showed that a hysteresis loop existed in the radial pressure curves of all packings. The radial pressures obtained when decreasing the axial loads were greater than when increasing the axial loads. The best axial load vs. radial pressure characteristics at all temperatures were obtained with a packing which had a shroud consisting of three wedge shaped Teflon rings.

Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF PROCEDURES AND TECHNIQUES FOR PREPARING BONDED DOUBLE LAYER TANTALUM-COPPER COMPOSITE PLATES, by R. C. Bertossa and S. Rau. Rept. on Atlas Materials, Contract AF 33(616) 5215. Nov 58, 114p. 5 refs. WADC Technical rept. 58-396; AD-203 901.
Order from LC mi$6.00, ph$18.30 PB 143 623

A process for bonding tantalum sheet to OFHC copper was successfully accomplished both by casting molten copper directly into an annealed tantalum cone under controlled vacuum-inert gas atmospheres, and by using intermediate brazing alloys to produce high integrity,

vacuum bonded joints between OFHC copper and annealed tantalum. Metallurgical and microhardness evaluations reveal that sound, continuous bonds can be effected, with ductile interfaces. Elevated temperature tests on copper-tantalum clad nose-cones exhibited the ability of selected brazing alloys to maintain intimate contact between the copper and tantalum at temperatures up to the melting point of copper.

Stanford Research Inst., Menlo Park, Calif.
A NEW COORDINATE SYSTEM FOR SATELLITE ORBIT STUDY, by J. L. Brenner, G. E. Latta and M. Weisfeld. Interim technical rept. no. 2 on Contract AF 29(600)1773. 15 June 59, 90p. 5 refs. AFMDC-TR-59-27; AD-216 455.
Order from LC mi$4.80, ph$13.80 PB 143 517

This report gives an accurate prediction of the orbit of a near-earth satellite, neglecting drag. A special coordinate system suggested by D. G. King-Hele has been so refined that the predictions can be made to within a few seconds of arc at all points in the orbit of a typical satellite, with apogee and perigee distances of (say) 400 and 3000 statute miles respectively. King-Hele and other authors have proposed similar but somewhat less exact equations; further, the validity of these equations ($e \leq 0.05$) was restricted to small eccentricities. No such restriction is made in the present theory. Formulas in this report give Ω, I, $U = 1/Lr$, M as functions of the time t. A completely rigorous proof of the accuracy of these formulas is available only in special cases. The order of approximation of the formulas is discussed by the use of arguments based on the energy integral. Their accuracy has been verified also by independent numerical integration of the differential equations.

Sanitation and Safety Engineering

Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
FACTORS INVOLVED IN DETERMINING THE EFFICIENCY OF FIRE EXTINGUISHING AGENTS, by Ralph L. Hough. Apr 59, 75p. 6 refs. WADC Technical note 58-281; AD-203 398.
Order from LC mi$4.50, ph$12.30 PB 143 541

Results of the agent concentrationstudies indicate that currently available agents may act as "super agents" through more efficient application. "Critical saturation values" are proposed for the agents, bromochloromethane (CB) and bromotrifluoromethane (BT or Freon 13B1). These values represent minimum volumetric concentrations necessary when extinguishing 100 octane aviation fuel diffusion flames and when utilizing the agent at 100 per cent efficiency. An efficiency equation is proposed for use with the "critical saturation value." A test procedure is outlined for applying the equation to a particular system. The equation may be used as a tool in evaluating extinguishing systems.

Bureau of Yards and Docks, Washington, D. C.
REFUSE DISPOSAL. 1 Sep 52, 30p. 5 refs. Technical pub. NAVDOCKS TP-Pu-1.
Order from OTS $0.75 PB 161 054

The purpose of this publication is to provide detailed information to serve as a guide in organizing an efficient collection, segregation, and disposal system at a naval establishment. The procedures described herein are applicable to all solid forms of waste resulting from human activities, except the following specialized forms of waste: dehydrated sewage sludge, industrial process wastes such as oil sludge and sandblast refuse, excavated earth, wreckage from buildings, and discarded explosives. Suggested methods for disposing of some types of oil sludge are given. The disposal of sandblast refuse resulting from the docking of ships, and other specialized wastes, is to be covered in other publications.

Naval Research Lab., Washington, D. C.
VISIBILITY AND SUGGESTED MILITARY USES AT NIGHT OF SELF-LUMINOUS MARKERS EXCITED BY STRONTIUM-90, by G. T. Hicks, C. M. Whitfield, Jr. and L. H. Dawson. 23 June 53, declassified 15 Dec 53. 14p. 2 refs. NRL rept. 4192.
Order from LC mi$2.40, ph$3.30 PB 143 866

Self-luminous markers excited by the radioisotopes strontium-90 are available to the armed services. Visibility tests have been made on these markers at night under different sky conditions. It was found that the maximum visible distance increased in direct proportion to an increase in marker radius for a given brightness. It was found that on a clear moonless night, a radioactive green marker 1-3/4 inches in diameter with brightness greater than 60 effective microlamberts could be seen approximately 1000 feet when viewed extrafoveally.

New York U. Coll. of Engineering, N. Y.
THE ENGINEERING BIOTECHNOLOGY OF HANDLING WASTES RESULTING FROM A CLOSED ECOLOGICAL SYSTEM, by William T. Ingram. Rept. on Contract AF 18(603)71. Feb 58, 221p. 174 refs. AFOSR-TR-58-148; AD-162 277.
Order from LC mi$9.90, ph$34.80 PB 143 122

This report is directed to an examination of the status of existing information and the areas of research requiring attention in connection with the handling of wastes resulting from human occupancy of a closed ecological system. Probable wastes to be handled are classified. The problems related to handling and treatment and to cycling and reuse of treated end products in liquid, solid, and gaseous form are discussed. Five detailed reports discussing the present status of knowledge of wastes handling in closed systems are included as appendices. Areas of research and development are suggested with respect to skin excretions, algae, culture, carbon dioxide conversion to oxygen, the handling of closed space air, and the handling of bodily and other wastes. A master file of 174 annotated references and an alphabetical author index to those references are included.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Pennsylvania State U., University Park.
ODOR AND FLAVOR PROBLEMS IN RADIATION STERILIZATION OF FOODS, by D. V. Josephson. Rept. no. 9 (Final) for 3 May 55-3 Dec 56 on Contract DA 19-129-qm-375. [1956] 32p. 12 refs. File no. S-534; AD-122 143.
Order from LC mi$3.00, ph$6.30 PB 143 781

The following are considered to be major accomplishments of the investigation: (1) Methodology was developed which should be useful in application to any flavor identification problem. This consisted of a distillation technique to collect volatiles, gas chromatography to fractionate the volatiles and mass spectrometry to identify the individual compounds. (2) It was shown that a group of disagreeable smelling sulfur compounds are responsible for the radiation induced off-flavor and odor in skim milk and sodium caseinate sols. (3) Two off-flavor preventive mechanisms of interest were noted. (a) Radiated skim milk exhibited considerably less off-flavor and off-odor than did radiated milk protein preparations. This difference was found to be due in substantial part to the presence of lactose. The possibility that lactose, a relatively unsweet carbohydrate, may be used as an additive to foods to prevent radiation induced off-flavors seems worthy of consideration. (b) According to evaluations by the taste panel, skim milks which were preheated to 180° F. for 10 minutes had more acceptable flavor than skim milks which had only been pasteurized or which had received no preheating treatment at all prior to radiation. These observations suggest the feasibility of combining heat treatment and radiation in the preservation of milk.

United States Testing Co., Inc., Hoboken, N. J.
MEAT ANALYSIS, by Dean Foster. Rept. no. 8 (Final) for 25 Apr 55-24 Apr 57 on Contract DA 19-129-qm-346. [1957] 12p. QFCIAF File no. A-319.
Order from LC mi$2.40, ph$3.30 PB 143 666

An attempt was made to determine how and to what extent it is possible to differentiate between comparable canned and fresh foods.

Packaging

Forest Products Lab., Madison, Wis.
PRESERVATION OF THE EXTERIOR SURFACES OF WOODEN SHIPPING CONTAINERS TO RETAIN IDENTIFICATION SYMBOLS IN LONG-TERM OUTDOOR STORAGE: FOURTH PROGRESS REPORT ON FIELD TESTS, by V. P. Miniutti, E. A. Mraz, and D. F. Laughnan. 17 June 58, 31p. 5 refs. Rept. no. 58-1.
Order from LC mi$3.00, ph$6.30 PB 143 057

This report summarized the procedures used in preparing, stenciling, and placing wood shipping containers in outdoor storage at Madison, Wis.; Panama Canal Zone; Fort Churchill, Canada; and Yuma, Ariz., and gives the results of inspections of steel bindings and stencils on the boxes after 3 years of outdoor storage.

Forest Products Lab., Madison, Wis.
PRESERVATION OF THE EXTERIOR SURFACES OF WOODEN SHIPPING CONTAINERS TO RETAIN IDENTIFICATION SYMBOLS IN LONG-TERM OUTDOOR STORAGE: FIFTH PROGRESS REPORT ON FIELD TESTS, by V. P. Miniutti, E. A. Mraz and D. F. Laughnan. 2 June 59, 33p. 6 refs. Rept. no. 59-1.
Order from LC mi$3.00, ph$6.30 PB 143 062

Wood shipping containers were stenciled, bound with steel bindings, and placed in outdoor exposure at Madison, Wis., Panama Canal Zone, Fort Churchill, Canada, and Yuma, Ariz. Four marking materials were used with seven combinations of two undercoat and four topcoat treatments on boxes made of red oak, Douglas-fir, and southern yellow pine. The best legibility after 4 years of exposure was found on the backs (north exposure) of the test boxes for 9 of the 12 combinations of species and sites, and on the fronts (south exposure) for the other 3 combinations. For boxes pretreated with material A, a water-repellent preservative, there was no combination of side, species, and site for which all stencils made with 12 combinations of marking material and undercoat-topcoat treatment were legible after 4 years of exposure. Stencils made with four of these combinations were legible after 4 years of exposure on the backs of the boxes of all three species from all of the test sites. A comparison of the southern yellow pine boxes with and without pretreatment with material A indicated that material A had a detrimental effect on the performance of the stencils at three of the sites.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A STUDY OF THE STABILITY OF EXTERNALLY PRESSURIZED GAS BEARINGS, by Lazar Licht and Harold Elrod. Interim rept. on Contract Nonr-2342(00). Nov 58, 48p. 6 refs. I-A2049-4.
Order from LC mi$3.30, ph$7.80 PB 143 477

The subject of this paper is the stability of externally pressurized gas bearings. The pertinent equations are linearized and the stability criteria stated in considering small deviations from the equilibrium point. The flow in the bearing clearance is treated on a distributed rather than on a lumped parameter basis. Results thus obtained, when compared with those previously arrived

at by means of a simplified analysis, show a marked divergence in the limiting values of parameters which influence the stability of the bearing. Differences in predictions of the simplified and present analyses with regard to the permissible compression volume in the bearing interspace and the effect of varying the mass of the bearing are emphasized and discussed.

Engines and Propulsion Systems

Ballistic Research Lab., Aberdeen Proving Ground, Md.
EXPERIMENTAL STUDY OF COMBUSTION INSTABILITY IN SOLID ROCKET PROPELLANTS: PART I, by Leland Watermeier, Trexler Satkowski, and Thomas Mifflin. Oct 58, 65p. 2 refs. Memo. rept. no. 1172; AD-206 469.
Order from LC mi$3.90, ph$10.80 PB 143 263

Slabs of double-base and composite rocket propellants were burned in a transparent-walled vessel which was vented to the atmosphere. The propellants were ignited at ambient pressures of 200-300 psi with the chamber pressure reaching approximately 350-475 psi during the burning process. A new method was developed for the determination of burning rates of solid propellants. The apparatus and procedure used in the investigation are presented together with selected photographs of the burning propellant surfaces.

Battelle Memorial Inst., Columbus, Ohio.
RESEARCH STUDIES ON THE COOLING AND CLEANING OF EXHAUST GASES CONTAINING BORON COMBUSTION PRODUCTS, by G. M. Hein, A. R. Orban, and R. B. Engdahl. Final technical rept. on Contract AF 40(600)711. July 58, 71p. 11 refs. AEDC-TR-58-9; AD-161 031.
Order from LC mi$4.50, ph$12.30 PB 138 609

All possible methods which might be practicable for the removal of boron oxide particles from high-temperature exhaust gases have been considered in this project. A literature survey led to the conclusion that wet scrubbers would be most adaptable for this application.

Hiller Aircraft Corp., Palo Alto, Calif.
A DESIGN STUDY OF HELICOPTERS POWERED BY ROTOR TIP MOUNTED TURBOJET ENGINES, by C. W. Messinger, W. Gevarter and others. Summary rept. on Contract Nonr-1814(00). Oct 58, 148p. 28 refs. Rept. no. 58-139.
Order from LC mi$7.20, ph$22.80 PB 143 247

A design study of tip-turbojet powered helicopters of several gross weights to demonstrate practicality of the concept and to establish performance capabilities for comparison with helicopters using other methods of propulsion.

Jet Propulsion Center, Purdue U., Lafayette, Ind.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF FILM COOLING IN ROCKET MOTORS, by A. R. Graham. Final rept. on Contract N7onr-394(18). Oct 57, 274p. 34 refs. Rept. no. F 57-3; AD-200 878.
Order from LC mi$11.10, ph$42.60 PB 138 745

Experiments on film cooling were conducted with a rocket motor burning WFNA (white fuming nitric acid) and JP-4 (jet engine fuel) at a combustion pressure of 500 psia and at a thrust level of 500 pounds. The flow rates of film coolant required for film cooling different length cylindrical sections with WFNA and JP-4 were determined, and those results were compared to the experimental results previously obtained by Sellers (9) for the case of film cooling with water. An analytical method for calculating the required film coolant flow rate for cooling a given length cylindrical section was devised.

Propulsion Research Corp., Santa Monica, Calif.
ESCHER WYSS CLOSED CYCLE AIRCRAFT POWERPLANT STUDY. PART II, by Rolf D. Buhler. Interim summary rpt. on Study of the Military Applications Potential of Closed Cycle Gas Turbines, Contract AF 18(603)27. 10 May 57, 48p. 5 refs. Rept. no. R-259; AFOSR TR-57-37; AD-126 570.
Order from LC mi$3.30, ph$7.80 PB 129 887

A portion of a study on closed cycle gas turbines for aircraft has been summarized and evaluated. This study dealt with closed cycle turbine - ducted fan powerplants suitable for a gas-cooled reactor heat source. The reactor - gas turbine loop would use helium, at a turbine inlet condition of about 70 atm and 1800°F. Cycle calculations with and without a regenerator show a potential heat consumption at sea level static conditions of 7.5 - 12.2 x 10^3 Btu/hr-lb thrust (equivalent to an sfc of .42 - .68 for hydrocarbon fuels), and an air specific impulse of about 30 (#-sec/lb) with a 1.6:1 pressure ratio fan. The regenerator would be extremely compact, about 1.6 cu. ft/hp, the cooler rather bulky, about 30 cu. ft/hp, but not excessively heavy. The cooler and regenerator together would weigh about .13 lb/hp. The closed cycle turbomachinery would be extremely small, favoring the design of large power units (above 15,000 hp).

Propulsion Research Corp., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF A THREE DIMENSIONAL ALL SUPERSONIC DIFFUSING CASCADE, by T. Iura and E. Beder. Rept. on Contract AF 18(600)1143. May 58, 185p. 18 refs. Rept. no. R-288; AFOSR TR-58-132; AD-203 712.
Order from LC mi$8.40, ph$28.80 PB 142 912

A three-dimensional all-supersonic diffusing cascade was designed by the stream surface characteristics method and tested in a wind tunnel over the Mach number range 2.2 to 3.0. Stable supersonic flow was established over a wide range of incidence angles. Chordwise blade-surface static pressures, exit-plane pitot surveys, and Schlieren photographs were obtained.

Manufacturing Equipment and Processes

American Car and Foundry Co., New York.
WELDABILITY OF RARE-EARTH-TREATED HOMOGENEOUS ARMOR STEEL PLATE, by George Reed. Rept. on Contract DA 36-034-ORD-1423. 31 July 57, 31p. Major rept. no. 207B; WAL-642/218-2.
Order from LC mi$3.00, ph$6.30 PB 139 164

The rare-earth-oxide-treated heat had the best weldability and the production armor heat the poorest. The rare-earth-oxide-treated heat also possessed the lowest hardenability, and better inherent weldability. It was indicated, that the rare-earth-metal addition significantly reduced the sulfur content of the steel and improved the impact resistance. The rare-earth-oxide addition, appeared to have no significant effects on either sulfur content or impact resistance.

Army Chemical Corps Engineering Command, Army Chemical Center, Md.
ANNUAL STANDARIZATION SYMPOSIUM NO. 2, 18-19 MAY 59, by Kenneth P. Moseley. 12 June 59, 94p.
Order from LC mi$5.40, ph$15.30 PB 143 288

Chemical Corps Progress, Standardization and Small Business, Effect of Department of Defense Standardization on Research and Development, Standardization - A Vital Link to Government-Industry Cooperation, Engineering Standardization - The Bridge Between Research and Development in Production, Engineering Standards, The Standards Engineers Society (SES) and the Defense Standardization Program, The Importance of Standard Testing Methods as They Relate to Military Standards, the ASTM and Industrial Chemicals, Product Acceptance and Inspection, Legal Aspects of Standardization, Conservation of Manpower and Materials, Department of Defense Standardization, Panel Discussions.

Titanium Metals Corp. of America [Henderson, Nev].
TITANIUM SHEET ROLLING PROGRAM FOR Ti-6Al-4V AND Ti-4Al-3Mo-1V. FINAL REPORT, PART I: Ti-4Al-3Mo-1V. Final rept. on Contract NOas-56-993-C. 15 May 59, 119p.
Order from LC mi$6.00, ph$13.30 PB 143 770

Development and production of Ti-4Al-3Mo-1V sheet under the Department of Defense Titanium Sheet Rolling Program. Development of manufacturing methods and selection of a sponge hardness level for the alloy and production of heat treated aircraft quality sheet for evaluation by various aircraft companies. Essentially all sheets developed strengths above the original target of 147,000 psi minimum yield strength after solution treating and aging. Ductility in the solution treated and aged condition varied with the gage.

Titanium Metals Corp. of America [Henderson, Nev.]
TITANIUM SHEET ROLLING PROGRAM FOR Ti-6Al-4V AND Ti-4Al-3Mo-1V. Final rept., Pt. 2, on Ti-6Al-4V, Contract NOas-56-993-C. 1 July 59, 53p.
Order from LC mi$3.60, ph$9.30 PB 143 628

Annealed Ti-6Al-4V sheet in various aircraft gages on a commercial basis. Information on production procedures, chemical uniformity, and mechanical properties of the sheets produced are presented. Sheets were also solution treated on the resistance heating, spray quench apparatus to demonstrate heat treat capability.

Westinghouse Research Labs., Pittsburgh, Pa.
JOINING OF MOLYBDENUM, by William N. Platte. Rept. for 15 Feb 56-14 Apr 57 on CFPS Materials, Contract AF 33(616)3524. Aug 57, 165p. 38 refs. WADC Technical rept. 57-309; AD-149 847.
Order from LC mi$7.80, ph$25.80 PB 143 644

Available metallurgical data on molybdenum base alloys indicated that additions of aluminum, titanium, carbon, and zirconium should provide good welding properties. Aluminum additions in the range of 0.18 to 0.22% gave welds that could be deflected 120° at room temperature. Welds in 0.5% Ti with 0.05% C produced the best results. Carbon in molybdenum-carbon alloys was shown to improve the weld metal ductility by reducing the oxygen content of the base material and by a protective deoxidization action during welding. Moldbdenum with 0.06% carbon showed the best bend ductility within the carbon range examined. Post-welding residual stresses could be eliminated by a vacuum heat treatment at 1832°F.

Transport, Traction and Hoist Facilities

Detroit Arsenal, Center Line, Mich.
TEST OF THE DUAL PURPOSE HEATER KIT INSTALLED ON THE MORTAR CARRIER, M84, AT LOW AMBIENT TEMPERATURES, by Simon J. Grabowski. 10 Nov 58, 42p. Rept. no. 4330 (Final).
Order from LC mi$3.30, ph$7.80 PB 139 144

To evaluate the effectiveness of a dual purpose heater kit on the Mortar Carrier, M84, tests at 0 F, minus 25 F, minus 45 F, and minus 65 F were conducted at the Detroit Arsenal. Excessive heating time of the power plant compartments was experienced during tests at low ambient temperatures. However, the personnel heating system achieved the minimum Continental Army Command temperature recommendations. A recommendation is made that the kit be modified to lower excessive heating time of the power plant compartments.

Mansfield Tire and Rubber Co., Ohio.
THE DESIGN, DEVELOPMENT, AND TESTING OF AN IMPROVED TYPE "COMBAT" TIRE. Final rept. for 4 June 54-30 June 57 on Contract DA 20-089-ORD-37142. [1957] 149p. 49 refs. AD-143 293.
Order from LC mi$7.20, ph$22.80 PB 138 660

An improved combat tire was constructed with regular 11.00-20 NDCC military tire molds, except for specially profiled mold base rings which allowed for maximum bead widths of 2 3/4 inches. A conventional type drum with a 1/4-in. rubber-and fabric-pad was used. A relatively large power drilling awl was used to vent the uncured tires. A specially designed new mold was made for curing the air bags. All materials used in the tires were standard natural-rubber compounds with regular nylon cord and cotton square woven fabrics, except for the tread stock which was the regular cold-rubber antiozonant compound. The double nylon-cord flippers were applied on the drum at the specified positions and stitched down to bead areas before the bead cables were applied. Each assembly unit was thoroughly stitched and awled to remove all possible air during the tire building. Two relatively wide breaker strips were applied as a band. The tires were shaped and bagged in conventional vacuum boxes with the inflated air bag capped to hold the pressure. The tires were cured on the tight side to avoid hot fracture after release of the internal pressure. The tires did not conform to the dimensions of regular military tires cured in the military NDCC molds. Endurance-wheel and limited road tests followed by plunger-energy tests were made on the same tire; results were satisfactory. Relatively dissatisfactory road tests for vehicle handling and tire action were run. Successful flotation, traction, and drawbar pull tests were made. Internal examination showed no major defects.

Massachusetts Inst. of Tech., Cambridge.
THE TRANSPORTATION PROBLEM WITH RANDOM DEMANDS, by James R. McCord, III. Master's thesis. Interim technical rept. no. 12 on Fundamental Investigations in Methods of Operations Research, Contract DA 19-020-ORD-2684. June 59, 100p. 3 refs. AD-216 900.
Order from LC mi$5.40, ph$15.30 PB 143 321

This report is an analytical exploration of the dependence of the classical transportation problem on variable and random parameters. Some well-known characteristics of the classical problem are first summarized. This facilitates the subsequent detailed investigation of the general 2 x n (two supplies and n demands) problem as a function of variable supplies, demands, and unit costs. The results are interpreted in terms of a two-dimensional geometrical visualization; in a certain sense, this type of picture may be viewed as a model of the class of all 2 x n problems. An interesting by-product of this analysis is a very simple method for solving classical 2 x n and m x 2 transportation problems. Some indications of possible generalizations to larger problems are also presented.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
LOW SURFACTANT CONTENT AMPHOTERIC CLEANERS, by A. Mankowich. 13 Aug 58, 13p. 3 refs. Rept. no. 62.
Order from OTS $0.50 PB 151 172

Low surfactant content alkaline cleaners have been developed suitable for use with missile component parts of magnesium, aluminum, zinc, etc. These compounds possess excellent detersive, heat stability and cleaning capacity characteristics and economy. They contain only 3.0 percent of a specific quaternary imidazolium hydroxide amphoteric surfactant plus 1.5 percent isooctylphenyl nonaethylene glycol ether (IOPNG). The amphoteric agent is the dicarboxylic analogue of the coconut oil derivative. Nonionics of the alkyl polyethylene glycol ether or alkyl polyethylene glycol thioether types may be substituted for IOPNG. The developed compounds permit a saving of about 16 percent over present-type Specification P-C-436a products.

Institute of Rubber Research, U. of Akron, Ohio.
STRESS RELAXATION AND STRUCTURE OF HIGH TEMPERATURE ELASTOMERS, by Maurice Morton, V. R. Allen, and R. D. Gates. Technical rept. no. 2, 1 Sep-31 Nov 58, on Contract Nonr-2573(00). [1958] 23p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 143 458

A further theoretical treatment has been applied to the relationship between sol formation and network degradation of elastomers, taking into consideration the possibility of "recombination" processes which may form new network chains. Some estimates have been made of the extent to which such a process may decrease the amount of sol obtained for a given degree of network degradation. The actual results obtained on the degradation of a swollen sulfur vulcanizate of natural rubber indicate that the main occurrence is actually a random chain scission, with some degree of "recombination" of the degraded chains. In other words, a crosslinking process appears to accompany the scission process. Natural rubber, vulcanized with sulfur to varying degrees, appears to show the sol-gel relation for crosslink scission, as would be expected. However, the situation is complicated to some extent by the probable occurrence of simultaneous random chain scission during vulcanization. (See also PB 140 880)

Ceramics and Refractories

Armour Research Foundation, Chicago, Ill.
THE MECHANICAL PROTECTION OF THE W/Ir THERMOCOUPLE, by Gary Steven and Walter C. Troy. 16 Jan 50, 10p. 4 refs. NEPA 1280-ARM-26; Rept. no. 25; AD-204 948.
Order from LC mi$1.80, ph$1.80 PB 138 317

Equipment was designed and constructed for use in subsequent tests. Beryllia tube protection of the W/Ir thermocouple was found to be unsatisfactory because of the porosity of the available crucibles. A literature survey on rhenium is appended.

Illinois U., Urbana.
FATIGUE AND INTERNAL STRESS ANALYSIS OF CERAMIC COATED METAL COMPOSITES, by J. H. Lauchner and D. G. Bennett. Rept. on Contract AF 18(603)28. Sep 58, 37p. 23 refs. Dept. of Ceramic Engineering rept. no. 83; AFOSR TR-58-129; AD-203 494.
Order from LC mi$3.00, ph$6.30 PB 138 624

Ceramic coated metal composites were studied under mechanically and thermally induced stresses. Coating metal interfacial structure considerations indicate a saturation of the glassy phase by oxides of the base metal accompanied by the presence of residual strain gradients essentially within the interfacial zone. The maximum induced strain (thermal or mechanical) which cobalt bearing ceramic coatings could withstand without fracture was found to be a function of residual stress.

Illinois U., Urbana.
METAL BONDED TITANIUM DIBORIDE, by James A. Nelson, Tracy A. Willmore and Dwight G. Bennett. Rept. on Ceramic Components for Aircraft Power Plants, Contract W33-038-ac-14520. Mar 52, 36p. 8 refs. Dept. of Ceramic Engineering rept. no. 61; WADC Technical rept. 52-111; ATI-158 806.
Order from LC mi$3.00, ph$6.30 PB 143 651

Titanium diboride in a finely divided state was combined with thirty percent of either powdered iron, cobalt, nickel, chromium, or zirconium and pressed into compacts which were fired in an argon atmosphere at temperatures exceeding the melting point of the added metal. The sintering characteristics of the compacts and the phases present after firing was described. Tests were made for oxidation resistance at 2000°F.

Illinois U., Urbana.
SOME STRUCTURE AND PROPERTY STUDIES OF RADIATION REFLECTIVE CERAMIC COATINGS, by Elwin Johnson, Henry G. Lefort and Dwight G. Bennett. Rept. on Contract AF 18(603)28. Sep 58, 52p. 4 refs. Dept. of Ceramic Engineering rept. no. 84; AFOSR TN-58-138; AD-204 555.
Order from LC mi$3.60, ph$9.30 PB 139 172

The behavior of crystalline CeO_2 in two types of matrix glass, one alkali and alumina rich and the other alkali and alumina free, plus a limited study of the chemical behavior of stabilized zirconia in matrix glasses of simple barium-boro-silicate type. The alkali and alumina bearing matrix glass showed a greater devitrification tendency than the alumina and alkali free glass.

Kennametal, Inc., Latrobe, Pa.
AN INVESTIGATION OF PHYSICAL PROPERTIES OF CEMENTED TITANIUM CARBIDE COMPOSITIONS, by J. C. Redmond, J. W. Graham and J. R. McVeigh. Final rept. on Ceramics, Components, Power Plant Aircraft, Contract AF 33(038)27732. Aug 52, 70p. WADC Technical rept. 52-235; AD-1116.
Order from LC mi$3.90, ph$10.80 PB 143 649

Stress-to-rupture tests were made on 15 TiC-base cermets at 1600° and 1800°F to determine their suitability as blading for aircraft gas turbines. Turbine-bucket-root configurations were designed and tested. Ni-bonded TiC was at least equal to currently used alloys in stress-to-rupture properties at present engine temperatures, and was superior at 1800°F. An Ni-Mo alloy doubled the stress-to-rupture strength of the TiC-base compositions. Fe-Si-alloy-bonded TiC was equivalent to Ni-bonded TiC in stress-to-rupture strength. The best bucket root designs, characterized by large radii and 1 or 2 serrations, showed strengths up to 5 times as great as those obtained with conventional fastenings.

Kennametal, Inc., Latrobe, Pa.
PRELIMINARY INVESTIGATION OF ULTRASONIC EXAMINATION OF CERMET TURBINE BUCKETS, by John C. Redmond and Alden M. Burchardt. Rept. on Contract AF 33(600)23285. Jan 56, 28p. WADC Technical rept. 56-89; AD-97 540.
Order from LC mi$2.70, ph$4.80 PB 130 366

Investigation of ultrasonic testing for detection of internal discontinuities in titanium carbide base cermet buckets or differences between buckets of the same composition. Development of methods for measuring sound velocities longitudinally in roots and for the detection of flaws within airfoil. Correlation between the results of ultrasonic examination, between metallurgical properties and also performance.

Minerals Research Lab., U. of California, Berkeley.
PREDICTING THE THERMODYNAMIC STABILITIES AND OXIDATION RESISTANCES OF SILICIDE CERMETS, by Alan W. Searcy. Technical rept. no. 5 on Contract Nonr-222(32). Sep 56, 17p. 8 refs. Series no. 84, issue no. 5.
Order from LC mi$2.40, ph$3.30 PB 128 604

Smith, A. O., Corp., Milwaukee, Wisc.
HIGH TEMPERATURE COATING RESEARCH, by M. K. Blanchard. 20 Nov 48, 10p. Rept. no. CRL-HTC-10; NEPA 835-AOS-10; AD-204 196.
Order from LC mi$1.80, ph$1.80 PB 138 319

Smith, A. O., Corp., Milwaukee, Wisc.
HIGH TEMPERATURE COATING RESEARCH, by M. K. Blanchard. 20 Dec 48, 11p. Rept. no. CRL-HTC-11; NEPA-857-AOS-11; AD-204 197.
Order from LC mi$2.40, ph$3.30 PB 138 324

See also PB 138 319

Fuels, Lubricants, and Hydraulic Fluids

Burke Research Co., Warren, Mich.
RESEARCH ON VINYLIC FILLER LUBRICANTS AND GREASES, by U. F. Nager, M. T. Johnston and P. Davis. Technical rept. no. 19T, for 1 Oct-31 Dec 57 on Contract Nonr-2146(00). [1957] 16p. 5 refs.
AD-157 360.
Order fromLC mi$2.40, ph$3.30 PB 138 627

The preparation of fluorinated oils by telomerization was continued. Several possible new routes to prepare fluorocarbon dinitriles were proposed for investigation. The following reactions were investigated: (1) vapor phase reaction of fluorohalogenocarbons with cyanides, (2) reactions of fluorohalogenocarbons with cyanides in solvents, (3) vapor phase pyrolysis of ammonium perfluoroglutarate in the presence of NH_3, and (4) reaction of perfluoroalkyl Li with cyanogen. (See also PB 138 884)

California Research Corp. [La Habra]
DEVELOPMENT OF HIGH-TEMPERATURE AIRCRAFT HYDRAULIC FLUIDS, by Neil W. Furby. Rept. on Hydraulic Fluids, Lubricants and Related Materials, Contract AF 33(038)9831. Nov 51, declassified. 111p. AF Technical rept. no. 6685; ATI-188 471.
Order from LC mi$6.00, ph$18.30 PB 143 267

The requirements for a nonflammable hydraulic fluid possessing favorable viscosity, volatility, and lubricity characteristics led to the investigation of the organo-silicates as possible new base materials to meet this demand. The studies conducted by the California Research Corporation have resulted in the synthesis of a number of siloxanes, disiloxanes, and organo-phosphorus compounds in an effort to develop a fluid that would meet the requirements as outlined in the three phases of their program. Data presented on mechanical test evaluation, viscosity-volatility relationships, viscosity-temperature characteristics, and fluid stability, indicate the potentiality of the organo-silicates as possible aircraft hydraulic fluids.

California Research Corp. [La Habra]
DEVELOPMENT OF HIGH-TEMPERATURE AIRCRAFT HYDRAULIC FLUIDS, by Neil W. Furby. Rept. on Hydraulic Fluids, Lubricants and Related Materials, Contract AF 33(038)9831, Oct 52, declassified 19 Oct 55. 62p. AF Technical rept. no. 6685, sup. 1; ATI 184 796.
Order from LC mi$3.90, ph$10.80 PB 143 267S1

A high temperature silicate base hydraulic fluid capable of operating from -65°F to over 400°F was formulated from a mixed monomer orthosilicate base stock, a silicone viscosity index improver, and a basic amine inhibitor to retard oxidation and hydrolysis. Various additives were evaluated for their effect on oxidation, viscosity, hydrolysis, lubricity, and flammability properties of silicate formulations. Further synthesis work was done on silicate and phosphonate esters as new base materials. Bench-scale wear tests and gear and piston type hydraulic pump tests were carried out on experimental hydraulic fluids. (See also PB 143 267)

California Research Corp. [La Habra]
DEVELOPMENT OF HIGH-TEMPERATURE AIRCRAFT HYDRAULIC FLUIDS, by Neil W. Furby. Rept. on Hydraulic Fluids and Lubricants MX 1576, Contract AF 33(038)9831. Sep 53, declassified 19 Oct 55. 85p. AF Technical rept. no. 6685, sup. 2; AD-22 067.
Order from LC mi$4.80, ph$13.80 PB 143 267S2

Progress for the year 1952 in the development of a high temperature aircraft hydraulic fluid for operation from -65°F to 400°F is described. Compounds synthesized for investigation as base materials included silicates, trisiloxanes, silicon-phosphorus compounds, phosphonates, and miscellaneous compounds. Diethyl and methylphenyl silicones as well as polymethacrylates were investigated as V. I. improvers for silicate base fluids. Additives were evaluated for effects on high temperature stability, hydrolytic stability, and antiwear properties. Four-ball wear tests and 3000 psi Vickers and New York Airbrake piston pump tests were conducted on several experimental fluids to determine lubricating properties. (See also PB 143 267S1)

Frankford Arsenal, Philadelphia, Pa.
MOLYBDENUM DISULFIDE DRY LUBRICANT STUDY, by B. Hawthorn. 31 Dec 57, 10p. Rept. no. MIC-68A; AD-147 783.
Order from LC mi$1.80, ph$1.80 PB 138 600

An evaluation was made of the performance of a particular brand of molybdenum disulfide suspension as a tool lubricant in small arms ammunition manufacturing operations, both with and without supplemental lubrication. No significant gain was reported.

Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain).
AN EXPERIMENTAL INVESTIGATION ON THE COMBUSTION OF MONOPROPELLANT DROPLETS, by P. Pérez del Notario and C. Sánchez Tarifa. Rept. on Contract AF 61(514)997. 20 Jan 59, 26p. 4 refs. AFOSR-TN-59-628; AD-217 813.
Order from LC mi$2.70, ph$4.80 PB 143 171

In the present work the results of an experimental investigation with the object of obtaining the velocities of combustion of monopropellant droplets within an inert atmosphere are shown. This investigation was performed to check the theoretical results previously obtained.

Instituto Nacional de Tecnica Aeronautica "Esteban Terradas" (Spain).
FINAL REPORT, by G. Millan. Rept. on Contract AF 61(514)997. 25 Feb 59, 10p. 12 refs. AFOSR-TR-59-68; AD-217 815.
Order from LC mi$1.80, ph$1.80 PB 143 152

With regard to homogeneous combustion, the general objectives of the program of work were to contribute to the theoretical study of the characteristics of the laminar flames, taking the existing semianalytical methods as the starting point and including some non-steady cases, such as ignition of a combustible and homogeneous gaseous mixture, as well as others of flames with heat losses. As regards heterogenous combustion, the theoretical and experimental study of the combustion of monopropellant droplets, and of fuel sprays, was included in the program.

Midwest Research Inst. [Kansas City, Mo.]
A RADIOACTIVE TRACER INVESTIGATION OF THE MECHANISM OF MoS_2 AND WS_2 LUBRICATION, by. M. T. Lavik and S. L. Levy. Rept. on Contract AF 49(638)157. June 58, 8p. 2 refs. AFOSR TR-59-10; AD-209 493.
Order from LC mi$1.80, ph$1.80 PB 139 232

This project was designed to test Johnson's hypothesis describing lubrication by molybdenum disulphide.

Leather and Textiles

Harris Research Labs. [Washington, D. C.]
A SURVEY OF 18-OUNCE BLENDED SERGE FABRICS: LABORATORY EVALUATION, by John Menkart. Rept. on Air Force Textile Materials, Contracts DA 19-129-qm--1122; AF 33(616)-(54-172; 55-82; 57-20). May 59, 50p. 21 refs. WADC Technical rept. 58-602; AD-214 699.
Order from OTS $1.25 PB 151 920

The development of alternates for the 18 oz. wool serge was the object of the investigation. Twenty experimental fabrics were made and their properties were evaluated, in comparision with those of the standard serge, at Quartermaster Research and Engineering Center, Natick, Mass. On the basis of the laboratory data, tentative recommendations are made for the selection of alternates, resulting in a conservation of wool, with the least change in functional properties. Of the fabrics studied, a ternary blend of 70% wool, 20% viscose, and 10% nylon is indicated as providing the closest approach to the wool serge.

Institute of Polymer Research, Polytechnic Inst. of Brooklyn, N. Y.
IMPROVEMENT OF THERMAL STABILITY OF TEXTILE FIBERS, by I. Saad. Progress rept. no. 8 (Annual summary) for 1 July 57-30 June 58 on Contract N140(132)57745B. [1958] 32p.
Order from LC mi$3.00, ph$6.30 PB 143 086

Within the limits of the work one arrives at the conclusion that substantial coatings by the method of embedding catalyst in the fiber surface are feasible, and that the amount of deposited polymer may be increased and its uniformity improved by the application of larger concentrations of catalyst and by shortening the coating treatment. (See also PB 132 855)

Owens-Corning Fiberglas Corp., Newark, Ohio.
PROPERTIES OF GLASS FIBERS AT ELEVATED TEMPERATURES, by W. H. Otto. Quarterly rept. no. 4, 16 Mar-15 June 59, on Contract NOas-58-841-c. 25 June 59, 20p.
Order from LC mi$2.40, ph$3.30 PB 143 669

Single fiber tensile strength measurements were made on silica monofilament at temperatures from 75°F to 2000°F. Static fatigue measurements on silica fibers were made at temperatures up to 1830°F. The effects of standard 630 textile size on high temperature strength and fatigue were studied on E-glass and X-37B glass.
(See also PB 140 701)

Paints and Finishes

Aberdeen Proving Ground, Md.
DEVELOPMENT OF A ONE-COAT FINISH FOR SPRAY APPLICATION TO TIN AND TERNE PLATE, by C. U. Van Duyne and C. F. Pickett. Rept. no. 6 on Finishing Coats Systems, Ordnance Proj. no. TB4-771D. 29 July 55, 28p. Engineering Labs. rept. no. 4.
Order from LC mi$2.70, ph$4.80 PB 138 949

The object of this project is to develop a quick drying one-coat finish for spray application on tin and terne plate containers which will be sufficiently dry after a one-minute bake at 300°F to permit handling and packaging of the containers. A two-coat finishing system for spray painting tin and terne plate containers as recommended by this installation was deemed too lengthy an operation by various can manufacturers. After materials covered by existing specifications were evaluated and found to be unsatisfactory a new product was developed meeting the specific requirements of the problem.

Bureau of Aeronautics, Dept. of the Navy, Washington, D. C.
MINUTES OF COLLOQUIUM ON AIRCRAFT ORGANIC PROTECTIVE COATINGS PROBLEMS OF THE BUREAU OF AERONAUTICS, FEBRUARY 27-28, 1947. 125p.
Order from LC mi$6.30, ph$19.80 PB 143 089

A series of papers are covered as well as some of the discussion.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
DETERMINATION OF CHLORENDIC ACID IN FIRE RETARDANT PAINT, by G. G. Esposito. 14 Aug 59, 7p. Rept. no. CCL-80.
Order from LC mi$1.80, ph$1.80 PB 143 564

A new test method is presented for determining chloredic (hexachloroendomethylenetetrahydrophthalic) acid in chlorinated alkyd resins used in fire retardant paints. The new procedure employs isopropyl alcohol

in the saponification medium to separate the acid as the dipotassium salt. The acid is extracted from water with ethyl ether and titrated in a nonaqueous medium.

Photographic Materials

Rome Air Development Center, Griffiss AFB, N. Y.
THE APPLICATION OF DIAZO TYPE MATERIALS TO INDUSTRIAL PLANNING AND ENGINEERING, by George F. Sztuk. Oct 58, 15p. RADC-TN-58-250; AD-202 097.
Order from LC mi$2.40, ph$3.30 PB 138 622

The Maintenance Engineering Plant Layout Standardization Program requires the use of Diazo type color materials for the production in Diazo machines of colored overlay plant layouts and their blue line reproductions. RADC has conducted tests to establish specifications for the Diazo color foils to be supplied by two commercial firms and has assisted in revising plant equipment color classifications. The general results of these tests and consequent recommendations are given in this report.

Technical Operations, Inc., Burlington, Mass.
THE PHOTOGRAPHIC IMPLICATIONS OF THE CHEMISTRY OF QUINONE, FOG, ACCELERATED, CONTAGIOUS, INFECTIOUS AND SUPERADDITIVE DEVELOPMENT, LATENSIFICATION AND DESENSITIZATION, by James E. LuValle and Gershon M. Goldberg. Technical note on Contract AF 18(600)371. 31 July 58, 25p. 11 refs. Rept. no. TOI 58-28; AFOSR TN-58-723; AD-162 258.
Order from LC mi$2.70, ph$4.80 PB 138 879

Plastics

Bjorksten Research Labs., Inc. [Madison, Wis.]
WEATHERING TESTS OF PLASTICS AND DESIGN OF SUSPENDED ENVELOPE SOLAR STILLS. Rept. on OSW Contract 14-01-001-91. Sep 59, 46p. 3 refs. Office of Saline Water Research and Development progress rept. no. 30.
Order from OTS $1.50 PB 161 095

A program for investigation of the resistance of plastic film materials to solar radiation and weathering under distillation conditions was carried on through the use of accelerated laboratory tests as well as outdoor exposure tests. Sample containers affording protection of the film specimens while subjecting them to distillation conditions were developed, and an accelerated testing device constructed which appears suitable for rapid screening of materials, though direct correlation with outdoor exposure can not be established as yet. The program was subsequently extended to include preliminary design, construction, and initial testing of suspended envelope stills in modular unit form. A design was developed which utilizes commercially available structural elements requiring a minimum amount of fabrication into still modules. Available plastic materials having superior resistance to exposure presented extensive problems in effective sealing.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
HEAT OF POLYMERIZATION OF EPON 828, by Charles Lenchitz, Ronald Brown and Salvatore Stivala. June 58, 13p. 2 refs. Technical rept. 2505.
Order from LC mi$2.40, ph$3.30 PB 138 924

The heat of polymerization of Epon was measured with ethylenediamine (EDA), diethylenetriamine (DETA), and triethylene tetramine (TETA). The results obtained are compared with calculations made from the heats of formation of the reactants and the products.

Frick Chemical Lab., Princeton U., N. J.
MOLECULAR WEIGHT DISTRIBUTION BY STRESS RELAXATION, by A. V. Tobolsky, A. Mercurio and K. Murakami. Rept. on Contract Nonr-1858(07). 26 Feb 58, 3p. 3 refs. ONR Technical rept. RLT-23.
Order from LC mi$1.80, ph$1.80 PB 139 054

The stress relaxation properties of linear amorphous polymers in the region of rubbery flow have been shown to be dependent on molecular weight and molecular weight distribution.

Wood and Paper

College of Forestry, Syracuse, N. Y.
MECHANISM OF SOLUTION OF HEMICELLULOSE IN ALKALI, by Igor Sobolev (Doctoral thesis) and Conrad Schuerch. Technical rept. no. 2, May-July 58, on Contract DA 30-115-ORD-923. [1958] 25p. 19 refs. AD-137 112.
Order from OTS $0.75 PB 151 177

When wood is pulped with sodium hydroxide and the liquors are simultaneously hydrogenated in the presence of nickel catalyst, the process resembles soda pulping very closely in the species usable, the optimum conditions, alkali consumption and pulp yield and analysis. However, the lignin is a relatively simple mixture of distillable phenols and thermoplastic resins, and the pulp appears somewhat lighter in color than comparable soda pulp. The process can be carried out effectively on wood meal or chips and with the catalyst separate from the wood. Hydrogen pressure need only be about 600 p. s. i. Lignin hydrogenated in this fashion appears to be a more attractive material than that produced from the hydrogenation of pulping liquors or commercial lignins. A number of experimental pulps are described. (See also PB 142 747)

Rock Island Arsenal Lab., Ill.
DETERMINATION OF SAMPLE SIZES FOR TESTING OF MIL-P-10831A, TYPE I TARGET PAPER, by Evelyn S. Burke. 28 May 59, 20p. Rept. no. 59-1440; AD-216 527.
Order from LC mi$2.40, ph$3.30 PB 143 332

Royal Inst. of Tech. (Sweden).
STUDIES ON THE HEARTWOOD CONSTITUENTS OF CONIFERS, Final technical rept. no. 1 for 1 Feb 58-31 Mar 59 on Contract DA 91-508-euc-288. 25 Apr 59, 48p. 6 refs. AD-217 432.
Order from LC mi$3.30, ph$7.80 PB 143 051

Three South African and one South American species of the genus Podocarpus were examined but no interesting substances were found. The South American Saxegothea conspicua was also investigated without yielding any results of interest. Investigation of the heartwood constituents of the Chilean Austrocedrus (Libocedrus) chilensis was made. The heartwood of the Tasmanian Arthrotaxis selaginoides was investigated for the first time. The old problem of the structure of shonanic acid from the Formosan conifer Libocedrus formosana has been solved. The heartwood of the Moroccan Tetraclinis articulata has been reinvestigated. There is no clear-cut relationship to the South African genus Widdringtonia nor does Tetraclinis exhibit any relationship to Callitris, an Australian genus to which Tetraclinis articulata was once supposed to belong. There is, however, some affinity to the northern genera of Cupressaceae and chemically perhaps it is related most closely to the Californian incense cedar, Libocedrus decurrens. Tetraclinis should be very carefully investigated. It appears to be a rich source of chemotaxonomically interesting compounds. The heartwoods of the Californian Cupressus macrocarpa and the Himalayan C. torulosa were subjected to preliminary investigation.

MATHEMATICS

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ASYMPTOTIC SOLUTIONS FOR DIFFERENTIAL EQUATIONS WITH A REGULAR SINGULAR POINT, by K. G. Guderley. Feb 59, 85p. 6 refs. WADC Technical rept. 58-617.
Order from OTS $2.25 PB 161 071

Air Force Cambridge Research Center, Bedford, Mass.
A METHOD FOR NUMERICAL EVALUATION OF THE COEFFICIENTS OF FOURIER SERIES, by Kurt H. Haase. June 59, 38p. 8 refs. AFCRC-TR-153; AD-216 366.
Order from LC mi$3.00, ph$6.30 PB 143 492

Programmed computation of these periodic Fourier coefficients in connection with the tabulation of $C_n(m)$ yields any desired number of Fourier coefficients. This new method is thus superior to other computational methods and schemes that a priori limit the number of obtainable coefficients. Fourier coefficients of specially selected orders can be obtained in a few steps, without the necessity of computing the entire sequence of coefficients. The method can be programmed for desk calculating machines as well as for computers.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
COINCIDENCE PROBABILITIES, by Samuel Karlin and James McGregor. Technical rept. no. 8 on Contract Nonr-225(28). 17 Nov 58, 46p. 20 refs.
Order from LC mi$3.30, ph$7.80 PB 143 479

Applied Mathematics and Statistics Lab., Stanford U., Calif.
COINCIDENT PROPERTIES OF BIRTH AND DEATH PROCESSES, by Samuel Karlin and James McGregor. Technical rept. no. 9 on Contract Nonr-225(28). 18 Nov 58, 51p. 9 refs.
Order from LC mi$3.60, ph$9.30 PB 143 478

In this paper we investigate certain aspects of the structure of the Markov process describing the transitions of n particles conditioned that no coincidence takes place. We refer to this process as the compound birth and death process of order n. Frequently, when no ambiguities arise the terms "birth and death" and "order n " will be suppressed. The basis of the subsequent analysis is principally an integral representation for $P\begin{pmatrix} t; & i_1, i_2, \ldots, i_n \\ & j_1, j_2, \ldots, j_n \end{pmatrix}$ which is derived from a corresponding integral formula for $P_{ij}(t)$.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
CONTINUOUS SAMPLING PROCEDURES WITHOUT CONTROL, by C. Derman, M. V. Johns, Jr., and G. J. Lieberman. Technical rept. no. 39 on Contract N6onr-25126. 10 Oct 58, 32p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 143 248

Several modifications of the Dodge CSP-1 procedure are presented. Changes are made in the rule of action when a defective item is observed while on sampling. The Average Outgoing Quality Limit (AOQL) for these new procedures are derived without the assumption of control. These results are compared with the AOQL assuming control. Further, the AOQL for the CSP-1 procedure using probability sampling (looking at every item with probability 1/k when on sampling) is derived without the assumption of control.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON NULL-RECURRENT MARKOV CHAINS, by John Lamperti. Technical rept. no. 22 on Contract Nonr-225(21). 10 Nov 58, 21p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 143 482

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE SUPREMUM AND INFIMUM OF THE POISSON PROCESS, by Ronald Pyke. Technical rept. no. 39 on Contract N6onr-25140. 21 Mar 58, 17p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 139 296

British Columbia U. (Canada).
EXTREMAL PROPERTIES OF HERMITIAN MATRICES II [AND] LINEAR TRANSFORMATIONS ON ALGEBRAS OF MATRICES, by Marvin Marcus and B. N. Moyls. Rept. on Contract AF 18(603)83. Aug 58, 21p. 3 refs. AFOSR TN-58-(667, 668); AD-162 200; AD-162 199.
Order from LC mi$2.70, ph$4.80 PB 139 156

Brown U. Div. of Applied Mathematics, Providence, R. I.
A SUBROUTINE FOR CALCULATION OF SPHERICAL BESSEL FUNCTIONS, by Cornelia M. Kalkman. Technical rept. no. 16 on Contract Nonr-562(07). Oct 58, 10p. 562(07)/16.
Order from LC mi$1.80, ph$1.80 PB 143 786

California U., Berkeley.
INFINITELY MULTIPLE VALUED HARMONIC FUNCTIONS IN SPACE WITH TWO BASE BRANCH CURVES OF ORDER ONE, by Griffith C. Evans. Technical rept. no. 29 on Contract Nonr-222(37). Nov 58, 61p. 5 refs.
Order from LC mi$3.90, ph$10.80 PB 143 409

Carnegie Inst. of Tech., Pittsburgh, Pa.
SEMI-DISCRETE POTENTIAL THEORY, by R. L. Helmbold. Technical rept. no. 34 on Mathematical Analysis of Electrical and Mechanical Systems Contract DA 36-061-ORD-490. 29 Apr 57, 69p. 22 refs. CIT-ORD-6D-TR34; AD-135 262.
Order from LC mi$3.90, ph$10.80 PB 138 632

The equations of a relatively new variant of the difference-equation method of approximately solving problems in partial differential equations are investigated, the discussion being restricted to partial differential equations involving the Laplace operator. The variant consists, for the two dimensional case, in replacing one of the partial derivatives by a central difference and the other partial derivative by an ordinary derivative, thus obtaining a system of ordinary differential equations to be solved in such a way as to satisfy certain boundary conditions. It is shown that the equations of this variant are equivalent to a variational principle, the analogue of the maximum principle holds, and an operational calculus is developed. Also included are a Green's function and Green's identities, applications to the estimation of eigenvalues, and explicit solutions in rectangular regions. Generalizations to higher dimensions are indicated.

Columbia U., New York.
ON STOCHASTIC APPROXIMATION, by C. Darman and J. Sacks. Rept. on Contracts Nonr-266(55, 51). Nov 58, 8p. 7 refs. CU 2-58-Nonr-266(51)MS.
Order from LC mi$1.80, ph$1.80 PB 143 480

Columbia U., New York.
A THEOREM ON CONVEX BODIES AND APPLICATIONS TO BANACH SPACES, by Aryeh Dvoretzky. Rept. on Contract Nonr-266(51). [1958] 8p. 4 refs. CU-1-58-Nonr-266(51)-MS.
Order from LC mi$1.80, ph$1.80 PB 143 468

Cornell U., Ithaca, N. Y.
ASYMPTOTIC EXPANSIONS IN GLOBAL LIMIT THEOREMS, by Ralph Palmer Agnew. Rept. no. 63 on Contract AF 18(600)685. Dec 56, 34p. 7 refs. AFOSR-TN-56-514; [AD-110 329].
Order from LC mi$3.00, ph$6.30 PB 139 024

Institute for Advanced Study, Princeton, N. J.
ON A CONJECTURE OF H. HADWIGER, by Branko Grünbaum. Rept. on Contract AF 49(638)253. Nov 58, 7p. 7 refs. AFOSR-TN-58-1055; AD-206 983.
Order from LC mi$1.80, ph$1.80 PB 139 073

Institute for Advanced Study, Princeton, N. J.
SEMINARS ON ANALYTIC FUNCTIONS, VOLUME I, SEPTEMBER 2-14, 1957. Rept. on Contract AF 18(603)118. [1957] 349p. 212 refs. AFOSR-TN-58-750; AD-201 502.
Order from LC mi$11.10, ph$53.10 PB 143 754

Contents:
Seminar 1. Theory of Functions of Several Complex Variables
Seminar 2. Conformal Mapping and Schlicht Functions

Institute for Advanced Study, Princeton, N. J.
SEMINARS ON ANALYTIC FUNCTION, VOLUME II, SEPTEMBER 2-14, 1957. Rept. on [Contract AF 18(603)118]. [1957] 320p. 107 refs. AFOSR-TN-58-750; AD-201 502.
Order from LC mi$11.10, ph$48.60 PB 143 755

Contents:
Seminar 3. Riemann Surfaces
Seminar 4. Theory of Automorphic Functions
Seminar 5. Analytic functions as Related to Banach Algebras
(See also PB 143 754)

Institute of Mathematical Sciences, New York U., N. Y.
THE EVALUATION OF TWO AND THREE-CENTER INTEGRALS ARISING IN CALCULATIONS ON MOLECULAR STRUCTURE, by C. Donald LaBudde and R. C. Sahni. Rept. on Contract AF 19(604)1705. Sep 58, 44p. 8 refs. Research rept. no. CX-35; AFCRC TN-58-601.
Order from LC mi$3.30, ph$7.80 PB 138 859

Institute of Statistics, North Carolina State Coll., Raleigh.
ASYMPTOTIC DISTRIBUTION OF SAMPLE SIZE FOR CERTAIN METHODS OF SEQUENTIAL SAMPLING, by L. L. Leaman and E. J. Williams. Technical rept. no. 21 on Experimental Designs for Industrial Research, Contract DA 36-034-ORD-1517. June 58, 66p. 30 refs. AD-200 572.
Order from LC mi$3.90, ph$10.80 PB 142 862

Institute of Statistics, North Carolina State Coll., Raleigh.
AN INVESTIGATION OF ROBUSTNESS TO NON-NORMALITY OF CRITERIA FOR TESTING OUTLYING OBSERVATIONS, by W. L. Davis and R. J. Hader. Technical rept. no. 20 on Contract DA 36-034-ORD-1517. June 58, 47p. 23 refs. AD-200 571.
Order from LC mi$3.30, ph$7.80 PB 143 688

The results of this study may be summarized as follows: (1) All statistics under study are fairly sensitive to non-normality. (2) The sensitivity increases with increasing sample size. (3) There was no evidence to indicate that one statistic or a group of statistics is any less sensitive to non-normality than any other.

Institute of Statistics, U. of North Carolina, Chapel Hill.
ON THE CONSTRUCTION OF PAIRWISE ORTHOGONAL SETS OF LATIN SQUARES AND THE FALSITY OF A CONJECTURE OF EULER, II, by R. C. Bose and S. S. Shrikhande. Rept. on Contract AF 49(638)213. May 59, 13p. 3 refs. Mimeograph series no. 225; AFOSR TN-59-518; AD-216 239.
Order from LC mi$2.40, ph$3.30 PB 143 028

Institute of Tech., U. of Minnesota, Minneapolis.
A BOUNDARY VALUE PROBLEM FOR A SYSTEM OF ORDINARY LINEAR DIFFERENTIAL EQUATIONS INVOLVING POWERS OF A PARAMETER, by William A. Harris, Jr. Technical rept. no. 3, 16 Mar-15 June 57, on Contract DA 11-022-ORD-2042. 20 Mar 58, 141p. 9 refs. AD-156 723.
Order from LC mi$7.20, ph$22.80 PB 143 258

This paper is concerned with the existence and nature of eigenvectors which are solutions of a vector differential equation of the form

$$\frac{d}{dx}\,\bar{y}(x,\lambda) = A(x,\lambda)\,\bar{y}(x,\lambda) + \bar{g}(x,\lambda),\quad q \le x \le b,$$

with the boundary conditions

$$W_a(\lambda)\,\bar{y}(q,\lambda) + W_b(\lambda)\,y(b,\lambda) = 0.$$

The $A(x,\lambda)$, $W_a(\lambda)$ and $W_b(\lambda)$ are n x n matrices which possess convergent representations of the form

$$A(x,\lambda) = \lambda^h \sum_{j=0}^{\infty} A_j(x)\,\lambda^{-j}$$

$$W_a(\lambda) = \lambda^{h'} \sum_{j=0}^{\infty} W_{aj}\,\lambda^{-j}$$

$$W_b(\lambda) = \lambda^{h'} \sum_{j=0}^{\infty} W_{bj}\,\lambda^{-j}$$

when the complex parameter λ is sufficiently large; h is a positive integer and h' is a non-negative integer.

Institute of Tech., U. of Minnesota, Minneapolis.
SIMPLIFICATIONS OF SYSTEMS OF LINEAR DIFFERENTIAL EQUATIONS INVOLVING A TURNING POINT, by H. L. Turrittin and W. A. Harris, Jr. Technical rept. no. 2, 15 Sep 57-15 Sep 58, on Contract DA 11-022-ORD-2042. 13 Dec 57, 39p. 42 refs. AD-156 171.
Order from LC mi$3.00, ph$6.30 PB 143 257

It is found that an asymptotic reduction in the order of the matrix equation

(1) $\epsilon^h \frac{dX}{dt} = \{A_0(t) + \epsilon A_1(t) + \epsilon^2 A_2(t) + \ldots\} X$, where h is a positive integer, ϵ a small parameter, and the A's are square matrices with holomorphic elements near t = 0, is always possible if the characteristic roots $\lambda_i(t)$ of the lead matrix $A_0(t)$ can be separated into two distinct sets, so that no root of the first set coincides with any root of the second set at or near t = 0. Also all turning point problems for equations of type (1), where the A's are 2 by 2 matrices, have been classified and reduced to one of three possible canonical forms.

Johns Hopkins U., Baltimore, Md.
RECENT WORK ON FAMILIES OF PERIODIC SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS, PART I; SINGULAR SOLUTIONS OF SYSTEMS OF REAL ANALYTIC EQUATIONS, PART II; [AND] THE STRÖMGREN-WINTNER PRINCIPLE ON THE TERMINATION OF FAMILIES OF PERIODIC SOLUTIONS, by Daniel C. Lewis, Jr. Rept. on Contract AF 18(600)665. 30 June 59, 63p. 14 refs. AFOSR-TR-59-70.
Order from LC mi$3.90, ph$10.80 PB 143 151

Laboratory of Statistical Research, U. of Washington, Seattle.
ON THE GROWTH OF STOCHASTIC PROCESSES, by Albert W. Marshall. Technical rept. no. 32 on Contract Nonr-477(11). 20 Oct 58, 79p. 15 refs.
Order from LC mi$4.50, ph$12.30 PB 143 797

Midwest Research Inst. [Kansas City, Mo.]
THE PADÉ TABLE AND THE τ-METHOD. by Yudell L. Luke. Rept. on Contract AF 49(638)66. Aug 57, 45p. 24 refs. AFOSR TN-57-570; AD-136 555.
Order from LC mi$3.30, ph$7.80 PB 130 733

Rational function representations of the function E are presented as defined by a differential equation of a standard form. Closed form expressions for the error are derived and used to appraise the error in a convenient manner. Rational approximations to the transcendents defined by the differential equation are derived by the τ method. Numerical examples are worked out and the true error is compared with that predicted.

Minnesota U. School of Business Administration, Minneapolis.
SURVEY OF NONPARAMETRIC STATISTICS, by I. Richard Savage. Special rept. no. 1 on Contract Nonr-2582(00). 6 Nov 58, 10p. 21 refs.
Order from LC mi$1.80, ph$1.80 PB 143 459

North Carolina U., Chapel Hill.
MATRIX INVERSION, ITS INTEREST AND APPLICATION IN ANALYSIS OF DATA, by B. G. Greenberg and A. E. Sarhan. Technical rept. no. 5 on Estimation of Parameters by Order Statistics, Contract DA 36-034-ORD-2184. 15 May 58, 21p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 143 561

Matrix inversion is used in the least squares analysis of data to estimate parameters and their variances and covariances. When the data come from the analysis of variance, analysis of covariance, order statistics, or the fitting of response-surfaces, the matrix to be inverted usually falls into a structured pattern that simplified its inversion.

Oregon U., Eugene.
REGULAR MEASURES AND STOCHASTIC PROCESSES IN TOPOLOGICAL GROUPS, by R. P. Pakshirajan. Technical rept. no. 2 on Contract DA 04-200-ORD-651. 26 May 59, 57p. 13 refs.
Order from LC mi$3.60, ph$9.30 PB 143 055

Purdue Research Foundation, Lafayette, Ind.
COMMUTATORS AND ABSOLUTELY CONTINUOUS OPERATORS, by C. R. Putnam. Technical note no. 1 on Commutators on a Hilbert Space, Contract AF 18(603)139. July 57, 17p. 10 refs. AFOSR-TN-56-457; AD-97 073.
Order from LC mi$2.40, ph$3.30 PB 128 628

A discussion is presented of commutators and absolutely continuous operators. Five general theorems on commutators and certain associated sets are given, and applications of some of the results are made to prove 8 theorems dealing with Toeplitz, Hankel, and Jacobi matrices. All operators are bounded linear transformations on a Hilbert space consisting of elements x. The results obtained depend on the methods of C. R. Putnam (Proc. Amer. Math. Soc., 7:1026-1030, 1956), and are similar to those results except for the second and third commutators.

Stanford U., Calif.
THE ADMISSIBILITY OF PITMAN'S ESTIMATOR OF A SINGLE LOCATION PARAMETER, by Charles Stein. Technical rept. no. 20 on Contract Nonr-225(21). 15 Oct 58, 19p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 143 791

Stanford U., Calif.
DEGENERACY IN LINEAR PROGRAMMING: WHERE IS THE PROBLEM? by Harvey M. Wagner. Technical rept. no. 49 on Contract N6onr-25133. 3 Mar 58, 12p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 139 160

The degeneracy problem, which may or may not arise when the degeneracy condition exists, is of two sorts. The first type concerns the rigorous demonstration that the simplex method unequivocally leads to an optimal solution. The second type concerns the amount of computational effort which should be expended to avoid a theoretically possible but empirically rare occurrence. Nelson's resolution of the problem neither solves the first aspect completely nor the second aspect adequately. The common occurrence of the degeneracy conditions, for reasons explained by Nelson, in contrast to the infrequent occurrence of cycling, has led practitioners to be less exacting in the requirements of their computational scheme than the mathematicians have been in the details of their logical proofs.

Trinity Coll., Hartford, Conn.
REGULARITY PRESERVING FACTOR SEQUENCE TRANSFORMATIONS OF SERIES OF CHARACTERISTIC FUNCTIONS OF THE DIFFERENTIAL OPERATOR $z^N - d^2/dz^2$, by W. J. Klimczak. Rept. on Contract AF 18(600)1397. 30 Nov 58, 24p. 4 refs. AFOSR TN-58-1059; AD-206 990.
Order from LC mi$2.70, ph$4.80 PB 139 083

The purpose of this paper is to study some special types of regularity preserving factor sequence transformations for series of the form

$$f(z) = \sum_{n=0}^{\infty} f_n w_n(z),$$

where the $w_n(z)$ are characteristic functions of the second-order differential operator

$$\mathcal{E}_z = z^N - d^2/dz^2,$$

N being a positive integer.

University Coll., Cork (Eire).
ON A CLASS OF FUNCTIONS REGULAR AND BOUNDED IN THE UNIT CIRCLE, by P. B. Kennedy. Technical note no. 5 on Contract AF 61(514)1399. [1953] 17p. 5 refs. AFOSR TN-59-670; AD-218 382.
Order from LC mi$2.40, ph$3.30 PB 143 167

University Coll., Cork (Eire).
A PROPERTY OF BOUNDED REGULAR FUNCTIONS, by P. B. Kennedy. Technical note no. 4 on Contract AF 61(514)1399. [1953] 17p. 4 refs. AFOSR TN-59-669; AD-218 381.
Order from LC mi$2.40, ph$3.30 PB 143 168

For a bounded regular function f(z) in the unit circle $|z| < 1$, an investigation is made of the relation between the growth of the Nevanlinna characteristic of the derivative of f and the angular measure of the set of singularities of f on $|z| = 1$.

Washington U., St. Louis, Mo.
DETERMINANTS IN MULTIVARIATE CORRELATION, by E. Muriel J. Ferguson, Winton H. Manning, and Philip H. DuBois. Technical rept.

no. 5 on Contract Nonr-816(02). Apr 58, 15p. 20 refs.
Order from LC mi$2.40, ph$3.30 PB 138 604

Washington U., Seattle.
NORMALITY AND REAL COMPACTIFICATION FOR SUBSETS OF PRODUCT SPACES, by H. H. Corson. Technical rept. no. 1 on Contract Nonr-477(22). 1 Nov 58, 15p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 143 467

Washington U., Seattle.
A THEOREM ON SEMI-CONTINUOUS SET-VALUED FUNCTIONS, by E. Michael. Technical rept. no. 4 on Contract Nonr-477(21). Dec 58, 9p. 4 refs.
Order from LC mi$1.80, ph$1.80 PB 143 607

Computing Devices

Air Proving Ground Center, Eglin AFB, Fla.
TELEMAG - A SYSTEM FOR PROCESSING TEST DATA RECORDED ON MAGNETIC TAPE, by James L. Blilie. June 59, 77p. APGC-TN-59-21; AD-214 632.
Order from LC mi$4.50, ph$12.30 PB 143 290

This report describes Telemag, a system which is used to process test data which may have been recorded on magnetic tape in the test vehicle, telemetered to a ground station or the Telemag and recorded, or telemetered and fed directly to Telemag. The report also presents a brief review of some telemetry and magnetic tape data recording techniques. The last two chapters deal respectively with the actions to be taken by people to best utilize Telemag and plans for expanding the facilities and functions of Telemag.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SIMULTANEOUS EQUATION ROUTINES FOR THE ORDVAC AND EDVAC, by Bailey T. Wade. Mar 56, 66p. Memo. rept. no. 987.
Order from LC mi$3.90, ph$10.80 PB 128 524

Bell Telephone Labs., Inc. [New York]
LEPRECHAUN: A SOLID-STATE DIGITAL COMPUTER, by J. A. Githens and M. J. Gilmartin. Supplement to Summary engineering rept. for 1 May 57-1 Aug 58 on Tradic Computer Research (Second Stage), Contract AF 33(600)34977. 1 Dec 58, 460p. AD-208 622.
Order from LC mi$11.10, ph$69.60 PB 143 648S

The TRADIC second feasibility computer, better known as LEPRECHAUN, is a high-speed solid-state digital computer capable of solving complex weapons guidance control problems in real-time. The computer was designed and built to meet several definite objectives. Firstly, the computer was built to demonstrate the feasibility of direct-coupled transistor logic (DCTL) used in a system involving thousands of transistors. The machine also provides for the test and evaluation of a moderately large magnetic-core memory driven by transistors. It serves as a vehicle for the continuing study and evaluation of the operating characteristics and reliability of transistors in these techniques. Secondly, LEPRECHAUN was designed for use in programming and logical design research in the use of digital computers for military real-time control applications. To meet this last objective, the computer incorporates some novel features which permit extreme flexibility in the logical interconnections. This supplement gives complete details of the design and construction of the LEPRECHAUN computer. (See also PB 143 648)

Bell Telephone Labs., Inc. [New York]
TRADIC COMPUTER RESEARCH (SECOND STAGE) by J. A. Githens and M. J. Gilmartin. Summary engineering rept. for 1 May 57-1 Aug 58 on Contract AF 33(600)34977. 1 Dec 58, 398p. 62 refs. AD-208 621.
Order from LC mi$11.10, ph$60.60 PB 143 648

This report summarizes the program for the development of solid-state technology for airborne weapons-control computers. Among the major items covered are: encoding and decoding techniques; two forms of non-destructive program storage; a wide temperature range magnetic core memory system; silicon direct coupled transistor logic; organization of a computer as an aid in trouble location; and programming techniques for the protection of stored constants and error correction in the weapons-control computer.

International Telemeter Corp., Los Angeles, Calif.
DIGIT DETECTOR. Technical rept. no. 20 [on Contract AF 30(602)1566] 14 Nov 57, 41p. RADC-TN-58-10; AD-148 543.
Order from LC mi$3.30, ph$7.80 PB 143 282

Information is recorded on the glass disc as opaque or transparent marks in a photographic emulsion. The disc is rotated past a small scanning spot of light. The information is read by a photomultiplier tube (PMT) which catches the beam from the spot after passage through the emulsion. A transparent ("white") mark gives a high current and an opaque ("black") mark gives a low current. The Digit Detector accepts the sequence of high and low currents from the PMT and announces to the search-logic electronics what information the spot is seeing. The information is stored in the memory, as photographic opaque or transparent marks, essentially in a binary code. Hence the output of the Digit Detector will be a sequence of impulses representing the two binary characters 0 or 1. The search logic groups these into lots of six and identifies them as characters or other graphical symbols.

International Telemeter Corp., Los Angeles, Calif.
WORD LIST FOR MECHANICAL TRANSLATION SYSTEM, MARK I. Technical rept. no. 10 on Computer Set, General Information Data AN/GSQ-16 (XW-1) (Photoscopic Information Storage Unit), Contract

AF 30(602)1566. 20 Mar 57, 17p. RADC-TN-57-201; AD-114 496.
Order from LC mi$2.40, ph$3.30 PB 143 283

The report is divided into 3 parts as follows:
Fundamental considerations of word list preparation
Simulated translation
  Using University of Washington word list & orig. text
  Using modified University of Washington word list & original text
  Using modified University of Washington word list & technical text
Excerpts from word lists
  University of Washington word list
  Modified University of Washington word list

Naval Ordnance Test Station, China Lake, Calif.
AN INTRODUCTION TO LINEAR PROGRAMMING WITH APPLICATIONS TO DATA REDUCTION PROBLEMS, by Frank Reed. Dec 57, 42p. 8 refs. NOTS-1932; NAVORD rept. 5838.
Order from LC mi$3.30, ph$7.80 PB 143 341

This paper presents an introduction to the mathematical theory of linear programming. The material covered is sufficient to enable the applied mathematician to solve a great number of practical problems. As illustrations of the usefulness of the technique, two problems related to the field of data reduction are solved.

[Remington Rand Univac Div., Sperry Rand Corp., St. Paul, Minn.]
[COMPUTER SURVEY]. Bimonthly Progress rept. no. 5, pt. 1, 1 May-1 July 47, on Contract N6onr-240, T.O.I. [1947] 37p. 4 refs. AD-205 033.
Order from LC mi$3.00, ph$6.30 PB 143 778

[Remington Rand Univac Div., Sperry Rand Corp., St. Paul, Minn.]
[COMPUTER SURVEY]. Bimonthly Progress rept. no. 8, 1 Nov-31 Dec 47, on Contract N6onr-240(01). [1948] 15p. AD-205 017.
Order from LC mi$2.40, ph$3.30 PB 143 779

(See also PB 143 778)

[Remington Rand Univac Div., Sperry Rand Corp., St. Paul, Minn.]
LOGISTIC PAPERS. ISSUE NO. 5, by C. Tompkins and W. W. Stifler, Jr. Bimonthly progress rept. no. 18, app. 1 on Contract N6onr-240, T.O.1. 25 July 51, 46p. ATI-208 085.
Order from LC mi$3.30, ph$7.80 PB 143 876

Contents:
The general concept of usage factors - critical notes
Usage factors and operations parameters - an example
Determination of a safety allowance
A hypothetical special purpose computer for procurement control problems
Extracts from a cost analysis of various tankers

Rome Air Development Center, Griffiss AFB, N. Y.
ORTHOGONAL FUNCTIONS AS SIGNAL ELEMENTS, by Alfred Kobos. Jan 59, 17p. 5 refs. RADC-TN-58-363; AD-206 256.
Order from LC mi$2.40, ph$3.30 PB 139 089

The use of orthogonal elements for transmitting digital data with a coherent-type system is illustrated, using a set of Gaussian pulses as an example. This technique is shown to be theoretically capable of providing a great increase in signaling speed. The necessary requirements of such a system are discussed, outlining future work which must be accomplished.

MECHANICS

Brown U. Div of Applied Mathematics, Providence, R. I.
THE BURSTING SPEED OF A ROTATING PLASTIC DISC OF VARIABLE THICKNESS, by Marie Madden Smith. Technical rept. no. 35 on Contract Nonr-562(10). Apr 58, 25p. 10 refs. C11-35.
Order from LC mi$2.70, ph$4.80 PB 139 258

This paper presents a method for determining the bursting speed of a thin rotating disc of varying thickness made of a strain-hardening material. The method is based on Tresca's yield condition and flow law and neglects all elastic strains.

Brown U. Div. of Applied Mathematics, Providence, R. I.
LIMIT ANALYSIS OF CYLINDRICAL SHELLS USING APPROXIMATE YIELD CONDITIONS, by H. Cohen and R. T. Shield. Technical rept. no. 2 for Mar 58 on Basic Research in Analysis and Design of Shells, Contract DA 19-020-ORD-4564. Apr 58, 32p. 10 refs. Rept. DA-4564/2; AD-137 082.
Order from LC mi$3.00, ph$6.30 PB 143 868

The theorems of limit analysis are used to obtain close bounds for the limit loading in some problems of symmetrically loaded cylindrical shells. It is shown that a parabolic prism approximation to the exact yield surface is a more useful approximation than the sandwich shell polyhedron surface when appreciable axial force is present.

Fritz Engineering Lab., Lehigh U., Bethlehem, Pa.
BUCKLING OF UNIFORMLY COMPRESSED STEEL PLATES IN THE STRAIN-HARDENING RANGE, by Geerhard Haaijer. Progress rept. no. 20 on Welded Continuous Frames and Their Components, Contract [N7onr]-39303. Aug 56, 66p. 20 refs. Fritz Lab. rept. no. 205E.7.
Order from LC mi$3.90, ph$10.80 PB 130 015

The problem of buckling of steel plates compressed beyond the yield strain is treated. General expressions for the buckling strength are derived assuming the material to have become orthogonally anisotropic.

Institute of Flight Structures, Columbia U., New York.
ON VIBRATIONS OF CYLINDRICAL SHELLS OF ELLIPTIC CROSS-SECTION, by G. Herrmann and I. Mirsky. Technical note no. 5 on Contract AF 18(600)1247. Dec 57, 24p. 3 refs. CU-17-57-AF-1247-CE; AFOSR-TN-57-734; AD-136 721.
Order from LC mi$2.70, ph$4.80 PB 138 602

Frequencies of free vibration of thin elastic cylindrical shells of constant thickness and elliptic cross-section are determined for several modes of motion. It is shown that purely longitudinal motions, for small ellipticities, are governed by a Mathieu equation and that the square of the frequency of a slightly elliptic shell with semi-axes a and b is the arithmetic mean of the squares of the frequencies of 2 circular shells with radii a and b, respectively. Purely torsional motion appears to be uneffected by ellipticity, while purely transverse motion (breathing mode) does not exist in elliptic cylinders. Flexural motions are studied by energy methods. It is found that in the absence of nodal lines parallel to the generator, the ellipticity increases the frequency considerably for shells of like cross-sectional area. If cylindrical shells of like circumference, that is of like mass, are compared with one another, the influence of ellipticity is stronger.

Michigan U. [Research Inst.] Ann Arbor.
ON THE INFINITE ELASTIC, PERFECTLY PLASTIC WEDGE UNDER UNIFORM SURFACE TRACTIONS, by S. A. Murch and P. M. Naghdi. Technical rept. no. 11 on Contract Nonr-1224(01). Jan 58, 23p. 9 refs. 2150-11-T; AD-161 937.
Order from LC mi$2.70, ph$4.80 PB 138 250

This paper is concerned with both plane strain and plane stress solutions of the infinite elastic, perfectly plastic wedge (of included angle $0 < \beta < 2$) under uniform surface tractions, where Tresca's yield condition and its associated flow rules are employed. Following a detailed examination of the character of the initial yield, attention is confined to the class of problems where yielding occurs externally on one or both boundaries. Specifically, complete solutions are obtained for a wedge under uniform shear on one face in both states of plane strain and plane stress, in the light of which the symmetry of the stress tensor is also discussed.

Minnesota U., Minneapolis.
FATIGUE CRACK DETECTION METHODS. PART 2: REVIEW OF EXPERIMENTAL DATA ON THE INITIATION AND PROPAGATION OF FATIGUE CRACKS IN TEST SPECIMENS, by L. J. Demer. Rept. for Jan-Mar 55 on Materials Analysis and Evaluation Techniques, Contract AF 33(038)20840. June 55, 77p. 45 refs. WADC-TR-55-86, pt. 2; AD-75 478.
Order from LC mi$4.50, ph$12.30 PB 143 877

Current fatigue literature contains numerous references to a few recent studies in which fatigue cracks have been detected very early in the specimen life. This paper attempts to clarify such isolated observations by making a detailed review of the available experimental data in relation to crack initiation and growth in laboratory fatigue test specimens. The data are analyzed considering the nature of the test material, the character of the specimen, the stress level of the test, and the manner of testing.

Missouri U. Engineering Experiment Station, Columbia.
BASIC RESEARCH IN FORCE RELAXATION METHODS, by Adrian Pauw. Final technical rept. on Contracts DA 23-072-ORD-(818, 1050). June 58, 173p. 5 refs. AD-200 756.
Order from LC mi$8.10, ph$27.30 PB 143 259

Part 1. Solution of linear simultaneous equations by pivotal and stepped group-operator relaxation
Part 2. Solution of hinged space frames by the method of bar-force relaxation
Part 3. The use of pivotal and stepped-block relaxation patterns in the solution of difference and partial-difference equations
Part 4. Solution of polynomial equations

Polytechnic Inst. of Brooklyn, N. Y.
APPLICATIONS OF A CONSISTENT THEORY FOR STRAIN HARDENING PLASTIC SOLIDS, by Nicholas Perrone and P. G. Hodge, Jr. Rept. on Contract Nonr-839(11). Oct 57, 120p. 19 refs. PIBAL rept. 403.
Order from LC mi$6.00, ph$18.30 PB 138 857

A critical analysis of a kinematic model for hardening first suggested by Prager is given. Specific applications to the flexure of non-symmetric sandwich beams, the bending of circular and annular plates, and the axisymmetric loading of circular cylindrical shells are made.

Aerodynamics and Pneumatics

Arnold Engineering Development Center [Tullahoma, Tenn.]
A SMALL-SCALE FORCED-OSCILLATION DYNAMIC BALANCE SYSTEM, by C. J. Welsh and P. L. Clemens. Rept. on ARO, Inc. Contract AF 40(600)700 Sup. 6(58-1). June 58, 17p. 6 refs. AEDC-TN-58-12; AD-157 143.
Order from LC mi$2.40, ph$3.30 PB 143 274

A small-scale, forced-oscillation dynamic balance for measuring damping derivatives of models with one degree of freedom is described. Results of measurements of $C_{m_q} + C_{m_{\dot{\alpha}}}$ for a clipped-delta-wing-body configuration over a range of Mach numbers of 2.0 to 5.0 are given. The measurements are shown to be consistent and to follow the trend with Mach number as predicted by theory.

Cornell Aeronatuical Lab., Inc., Buffalo, N. Y.
RESEARCH ON ROTATING STALL IN AXIAL FLOW COMPRESSORS. PART II. ON THE SEPARATION OF THE UNSTEADY LAMINAR BOUNDARY LAYER, by R. A. Hartunian and F. K. Moore. Rept. on Contract AF 33(616)3558. Jan 59, 33p. 14 refs. WADC Technical rept. 59-75, Pt. 2; AD-216 302.
Order from OTS $1.00 PB 161 072

A theoretical study is made of the unsteady but nearly quasi-steady laminar incompressible boundary layer near separation. It is shown that near separation on an airfoil, say, the general problem divides into (1) a problem of unsteady perturbation with a separation point which, in the quasi-steady approximation, is fixed with respect to the wall and (2) a steady problem related to that of a moving wall. The singularity near separation is analyzed for the unsteady and moving-wall cases. It is concluded that in the former case, the separation criterion of vanishing wall shear applies, and in the latter case (and in general) separation occurs whenever shear and velocity simultaneously vanish. The Falkner-Skan analysis is extended to apply to the two fundamental problems. In the unsteady case a shift of separation point is calculated. In the moving-wall case, the point of zero shear, the point of maximum adverse pressure gradient, and the point of simultaneously zero velocity and shear are noted. The implications of the results of this study regarding the complete generality of the separation criterion cited above, as well as the potentialities of application of the results in the formulation of an approximate method for unsteady boundary-layer calculation, are discussed. (See also PB 151 948)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
INVESTIGATION OF TRANSITION CAUSED BY THE STOPPING OF A FLAT PLATE, by John C. Hegarty. Rept. on Contract AF 18(600)1014. June 58, 38p. 8 refs. Technical note BN-141; AFOSR TN-58-627; AD-162 157.
Order from LC mi$3.00, ph$6.30 PB 138 871

The present paper investigates the amplification of the small perturbation due to boundary-layer instability into discrete vortex lines and their subsequent distortion into a three-dimensional pattern. The intensification of the vortices and the three-dimensional distortion is believed to be a necessary step of the phenomena of transition from laminar to turbulent flow. The investigation was initiated because of criticism against the use of a trip wire as a means of promoting the process of amplification of the small perturbation. The results in many respects are in accord with those obtained from the trip wire.

Massachusetts Inst. of Tech., Cambridge, Mass.
INTRODUCTORY STUDY OF FLUTTER OF LOW-ASPECT-RATIO WINGS AT SUBSONIC SPEEDS, by Herbert M. Voss and Hermann J. Hassig. Rept. on Aero-Elastic and Structures Research, Contract NOas-51-109-c. 1 May 52, 103p. 36 refs. AD-144 729.
Order from LC mi$5.70, ph$16.80 PB 143 568

Acceleration potential methods and their application to the circular wing are reviewed. The flutter analysis and forced vibration of wings with circular and elliptical plan forms are outlined, pointed toward the design of an experimental model. An improved theory for low-aspect-ratio rectangular wings is given as well as an extension of low-aspect theory to include unsteady flow. The compressibility correction in subsonic flow is also considered.

Massachusetts Inst. of Tech., Cambridge.
ON SIMPLE WAVES IN PERFECT AND DISSOCIATING GASES: THEORY AND APPLICATIONS, by Haim Kennet. Rept. on Contract AF 18(600)961. Feb 58, 62p. 16 refs. Fluid Dynamics Research Group rept. 58-1; OSR Technical note no. 58-302; AD-154 212.
Order from LC mi$3.90, ph$10.80 PB 143 511

A theoretical method is developed for estimating aerodynamic loads on oscillating airfoils in dissociating flow, when the flow is in dissociative equilibrium. This procedure is based on a method of solution originally prepared by Lighthill for the case of a perfect fluid.

Michigan U. Research Inst., Ann Arbor.
THE DIFFRACTION OF SHOCK WAVES THROUGH OBSTACLES WITH VARIOUS OPENINGS IN THEIR FRONT AND BACK SURFACES, by Russell E. Duff and Robert N. Hollyer, Jr. Rept. on Contract N6onr-232, T. O. 4. 7 Nov 50, 57p. 3 refs. Rept. 50-3; ATI-94 435.
Order from LC mi$3.60, ph$9.30 PB 143 646

This report presents the results of a photographic investigation of shock-wave diffraction through models with various openings in their front and back surfaces. Also included is a discussion of a method for determining the strength of shock waves by measurements of limiting Mach configurations.

National Research Labs., Ottawa (Canada).
ORGANIZATION OF A LARGE COMPUTATION IN AIRCRAFT STRESS ANALYSIS, by A. L. M. Grzedzielski. July 59, 49p. 16 refs. Aeronautical rept. LR-257.
Order from LC mi$3.30, ph$7.80 PB 143 577

Theoretical and organizational aspects of a large scale numerical stress analysis covering effects of applied loads and uneven temperature are discussed, using the example of a swept multi-spar model box for which experimental data are available. A large scale computation, actually performed during the design of a prototype aircraft, is described.

Naval Ordnance Lab., White Oak, Md.
TIME LAGS DUE TO COMPRESSIBLE-POISEUILLE FLOW RESISTANCE IN PRESSURE-MEASURING SYSTEMS, by J. M. Kendall. 2 May 50, 38p. 16 refs. Memo. no. 10677.
Order from LC mi$3.00, ph$6.30 PB 143 867

In the development of the aerodynamic features of a missile in the supersonic wind tunnel, many pressure measurements must be made. It is frequently found that the response time of the pressure-measuring systems is too great, especially when the measurements are made in an intermittent supersonic wind tunnel. The time response of pressure-measuring systems is basically analyzed in this report for the case where compressibility and viscosity are predominating factors.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
A SUMMARY OF EXPERIMENTS WITH SLOTTED TRANSONIC INSERTS IN THE NAVAL SUPERSONIC WIND TUNNEL, by Eugene E. Covert. Apr 58, 77p 25 refs. Technical rept. 207.
Order from LC mi$4.50, ph$12.30 PB 143 871

The calibration of the transonic nozzle blocks for the Naval Supersonic Laboratory Wind Tunnel indicates that the useful Mach number range is between 0.5 and 1.30 and that the distribution is relatively uniform. These results were obtained with a calibration pole and are expected to hold for all bodies of revolution of length twelve inches or less and winged bodies whose span is eight inches or less. The measurements indicate that for bodies with a blocking area up to one and one half percent of the tunnel area, the slots deblock as expected by the theory. Further, models with a length of two-thirds of the tunnel height or less, and whose span is forty-five percent of the tunnel height or less, may be tested on a development basis, provided a suitable correction is made for a flow inclination. Some auxiliary results are given which help explain the phenomena encountered in slotted tunnels.

Ohio State U. Research Foundation, Columbus.
CRITICAL PERFORMANCE PARAMETERS OF AN INTERMITTENT HIGH-PRESSURE FREE-JET SUPERSONIC WIND TUNNEL, by J. D. Lee and G. L. Von Eschen. Final rept. on Contract W33-038-ac-21683. 31 July 54, 117p. 12 refs. AD-46 137.
Order from LC mi$6.00, ph$18.30 PB 143 498

The flows from the nozzles of the free-jet, supersonic wind tunnel were calibrated. The performance of the wind tunnel while operating with long free jets was satisfactory. The internal growth of the viscous boundary was not excessive at any Mach number so that a core of usable size is available for testing with a second test region. No difficulty was experienced in starting the tunnel with free jets of the maximum length. The operation of the tunnel was theoretically analyzed by a 1-dimensional injector theory, and the results compared favorably with experimental measurements. The use of an adjustable diffuser resulted in very small changes in the operating efficiency of the tunnel. The optimum diffuser shape was deduced to be a constant-area duct followed by a diverging (subsonic) diffuser section. The only useful function of the adjustable diffuser appeared to be that of controlling the ratio of the test chamber pressure to the nozzle exit pressure. The components of the air supply and control system were judged to be satisfactory. Oscillograph records show that the control system allows the stagnation pressure to be held generally within less than 1% of a preselected value over the period of the test.

Polytechnic Inst. of Brooklyn, N. Y.
SOME HEAT TRANSFER PROBLEMS IN HYPERSONIC FLOW, by Antonio Ferri. Rept. on Contract AF 49(638)445. July 59, 61p. 13 refs. PIBAL rept. no. 473; AFOSR-TN-59-806.
Order from LC mi$3.90, ph$10.80 PB 143 600

The curved shock waves associated with blunt bodies at hypersonic velocity produce large entropy gradients and therefore large shear flows which interact with the boundary layer. In this paper the effects of this shear flow are discussed for the case of axially symmetric and two-dimensional flow fields and for low and high Reynolds number of flight. Approximate methods of heat transfer analysis are presented for the case of laminar boundary layer in the presence of a shear flow with a cold wall and in the case of zero pressure gradient. Results of an experimental investigation on the effects of interaction between external flow and laminar turbulent heat transfer and/or the effect of shear flow on transition are also presented. The experimental results show that these are large effects and important for practical applications.

Polytechnic Inst. of Brooklyn, N. Y.
THE THREE-DIMENSIONAL COMPRESSIBLE LAMINAR BOUNDARY LAYER, by Melvin Epstein. Rept. on Contract AF 49(638)217. Oct 58, 84p. 30 refs. PIBAL rept. no. 455; AFOSR-TN-58-894; AD-204 135.
Order from LC mi$4.80, ph$13.80 PB 143 510

A method is presented for determining approximate solutions to the three-dimensional compressible laminar boundary layer equations. The proposed method resembles the classical integral method in certain respects. It is designed, however, to overcome one of the principal difficulties associated with integral method, namely the problem of choosing appropriate analytical representations of the boundary layer profiles. This difficulty is magnified in the three-dimensional problem where an additional profile must be specified. In such cases it is desirable that a means of automatically choosing a set of profiles, which are appropriate to the problem at hand, be available. This is accomplished, in the present method, by means of an iteration procedure wherein improved approximations to the boundary layer profiles are generated from a set of simple initial profiles.

Technische Hochschule, Munich (West Germany).
THE NUMERICAL SOLUTION OF BOUNDARY-VALUE PROBLEMS FOR CERTAIN HYPERBOLIC LINEAR DIFFERENTIAL EQUATIONS, by Hans J. Stetter. Technical note no. 7 on Contract AF 61(514)1080. 24 Apr 59, 38p. 10 refs. AFOSR-TN-59-673; AD-218 385.
Order from LC mi$3.00, ph$6.30 PB 143 164

A detailed investigation is given of procedures yielding a numerical solution of certain boundary-value problems of a linear partial differential equation related to the wave equation. After the statement of the problem and the presentation of some analytic results the characteristic system of the equation is transcribed into a system of difference equations in a characteristic grid, using an ADAMS-interpolation difference scheme. It is shown how these difference equations may be conveniently solved in each point of the grid. A method is presented to take care of discontinuities in the boundary data. The numerical procedures necessary to get the computations on the difference equations started are also described.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
SCATTERING OF SURFACE WAVES ON AN IDEAL FLUID, by Harold Levine and Eugene Rodemich. Technical rept. no. 78 on Contract Nonr-225(11). 14 Oct 58, 65p. 10 refs.
Order from LC mi$3.90, ph$10.80 PB 143 336

California U., Los Angeles.
AN EXPERIMENTAL STUDY OF ACOUSTICALLY INDUCED CAVITATION, by William J. Galloway. Technical rept. no. 7 on Contract N6onr-275(07). Nov. 53, 62p. 27 refs.
Order from LC mi$3.90, ph$10.80 PB 143 218

California U., Los Angeles.
STUDY OF ACOUSTIC STREAMING, by Herman Medwin. Technical rept. no. 8 on Contract N6onr-275(07). Dec 53, 68p. 20 refs.
Order from LC mi$3.90, ph$10.80 PB 143 214

David Taylor Model Basin, Washington, D. C.
MOTION OF RIGID AND FLUID SPHERES IN STATIONARY AND MOVING LIQUIDS INSIDE CYLINDRICAL TUBES, by W. L. Haberman and R. M. Sayre. Oct 58, 68p. 30 refs. Rept. no. 1143.
Order from LC mi$3.90, ph$10.80 PB 138 641

This report considers the problem of steady, axial translation of rigid and fluid spheres in stationary and moving viscous, incompressible fluids bounded by an infinitely long cylinder. The investigation is based on Stokes' approximation for the hydrodynamic equations for slow flow. An exact and an approximate solution for the motion of rigid spheres are obtained. For fluid spheres (consisting of a fluid of different physical property than the external medium and having internal motion) an approximate solution is obtained. In general, the results show that the wall effect for fluid spheres is less than for corresponding rigid spheres. Streamlines and velocity distributions for several cases where the diameter ratio is 0.5 are compared with those in an infinite medium.

METALLURGY

Battelle Memorial Inst., Columbus, Ohio.
THE DEVELOPMENT OF CHROMIUM-BASE HEAT-RESISTANT ALLOYS, by J. M. Blocher, Jr., I. E. Campbell and others. Rept. on Contract AF 33(616)48. Jan 54, 170p. 30 refs. WADC Technical rept. 53-470; AD-31 248.
Order from LC mi$7.80, ph$25.80 PB 143 650

A study was made of the mechanical properties of high-purity Cr prepared by the thermal decomposition of CrI_2. Modification of the iodide-decomposition process led to the preparation of Cr containing less than 150 ppm of total impurities. A rough correlation of as-deposited iodide Cr hardness with total metallic-impurity content was obtained which shows a minimum hardness in the range of 500 to 1000 ppm. Chromium sheet, suitable for testing in bending, was made by arc melting iodide Cr and rolling the resultant ingots at 700°C. Rolling in air without sheathing or other special precautions produced sheet free of cracks. Many samples showed bend ductility at -25°C, although brittle failure occurred in all room-temperature tensile tests. Additions of controlled amounts of impurities were made to determine the compositional factors affecting the room-temperature ductility of Cr. The elements most detrimental were Ni (above 0.2%), and C and S (each in quantities over 0.015%). Fe and Si were not especially harmful up to about 0.2%. Variations in O content from about 60 to 3000 ppm had no effect on the bend ductility. Sheet for bend testing with less than 60 ppm of O could not be obtained without additions of C. It is possible that a sharp increase in ductility occurs at a lower O concentration, as is the case for Mo. Ni had little effect on the bend ductility in quantities above the lowest attained (10 ppm).

Fansteel Metallurgical Corp., North Chicago, Ill.
INFORMAL MONTHLY PROGRESS REPORT TO NEPA PROJECT [FOR OCTOBER 21-NOVEMBER 20, 1948] by Ralph Wehrmann. 23 Nov 48, 10p. NEPA 831-FAN-17; AD-203 994.
Order from LC mi$1,80, ph$1.80 PB 138 318

(See also PB 138 315)

Massachusetts Inst. of Tech., Cambridge.
PERIODIC STATUS REPORT NO. 25, by L. Rubin, M. Yim and others. Rept. for 1 Aug-31 Oct 58 on Contract Nonr-1841(28). [1958] 3p.
Order from LC mi$1.80, ph$1.80 PB 143 222

Contents:
Solid solution strengthening
Ductility-and-creep-rupture properties of nickel
Resistivity changes during creep of aluminum alloy
An investigation of high temperature behavior of austenitic stainless steels
(See also PB 140 626)

Naval Ordnance Plant, Indianapolis, Ind.
IMPROVING VANASIL HIGH SILICON ALUMINUM ALLOY BY PHOSPHOR COPPER MODIFICATION, by J. C. Wagner. 16 Feb 55, 24p. 10 refs. Materials rept. no. 40.
Order from LC mi$2.70, ph$4.80 PB 143 893

The addition of a small amount of dilute phosphor copper to Vanasil exerts a powerful influence in reducing silicon particle size and segregation. Modification by phosphor copper offers several advantages as contrasted to modification by sodium or sodium salts. The advantages are: reliability and ease of control, ability to be effective throughout the duration of a melt held molten at least two and one half hours, and ability to be effective when the alloy is remelted.

Research Inst., Temple U., Philadelphia, Pa.
HIGH TEMPERATURE PROJECT, by A. V. Grosse and J. B. Conway. Progress rept. no. 6, 1 Jan-1 July 52, on Contract N9onr-87301. 1 July 52, 16p. 1 ref. AD-135 203.
Order from LC mi$2.40, ph$3.30 PB 143 758

The studies concerned with the operation of powdered metal-oxygen torches, have been extended to various other powdered metals and alloys as follows: Aluminum, Magnesium, Manganese, Silicon, Calcium Carbide, Silicon Carbide, Calcium-Silicon, Zirconium-Silicon and Aluminum-Silicon. (See also PB 132 012)

Watertown Arsenal Labs., Mass.
HOT HARDNESS AND TENSILE PROPERTIES OF STAINLESS STEEL TYPE 304, TITANIUM ALLOY Ti-150A, AND SAE 4140 STEEL AT 300° AND 600°F, by Anthony K. Wong and George Gazza. July 59, 36p. 19 refs. Technical rept. no. WAL TR 116/2.
Order from LC mi$3.00, ph$6.30 PB 142 893

Hardness tests were made in modified Rockwell and Brinell machines equipped with a resistance-heated furnace. Tensile tests were conducted at strain rates of 0.1 and 0.5 inch per second. Tensile specimens were rapidly heated by an induction coil and held at temperature for one minute prior to application of load.

Watertown Arsenal Labs., Mass.
HOT-PRESSED AND ROLL-REDUCED COMPACTS OF ALLOY Ti-6%Al-4%V POWDER RECOVERED FROM WROUGHT METAL SCRAP, by S. V. Arnold. June 59, 25p. WAL TR-405.7/1; AD-217 828.
Order from LC mi$2.70, ph$4.80 PB 143 665

Massive scrap of alloy Ti-6%Al-4%V was embrittled with hydrogen and comminuted to powder of metallurgical quality. Compacts of this powder, hot-pressed to theoretical density approximated the original composition but showed equivalent strength and somewhat lower ductility. Compacts hot-roll-reduced developed higher strengths and ductility than the commercial mill-annealed wrought metal.

Ferrous Metals

Douglas Aircraft Co., Inc. [El Segundo, Calif.]
THE INFLUENCE OF EXTRANEOUS ELEMENTS IN D. C. ARC SPECTRA OF FERROUS ALLOYS, by Darwin P. Jensen and J. F. Young. Rept. on Emission Spectroanalytical Procedures, Contract AF 33(038) AF 33(038)23304. July 52, 42p. 15 refs. WADC Technical rept. 52-168; ATI-173 043.
Order from LC mi$3.30, ph$7.80 PB 139 068

The influence of one alloying element upon the spectral line intensity of any other alloying element was subjected to investigation in the D. C. Arc. The study was carried out by making homogeneous metallic alloys in an induction furnace. Manganese, silicon, nickel, chromium, molybdenum, vanadium, aluminum and copper were used as the alloying elements in an iron matrix, with percentage magnitudes commonly found in low alloy steels.

Illinois U., Urbana.
INVESTIGATION OF THE CRYSTALLOGRAPHY OF DIFFUSIONLESS PHASE CHANGES IN STEEL, by C. M. Wayman. Summary rept. on Contract AF 18(600)1311. 31 Aug 58, 10p. 13 refs. Rept. 20-AF; AFOSR [TR]-58-121; AD-202 922.
Order from LC mi$1.80, ph$1.80 PB 138 654

A summary of previous publications by technical societies by the authors on martensitic types of phase transformations in metals.

Metals Research Lab., Case Inst. of Tech., Cleveland, Ohio.
INVESTIGATION OF SIGNIFICANT PROPERTIES AND CHARACTERISTICS OF COLD WORKED STEEL. Technical rept. no. 2 on Contract W33-019-ORD-6339. 31 Aug 48, 46p. 29 refs. WAL rept. no. 310/90-8.
Order from LC mi$3.30, ph$7.80 PB 143 760

The change in the mechanical properties upon cold working forms a general curve for all steels. The rate of change is high from 0 to 20 per cent reduction, levels off for reductions from 20 to 60 per cent and increases again for reductions above 60 per cent. The variables such as carbon content and heat treatment before cold working seem to have little affect upon the rate of change of properties. The effect of these variables is merely to displace the properties after cold working by an amount which is consistant with the changes before cold working.

Metals Research Lab., Case Inst. of Tech., Cleveland, Ohio.
INVESTIGATION OF SIGNIFICANT PROPERTIES AND CHARACTERISTICS OF COLD WORKED STEEL: A COMPARISON OF THE MECHANICAL PROPERTIES OF COLD DRAWN STEEL BARS WITH A HEAT TREATED 4410 STEEL BAR. Technical rept. no. 23 on Contract DA 33-019-ORD-585. Jan 53, 17p. WAL rept. no. 310/90-80.
Order from LC mi$2.40, ph$3.30 PB 143 759

The 4140 steel heat treated to a tensile strength of 132,000 psi showed very high ductility, high impact energy, low transition temperature, was notch insensitive and was only slightly anisotropic. As compared to the cold worked steels, the heat treated steel showed higher mechanical properties in all the tests made in this investigation (i.e., longitudinal and transverse tensile, V-notched Charpy impact, and notched tensile tests). (See also PB 143 760)

Naval Weapons Plant, Washington, D. C.
INVESTIGATION OF THE EFFECT OF HYDROGEN EMBRITTLEMENT AND ITS RELIEF IN PHOSPHATE COATED AISI 4340 AND 1095 STEELS, by

P. H. Austin, S. V. Chek and Wm. Lurie.
12 Aug 59, 33p. 5 refs. NWPW-T-20-59; NAVORD rept. no. 6509.
Order from LC mi$3.00, ph$6.30 PB 143 424

The effect of hydrogen embrittlement resulting from the phosphate coating of AISI 4340 and 1095 steels, at various hardness levels, was investigated by the use of sustained load (ring) tests made at 80% of the uncoated notch breaking strength of the steels for corresponding hardnesses.

Nonferrous (except light) Metals

Armour Research Foundation, Chicago, Ill.
MEASUREMENT OF THE HEAT CAPACITY AND DENSITY OF LIQUID COPPER, by J. I. Lang. Rept. for 1 July 56-30 June 57 on Contract AF 33(616)3795. Nov 57, 23p. 1 ref. WADC Technical rept. 57-488; AD-142 138.
Order from LC mi$2.70, ph$4.80 PB 143 647

The density and specific heat of molten electrolytic tough-pitch copper meeting Federal Specification QQ-C-576 was determined for the temperature range 2000 to 4000°F.

Illinois Inst. of Tech., Chicago.
A STUDY OF ORDER IN Au_3Cu, by Francois d'Heurle (Doctoral thesis) and Paul Gordon. Technical rept. no. 2 on Contract Nonr-1406(03). Oct 58, 104p. 53 refs.
Order from LC mi$5.70, ph$16.80 PB 143 246

Isothermal jacket microcalorimeters have been built to study the evolution of small quantities of heat occurring over long periods of time at low temperature. The calorimeters have been used for the study of the order-disorder transformation of Au_3Cu. The critical temperature is 209-2°C. The total enthalpy change between a completely ordered and a completely disordered sample is estimated to be 375 calories per mole. At 100°C, in a quenched sample the rates of ordering can be more than a thousand times greater than would be calculated on the basis of the rates observed at 190°C.

New York U., N. Y.
RADIOTRACER STUDIES OF METAL - METAL ION EXCHANGE. I. CADMIUM, by Cecil V. King and Robert Skomorski. Technical rept. no. 1 on Contract DA 30-069-ORD-1682. Feb 58, 31p. 21 refs. AD-154 799.
Order from LC mi$3.00, ph$6.30 PB 143 453

The rate and extent of exchange between cadmium and its own ions in solutions of cadmium perchlorate has been studied by using radioactive Cd^{115} as a tracer. It was not found possible to measure the "exchange current" i_0, which would represent the actual rate of exchange at the metal surface. Instead, surface equilibrium appears to be reached within a few minutes, and the continuing pickup of activity to be controlled by grain-boundary diffusion within the metal. By comparison with lattice diffusion coefficients in the literature by the method of Fisher, grain boundary diffusion coefficients have been estimated from experiments at room temperature and at 98°C.

Structural Metallurgy and Corrosion

Armour Research Foundation, Chicago, Ill.
A STUDY OF HIGH TENSILE BRASSES. Final rept. for 20 Apr 56-28 Feb 58 on Contract NObs-72136. 31 Mar 58, 89p. 13 refs. AD-162 371.
Order from LC mi$4.80, ph$15.30 PB 143 937

Effects of composition, constitution, and past history on the fracture characteristics (particularly stress-corrosion susceptibility) of two high tensile brasses (manganese bronzes). Stress-corrosion and stress-rupture tests in 3% salt water were run. In the base wrought alloy (46B15e) the only cases where stress corrosion susceptibility was observed were those where only β phase was present. The casting alloy (SAE 430B) and its compositional modifications were sensitive to stress-corrosion cracking. This susceptibility is enhanced as the zinc content is increased or as the processing temperature is raised.

Bureau of Ships, Washington, D. C.
STATISTICAL PLAN FOR THE EXPERIMENT ON CORROSION BY H_2O AND O_2 IN ISOPROPYL BIPHENYL, by A. Lieberman. 16 Oct 56, 8p. 3 refs. Rept. no. 310B-28R1; AD-144 980.
Order from LC mi$1.80, ph$1.80 PB 138 630

To determine if corrosion of fuel cladding materials is accelerated by H_2O and O_2 in isopropyl biphenyl.

Columbia U., New York.
EFFECTS OF GASEOUS AND LIQUID ENVIRONMENTS ON THE BRITTLE FRACTURE OF ZINC SINGLE CRYSTALS, by L. C. Weiner. Rept. on Contract AF 18(600)898. 29 Aug 57, 7p. 20 refs. AFOSR-TN-57-553; AD-136 537.
Order from LC mi$1.80, ph$1.80 PB 130 241

The effects were studied of solid environments on the brittle fracture of Zn single crystals. Results are given of gaseous and liquid environments on cleavage strength. N, H, He, and CO_2 did not react with the Zn crystals to produce a surface coating and did not effect σ_F, the normal fracture stress. HCl and H_2S reacted to form a uniform, adherent surface layer of $ZnCl_2$ and ZnS, respectively. The films were of sufficient thickness to cause an increase in σ_F of the same order of magnitude as that of initially coated specimens. An O atmosphere increased σ_F similar to that noted with coated crystals, but no coating was visible. However, specimens treated in an O atmosphere and subsequently etched in dilute HNO_3 gave a value of σ_{FM} (mean value) of 2475 psi. A ZNO surface film of sufficient thickness was formed to cause this large increase in σ_F. A gaseous or liquid environment will only increase the cleavage strength of initially clean Zn single crystals, when the medium reacts to form an adherent surface film of a thickness greater than a few hundred angstroms.

Container Labs., Inc., Washington, D. C.
EVALUATION OF VOLATILE CORROSION INHIBITORS FOR PRESERVATION AND PACKAGING. PART I. LITERATURE SURVEY AND PRELIMINARY INVESTIGATION, by Gordon S. Mustin. Rept. on Contract DA 18-108-CML-6424. 20 Jan 58, 87p. 216 refs. Rept. no. 9927.
Order from LC mi$4.80, ph$13.80 PB 143 295

The objective of this Part I study is to assemble, review, and evaluate published literature and military agency reports, as well as current work in progress, as available, with a view to determining additional investigations required to evaluate specific applications to Chemical Corps equipment.

Defense Metals Information Center, Battelle Memorial Information Center, Columbus, Ohio.
TITANIUM ALLOYS FOR HIGH-TEMPERATURE USE STRENGTHENED BY FIBERS OR DISPERSED PARTICLES, by J. W. Holladay. Rept. on Contract AF 18(600)1375. 31 Aug 59, 79p. 20 refs. Rept. 117.
Order from OTS $2.00 PB 151 073

Available data are reviewed on heterogeneous structures of titanium in which the titanium matrix is reinforced by a dispersion of metal fibers or particles. Fiber reinforcement offers promise for improving the shorttime strength and modulus of elasticity in the temperature range of 1000 to 1400 F. It has been demonstrated that titanium can be strengthened by dispersion hardening and by fiber reinforcement, although the best conditions have not yet been fully established.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
ETCH PATTERNS IN ZINC, by Victor V. Damiano and Marvin Herman. Interim rept. on Contract AF 18(600)1581. July 59, 24p. 4 refs. Rept. no. I-A1878-3; AFOSR-TN-59-133; AD-210 861.
Order from LC mi$2.70, ph$4.80 PB 143 674

Loops and spiral etch patterns were observed on surfaces parallel or nearly parallel to the basal plane of zinc. These observations have been tentatively interpreted as the dissolution of a step in the surface with the end of the steps pinned.

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnott. Progress rept. no. 4. Nov 1948, 8p. NEPA 846-MIC-4; AD-204 942.
Order from LC mi$1.80, ph$1.80 PB 138 947

Portions of this report are illegible.

Naval Engineering Experiment Station, Annapolis, Md.
EVALUATION OF CORROSION RESISTANCE OF CHROMIUM BASE ALLOYS TO HIGH TEMPERATURE GASES FROM RESIDUAL FUELS, by Henry W. Schab and Frank R. Gessner, Jr. 11 Feb 57, 42p. 1 ref. Research and development rept. 070312D.
Order from LC mi$3.30, ph$7.80 PB 143 873

The corrosion resistance of several chromium alloys to high temperature gases was determined by burning residual type fuels in small atmospheric combustors and full-scale pressurized gas turbine type combustors. Tests show that the corrosion attack on these alloys, by combustion products of the residual fuels burned to produce temperatures of 1600° and 1700°F, was less than that suffered by the base line material, AISI 310 (25% Cr - 20% Ni) alloy.

Naval Engineering Experiment Station, Annapolis, Md.
OIL-ASH CORROSION RESISTANCE OF THREE CHROMIUM-ALUMINUM-IRON ALLOYS, by W. B. Ennis. 9 Dec 57, 10p. 3 refs. Letter rept. no. 070312E.
Order from LC mi$1.80, ph$1.80 PB 143 874

The three alloys tested in the microburner rigs indicated good corrosion resistance to oil-ash products, when compared to the 310 alloy.

Naval Ordnance Lab., White Oak, Md.
TENSILE PROPERTIES OF MICROSHRINKAGE-GRADED AZ-63 MAGNESIUM ALLOY, by I. J. Feinberg and J. D. Grimslev. 11 Mar 58, 37p. 3 refs. NAVORD rept. 6074.
Order from LC mi$3.00, ph$6.30 PB 143 761

A determination of tensile properties related to the degree of the defect obtained in radiographic classification is described. Expected minimum properties for AZ-63 casting material containing six degrees of microshrinkage are presented.

Powder Metallurgy Lab., Rensselaer Polytechnic Inst., Troy, N. Y
CEMENTED CARBIDE COMPOSITION CONTAINING NON-STRATEGIC METALS AS BINDERS, by F. V. Lenel and M. F. Hoffman. Final rept. on Contract NObs-55219. June 54, 120p. 11 refs.
Order from LC mi$6.00, ph$18.30 PB 143 645

Cemented carbides of the compositions 90 WC - 10 Co, 90 WC - 10 Ni and 90 WC - 10 Fe were sintered (a) conventionally without the application of pressure during sintering, (b) by passing an electric current through the samples and simultaneously applying pressure. Cemented carbides of the compositions 82 WC - 8 TiC - 10 Co, 82 WC - 8 TiC - 10 Ni and 82 WC - 10 TiC - 10 Fe were resistance sintered under pressure. Cutting tool inserts were prepared from the resistance sintered carbide samples. Among the three compositions, the one with cobalt was superior to the one with iron, which in turn was superior to the one with nickel. The solubility of WC in nickel at 2400°F

appears to be 12% by weight; of WC in cobalt at 2375°F was more than 14 weight percent; of WC in an alloy of 60 percent iron 40% nickel at 2300°F as approximately 5 weight percent.

Rock Island Arsenal Lab., Ill.
THE EFFECT OF PROLONGED AND EXCESSIVE HEATING ON PETROLATUM RUST PREVENTIVES, by R. E. Johnson. Rept. no. 16 on Rust Preventives, Development of New Improved Test Methods. 15 Nov 51, 25p. 2 refs. RIA Lab. no. 51-4542.
Order from LC mi$2.70, ph$4.80 PB 143 869

Apparently prolonged and excessive heating does not have an appreciable effect on the protective properties of the Petrolatum Type Rust Preventives, as panels coated with the materials after heating passed the protection requirements of the specification as well as the original materials. A definite increase in acidity was noted throughout the heating period, however, any deleterious effects this may have had was not evident in the protective ability of the materials as far as accelerated tests were concerned.

Rock Island Arsenal Lab., Ill.
WATER DISPLACING RUST PREVENTIVES. III: WATER STABILITY, DILUTION AND DISPLACEMENT FROM RUSTED SURFACES, by D. Bootzin. Rept. no. 12 on Rust Preventives, Development of Improved Test Methods. 25 Jan 50, 47p. 4 refs. RIA Lab. no. 50-79.
Order from LC mi$3.30, ph$7.80 PB 143 870

A water stability test, employing unrusted panels, combining water displacement and water stability was developed and recommended to replace the current AXS-1759 water displacement test. Dilution of rust preventives proved important in determining the factor of safety provided by manufacturers in insuring water displacement action and as a reflection of the amount of additive used in their product. A dilution test was recommended to be incorporated in the next specification revision. The water displacement test recommended was found to be more selective than one employing rusted surfaces since poor or borderline materials could not be detected on rusted specimens. Water displacing rust preventives apparently displaced water and arrested further rusting dependent on the inherent protective characteristics of the compound.

Rutgers State U. Coll. of Engineering, New Brunswick, N. J.
ON THE MECHANISM OF RECRYSTALLIZATION OF ALUMINUM, by Sigmund Weissmann. Technical rept. no. 10 on Contract Nonr-404(09). Aug 58, 36p. 28 refs.
Order from LC mi$3.00, ph$6.30 PB 143 294

In 99.998% aluminum recrystallized grains were shown to be the product of preferential subgrain growth whereby subgrains subtending large disorientation angles with respect to their neighbors exhibited the highest velocity of growth.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Harvard U., Cambridge, Mass.
THE HALF-LIFE OF THE METASTABLE LEVEL $A^3\Sigma$ OF THE NITROGEN MOLECULE, by O. Oldenberg. Final rept. for 1 Dec 55-31 Dec 56 on Contract Nonr-1866(08). 1 Oct 57, 10p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 138 901

Elementary Particles

Maryland U., College Park.
ON THE LEPTONIC DECAY MODES OF K-MESON, by K. Chadan and S. Oneda. Rept. on Contract AF 49(638)24. Aug 59, 11p. 12 refs. Physics Dept. Technical rept. no. 151; AFOSR-TN-59-877.
Order from LC mi$2.40, ph$3.30 PB 143 639

Michigan U. [Research Inst.] Ann Arbor.
NOTE ON THE PAIS-PICCIONI EXPERIMENT, by K. M. Case. Technical rept. on Contract Nonr-1224(15). Mar 56, 17p. 5 refs. 2457-1-T.
Order from LC mi$2.40, ph$3.30 PB 127 864

Two experiments to check the Gellmann-Pais "particle mixture" suggestion are analyzed, using a detailed, if crude, phenomenological description. A cloud-chamber experiment of the type proposed by Pais and Piccioni is compared to an experiment using a liquid-xenon bubble chamber. It is found that for likely values of the parameters involved, both experiments are considerably more difficult than envisaged by Pais and Piccioni. For intensity reasons, the bubble-chamber experiment seems preferable. However, unless quite accidentally the relevant cross sections have rather special values, it would seem that experiments of this type would have to wait until accelerators are available capable of producing considerably greater intensities than those in operation at present.

Instruments and Installations

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DESIGN AND CONSTRUCTION OF A GASEOUS XENON PARTICLE DETECTOR, by Raymond H. Kelly. May 59, 17p. 7 refs. WADC Technical note 59-103; AD-216 088.
Order from OTS $0.50 PB 161 069

The techniques for building stable, demountable, gaseous xenon particle detectors are describe. The aspects of design, construction, and use which are most apt to be troublesome are considered in detail.

Spectra obtained with U^{235}, Po^{231}, and Po^{210} alpha sources (from detectors constructed by these techniques) are displayed.

National Bureau of Standards, Washington, D. C.
PHOTOGRAPHIC DOSIMETRY AT TOTAL EXPOSURE LEVELS BELOW 20 mr, by Margarete Ehrlich and William L. McLaughlin. Oct 59, 26p. Technical note 29.
Order from OTS $0.50 PB 151 388

Assemblies of commercial photographic material sandwiched between two plastic scintillators can be used to measure high-energy X- or gamma-ray exposures down to 1 mr and less. The energy dependence of the assemblies' response is much less than that of a conventional photographic dosimeter, in some instances allowing an exposure interpretation with an accuracy of ±25 percent over the energy range from about 0.1 Mev to 1.25 Mev. However, low-intensity reciprocity failure limits the range of applicability of the system. Conventional photographic dosimeters, not incorporating scintillators, are usually preferable for routine personnel dosimetry. By extending the monitoring period, it may be possible to avoid personnel dosimetry below 20 mr entirely. However, by doing this, one introduces additional difficulties because of instabilities in the photographic image. In some instances, an increase in effective emulsion thickness, achieved by using stacks of identical films, may lead to an increase in emulsion sensitivity sufficient to extend the useful range of a film badge well below 20 mr, without the use of a scintillator.

Quartermaster Research and Engineering Center, Natick, Mass.
GROUND ZERO LOCATORS, by J. D. Loconti, H. W. Coles, and C. D. Thron. 1 Nov 56, 16p. 2 refs. Research rept. High Polymer series no. 7.
Order from LC mi$2.40, ph$3.30 PB 139 015

One of the problems of defense in the event of atomic warfare is the accurate pinpointing of ground zero of an atomic explosion. Since atomic explosions cause destruction on such a vast scale in contrast to conventional explosives, it will not be readily apparent where a bomb has been dropped. The types of destruction surrounding zero point will vary with distance, and the type of rescue operations needed will depend upon the nature of the destruction. Thus a rapid determination of zero is critical to a well-planned fire fighting and rescue operation.

Nuclear Engineering and Power

Convair, Fort Worth, Tex.
CALIBRATION OF THE ASTR, by J. C. Nance. Rept. on Contract AF 33(600)32054. 1 Nov 57, 139p. 7 refs. NARF-57-48T; FZK-9-090.
Order from LC mi$6.90, ph$21.30 PB 143 872

The Aircraft Shield Test Reactor (ASTR) is a one megawatt Convair-built reactor designed primarily to provide a radiation source for airborne shielding studies related to the Aircraft Nuclear Propulsion project. This is a summary report on the early experiments performed with the ASTR. The purposes of the experiments were in general: (1) To assemble all reactor components into an operating system (minus fissionable material) and establish the operational integrity of the system prior to the critical experiment. (2) To perform the critical experiment and determine the controllability of the reactor under idealized conditions. (3) To establish (by a series of low power experiments) the important nuclear characteristics of the reactor and shield system. (4) To establish an absolute low power calibration of the reactor and associated instrumentation. (5) To determine (by the thermal calibration method) the linearity of reactor instrumentation at high powers as compared to low power calibration. Results of the above experiments have proven the adequacy of the reactor system from the standpoint of safety, operability, and reliability.

Naval Research Lab., Washington, D. C.
HEAT-TRANSFER STUDIES ON A FORCED CONVECTION LOOP WITH MONOISOPROPYLBIPHENYL, by J. P. Stone, C. T. Ewing and others. Final rept. 21 Nov 58, 16p. 9 refs. Rept. 5225.
Order from OTS $0.50 PB 151 159

Heat-transfer coefficients for monoisopropylbiphenyl, heated in a long horizontal tube under conditions of turbulent flow, are correlated to an average deviation of ±0.99 percent with an equation of the Dittus-Boelter type. Physical properties used in correlation work are presented. The coefficients extended from 463 to 3107 Btu/hr-ft^2-°F for the following ranges of conditions: bulk-fluid temperatures, 240° to 604°F; heat-transfer surface temperatures, 312° to 816°F; heat fluxes, 44,800 to 308,000 Btu/hr-ft^2; Reynolds numbers, 18,500 to 350,000; fluid velocities, 5.7 to 36.4 ft/sec. In fouling experiments, no scaling of the heat-transfer surface of an organic type was observed at the extreme attainable conditions of 850°F heat-transfer surface temperature and 5 ft/sec fluid velocity. The condition of the equipment after 2-1/2 years of service is discussed.

Vitro Corp. of America, New York.
CONCEPTUAL DESIGN OF 20 Mw NUCLEAR HEATING PLANT, by G. Caravella, R. Epstein and others. Rept. on Contract DA 44-009-eng-2861. 1 Nov 56, declassified 1 Oct 57. 209p. 33 refs. KLX-1769.
Order from LC mi$9.30, ph$31.80 PB 138 972

The conceptual design reported herein describes a nuclear power plant whose prime purpose is the indirect generation of steam for space heating and other low temperature applications. A pressurized water reactor with a core consisting of highly enriched uranium (UO_2) embedded in stainless steel has been selected for this application. The fuel plates consist of highly enriched UO_2 embedded in a matrix of stainless steel and clad with stainless steel.

Vitro Corp. of America, New York.
CONCEPTUAL DESIGN OF 20 Mw NUCLEAR HEATING PLANT: ADDENDUM AND ERRATA. Rept. on

Contract DA 44-009-eng-2861. 2 Jan 57, declassified 10 Oct 57, 10p. KLX-1769A.
Order from LC mi$1.80, ph$1.80 PB 138 972S

See also PB 138 972

Nuclear Reactions

Maryland U., College Park.
ON THE SUPPRESSION OF P-STATE CAPTURE IN (K^-, p) ATOMS, by T. B. Day, G. A. Snow, and J. Sucher. Rept. on Contracts AF 49(638)24 and AT(40-1)2504. June 59, 11p. 18 refs. Physics Dept. Technical rept. no. 137; AFOSR-TN-59-606; AD-217 393.
Order from LC mi$2.40, ph$3.30 PB 143 346

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
A DISCUSSION ON K EXCESS, by R. L. Echols. 30 Mar 48, 20p. NEPA 478-STR-1; AD-203 999.
Order from LC mi$2.40, ph$3.30 PB 138 316

Radioactivity

Army Medical Research Lab., Fort Knox, Ky.
OPTIMUM X-RAY YIELDS IN BETA-EXCITED X-RAY SOURCES, by J. G. Kereiakes, O. E. Weir, and A. T. Krebs. Rept. on Biological and Medical Aspects of Ionizing Radiation. 27 July 58, 15p. 24 refs. Rept. no. 349.
Order from LC mi$2.40, ph$3.30 PB 138 677

The K X-ray yield excited by beta-particles in various target materials increased with increasing target thickness up to a maximum, after which the yield decreased because of X-ray absorption by target material.

Boeing Airplane Co., Seattle, Wash.
RADIATION DAMAGE TO TRANSISTORS, by D. A. Hicks, D. V. Keller and others. Rept. on Contract AF 33(600)35030. 1 Dec 58, 124p. 19 refs. Document no. D5-2880.
Order from LC mi$6.30 PB 143 692

Studies of the radiation damage to 23 transistor types; power and frequency ranges for both silicon and germanium. The damage constant (K) for each transistor type was determined. The average values are $(4.2 \pm 0.2) \times 10^{13}$ nvt-μsec for n-base germanium, $(1.8 \pm 0.2) \times 10^{13}$ nvt-μsec for p-base germanium, $(3.1 \pm 0.4) \times 10^{12}$ nvt-μsec for n-base silicon, and $(4.6 \pm 3.3) \times 10^{12}$ nvt-μsec for p-base silicon. Larger K indicates smaller susceptibility to permanent radiation damage.

General Electric Research Lab., Schenectady, N. Y.
SURVEY OF RADIATION DAMAGE THRESHOLDS, by R. M. Walker. Scientific rept. no. 1 on Contract AF 19(604)5557. July 59, 33p. 70 refs. AFCRC-TN-59-552.
Order from LC mi$3.00, ph$6.30 PB 143 403

We will be concerned here only with the process known as direct displacement. It takes energy to force an atom into an interstitial position, and the distinguishing feature of the displacement process is that there is a minimum threshold energy which must be transmitted to the nuclei before damage occurs. The present report is a review of the existing information on threshold energies. The basic theory is reviewed in the first section. The experimental information is summarized in the second section. In the final section the present status of the problem is discussed and suggestions are made for future work.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Naval School of Aviation Medicine, Pensacola, Fla.
READABILITY OF NAVCAD SELECTION TESTS, by Robert F. Lockman. 30 Sep 53, 6p. 6 refs. Proj. NM 001 057.16.05.
Order from LC mi$1.80, ph$1.80 PB 143 437

The results of this study demonstrate that the present tests in the NavCad selection battery as well as those under experimental evaluation are at suitable levels of reading difficulty for use with NavCad applicants. Thus, failure on any of these tests by an applicant must be assigned to some variable other than the complexity of the language of the tests. This report should be of interest to individuals in test construction and in selection and classification programs.

PHYSICS

Michigan U. Coll. of Engineering, Ann Arbor.
SCALAR DIFFRACTION BY AN ELLIPTIC CYLINDER, by N. D. Kazarinoff and R. K. Ritt. Rept. on Contract AF 19(604)4993. June 59, 27p. 7 refs. Rept. no. 2871-2-T; AFCRC-TN-59-394.
Order from LC mi$2.70, ph$4.80 PB 143 196

The method given in Reference 1 is applied to the case of scalar scattering by a perfectly reflecting elliptic cylinder illuminated by waves from a line source parallel to the axis of the cylinder. The surface distribution in the shadow zone is calculated, and the "creeping wave" representation for the scattered field in the shadow zone is derived. It is shown that the results are applicable if and only if $R_0\omega \gg 1$, where R_0 is the smallest radius of curvature on the cylinder and ω is the wave number.

New York U., N. Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Quarterly rept. no. 4, Nov 55-Jan 56, on Contract DA 36-039-sc-64526. May 56, 47p.
Order from LC mi$3.30, ph$7.80 PB 138 936

Contents:
Gamma ray and U. V. induced fluorescence in solutions with more than one solvent
Further investigations into trap distributions and non-radiative transitions
(See also PB 135 933)

Acoustics

California U., Los Angeles.
THE ABSORPTION OF SOUND IN GAS MIXTURES, by Frank A. Angona. Technical rept. no. 5 on Contract N6onr-275(07). Jan 53, 89p. 25 refs.
Order from LC mi$4.80, ph$13.80 PB 143 216

California U., Los Angeles.
ABSORPTION OF ULTRASONIC WAVES IN AQUEOUS SOLUTIONS OF MAGNESIUM SULFATE, by Oscar Bryan Wilson, Jr. Technical rept. no. 4 on Contract N6onr-275(07). June 51, 97p. 23 refs.
Order from LC mi$5.40, ph$15.30 PB 143 215

California U., Los Angeles.
SOUND ABSORPTION IN MAGNESIUM SULPHATE SOLUTIONS, by David Alan Bies. Technical rept. no. 6 on Contract N6onr-275(07). June 53, 71p. 19 refs.
Order from LC mi$4.50, ph$12.30 PB 143 217

California U., Los Angeles.
A STUDY OF FINITE AMPLITUDE DISTORTION OF A SOUND WAVE IN AIR, by O. Norman Geertsen. Technical rept. no. 3 on Contract N6onr-275(07). May 51, 26p. 11 refs.
Order from LC mi$2.70, ph$4.80 PB 143 049

Carnegie Inst. of Tech., Pittsburgh, Pa.
ON THE SCATTERING OF WAVES BY A DISK, by Albert E. Heins and Richard C. MacCamy. Technical rept. no. 29 on Contract AF 49(638)227. June 59, 21p. 5 refs. AFOSR-TN-59-721.
Order from LC mi$2.70, ph$4.80 PB 143 773

[Max-Planck Inst. für Stromungsforschung (Germany)]
RESEARCH ON INVESTIGATION OF THE INTERACTION OF SOUND AND TURBULENCE, by [W. Tellmien]. Annual rept. for 1 Dec 56-30 Nov 57 on Contract AF 61(514)1143. [1958] 37p. 8 refs. [AFOSR-TN-58-236]; AD-154 138.
Order from LC mi$3.00, ph$6.30 PB 143 402

Investigation was made of the elementary process of scattering of sound by a vortex and of the dependence of the scattering properties on the characteristic parameters of the problem. Consideration is given to superposition of the effects of elementary scattering in a field of flow in which the vortices are statistically distributed due to an arbitrarily given distribution function controlling direction of the axis, size and circulation of the vortices. This case represents the turbulent motion. Because the distribution function can be chosen arbitrarily one can treat, for instance, isotropic as well as non-isotropic turbulence.

Metals Research Lab., Brown U., Providence, R. I.
SCATTERING OF ELASTIC WAVES IN ISOTROPIC MEDIA BY SPHERICAL OBSTACLES, by Norman G. Einspruch and Rohn Truell. Technical rept. on Contract DA 19-020-ORD-4581. 1 Dec 58, 109p. 27 refs. AD-209 373.
Order from LC mi$5.70, ph$16.80 PB 143 091

The method of Ying and Truell for studying the scattering of compressional elastic waves by simple spherical obstacles has been applied to the analysis of scattering of compressional elastic waves by a fluid filled cavity and by layered obstacles in which the core of the layered scatterer is a (a) cavity, (b) rigid sphere, (c) fluid filled cavity, (d) elastic material of properties different from those of the surrounding medium. A general expression for the scattering cross section offered to a compressional wave has been derived. An analysis of the scattering of transverse elastic waves by spherical obstacles has been performed.

RCA Defense Electronic Products, Camden, N. J.
DESIGN AND STUDY OF CORRELATION INSTRUMENTATION FOR SPEECH ANALYSIS AND SYNTHESIS, by D. T. Hoger and F. L. Putzrath. Scientific rept. no. 2 on Contract AF 19(604)4128. 31 July 59, 54p. 1 ref. AFCRC-TN-59-566.
Order from LC mi$3.60, ph$9.30 PB 143 360

This report covers the studies leading to the selection of an optimum analog instrumentation for processing the output signal of a Vocoder for digital transmission over a standard voice channel. The system is based upon the matching of the incoming voice events against a catalog of speech patterns so that only the pattern number, rather than the speech event itself, need be transmitted. In the receiver, the proper speech pattern is retrieved from a similar memory and generates the required voltages for the Vocoder synthesizer. The system that was treated in detail features completely analog processing so that small deviations in the pattern can readily be accommodated. Time sequential, rather than parallel pattern comparison, is employed. A single magnetic drum is used as the storage medium which can serve any number of voice channels. A complete analysis of the system was made and no serious implementation problems were encountered.

Electricity and Magnetism

Institute of Mathematical Sciences, New York U., N. Y.
BASIC MATHEMATICAL RESEARCH FOR ELECTROMAGNETIC THEORY, by Morris Kline. Final rept. no. BR-25 on Contract AF 18(600)367. June 58, 19p. 24 refs. AFOSR TR-58-80; AD-158 369.
Order from LC mi$2.40, ph$3.30 PB 138 985

Naval Ordnance Lab., White Oak, Md.
MAGNETIC PROPERTIES OF THE MANGANESE CHROMITE-ALUMINATES, by Palmer L. Edwards. 1 May 58, 133p. 34 refs. NAVORD rept. 6099.
Order from LC mi$6.90, ph$21.30 PB 143 339

This paper reports on an experimental study of the magnetic properties of the spinel series $MnCr_2O_4$-$MnAl_2O_4$. This series was chosen for study because $MnCr_2O_4$ has a saturation moment at absolute zero which is inconsistent with the Néel theory and which has been attributed to the existence of Yafet and Kittel angles on the B sites by both Gorter and Lotgering. The $MnCr_2O_4$-$MnAl_2O_4$ series is particularly useful for such a study because there is only one type (approximately) of magnetic ion on each sublattice. The first chapter of this report gives an introduction to the molecular-field theory of magnetism leading up to the Neel theory of ferrimagnetism. The next chapter describes the preparation of the mixed-crystal series and the x-ray study to determine the locations of the magnetic ions on the A and B sublattices. The third chapter describes the experimental apparatus. The fourth chapter presents the Néel and the Yafet and Kittel theories. The fifth chapter presents the experimental data and compares it with the theories.

Westinghouse Electric Corp., East Pittsburgh, Pa.
THE EFFECT OF TEMPERATURE ON THE MAGNETIC PROPERTIES OF SILICON-IRON, COBALT-IRON AND ALUMINUM-IRON ALLOYS, by J. J. Clark and J. F. Fritz. Rept. on Magnetic Phenomena of Matter, Contract AF 33(616)5555. July 59, 57p. 3 refs. WADC Technical note 59-240.
Order from OTS $1.50 PB 161 078

The d-c and a-c magnetic properties of the following materials were measured over the temperature range from -60°C to 500°C: AISI silicon-iron grades M-36, M-22, M-19, M-14, M-6, Armco Oriented T-O-S, Hiperco 27, Hiperco 35, and 2.6% aluminum-iron. The data presented are: normal magnetization curves at various temperatures, normal permeability versus magnetizing force at various temperatures, coercive force and residual induction versus temperature, and total core loss at various inductions versus temperature. It is found that the low field permeability increases with increasing temperature, and the high field permeability decreases with increasing temperature, with a region between these two modes of variation in which the permeability is relatively stable over a limited temperature range. The coercive force, residual induction, and total core loss are all found to decrease with increasing temperature.

Electronics

Air Research and Development Command, Washington, D. C.
NSIA-ARDC CONFERENCE ON MOLECULAR ELECTRONICS, NOVEMBER 13-14, 1958, WASHINGTON, D. C. [1958] 105p. 74 refs. ARDC-TR-59-17; AD-211 691.
Order from LC mi$5.70, ph$16.80 PB 143 131

Contents:
Stimulated emission of radiation
Paramagnetic effects
Two-level solid-state masers
Ferrite amplification
Parametric amplification on electron beams
Non-linear capacitance amplifiers
Thermoelectric effects
Solid state electronics
The three level maser
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General considerations in research and development pertaining to thermoelectric devices
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Solid-state masers-design and performance
Prospects for millimeter wave generation by signal conversion in ferrimagnetic materials
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Crystal processing for amplification

Colgate U., Hamilton, N. Y.
PREDICTION OF RADIATION INTENSITIES IN THE FRESNEL AND NEAR-ZONE REGIONS OF MICROWAVE APERTURE ANTENNAS, by Frank B. Harris, Jr. Rept. on Contract AF 30(602)1778. Oct 58, 28p. 4 refs. RADC-TN-58-252; AD-202 095.
Order from LC mi$2.70, ph$4.80 PB 138 621

The theory developed in this report makes possible the grouping together of whole families of theoretical apertures, insofar as certain gross properties of their fields are concerned. The information obtained is sufficient to give an upper limit to the radiation intensity at distances from the aperture between infinity and one or two times the largest semi-diameter. Numerical results have been obtained, and presented in graphical form, for the following cases: (1) circularly symmetrical aperture with illumination tapered in various ways, (2) elliptical aperture with uniform illumination and several different eccentricities, (3) rectangular aperture with illumination function separable in the aperture coordinates and any combination of a number of different tapers on the two axes.

Field Emission Lab., Pennsylvania State U., University Park.
A SEARCH FOR POLARIZATION OF FIELD-EMITTED ELECTRONS, by Walter T. Peria. Technical rept. no. 10 on Study of Metal Surfaces by the Field Emission Microscope. Contract AF [illegible]. 85p. 35 refs. AFOSR-TN-622. AD-217 [illegible].
Order from LC mi$3.90, ph$10.80 PB 141 174

Experiments were performed designed to detect polarization of field-emitted electrons using Mott scattering. Electrons emitted from various crystallographic planes of a clean tungsten surface, from individual quarters of a phthalocyanine quadruplet on a clean tungsten substrate and from single ferromagnetic domains of iron were analyzed in a temperature range from 21°K to 900°K. In no case was any polarization detected. The average least detectable asymmetry factor that could be determined by the apparatus was calculated to be .04 corresponding to a polarization of 10% in a plane normal to the field emitted beam.

Tung-Sol Electric, Inc., Bloomfield, N. J.
RESEARCH AND DEVELOPMENT IN UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION, by B. G. Firth. Quarterly progress rept. no. 7 for 1 Jan-31 Mar 58 on Investigation in Utilization of Self-Sustained Field Emission, Contract DA 36-039-sc-73051. [1958] 33p. 4 refs. AD-211 532.
Order from LC mi$3.00, ph$6.30 PB 143 878

Molecular Physics and Spectroscopy

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena, Calif.
EMISSIVITY ESTIMATES FOR HEATED NO, by A. Thomson. Technical rept. no. 6 on Contract AF 18(603)02. Nov 57, 47p. 8 refs. AFOSR-TN-57-782; AD-148 388.
Order from LC mi$3.30, ph$7.80 PB 143 512

The emissivity of the β and γ systems of NO has been calculated between 4000°K and 8000°K for a range of optical densities. Both the positions and intensities of the bands were assumed to be distributed statistically. An approximately uniform average value for the square of the vibrational matrix elements was assigned to all contributing transitions. The emissivity was calculated at low pressure (pure Doppler broadening) and at high pressure (no rotational fine structure). It is found that, for the specified temperature range, the error induced by neglecting the rotational fine structure is less than 40%. The results obtained do not differ by more than about 50% from those described by Kivel, Mayer and Bethe although the analytical procedure is quite different.

Institute of Engineering Research, U. of California, Berkeley.
SPECTRAL REFLECTIVITY OF CERTAIN MINERALS AND SIMILAR INORGANIC MATERIALS, by J. T. Gier and R. V. Dunkle. Rept. on Contract DA 11-190-eng-3. 29 Jan 54, 16p. 5 refs. Series no. 62, issue no. 4.
Order from LC mi$2.40, ph$3.30 PB 128 131

Results were obtained with the heated cavity reflectometer. The spectral reflectivity of certain minerals indicates a nonuniformity of emissivity which would alter the equilibrium temperatures of these materials when exposed to the natural environment.

Naval Ordnance Lab., Corona, Calif.
SPECTROSCOPY CONFERENCES IN FRANCE AND ENGLAND, SEPTEMBER 1957, by Curtis J. Humphreys. Aug 58, 16p. 5 refs. NOLC rept. 417; AD-203 412.
Order from LC mi$2.40, ph$3.30 PB 138 806

A digest of data gathered during trip.

Ohio State U. Research Foundation, Columbus.
DESIGN AND DEVELOPMENT OF AN ELECTRON SOURCE WITH VELOCITY SELECTION BEFORE SCATTERING, by Edwin N. Lassettre and Ausma Skerbele. Final rept. on Contract AF 19(604)3078. Feb 59, 39p. 10 refs. Rept. 803-Final; AFCRC-TR-59-237; AD-214 416.
Order from LC mi$3.00, ph$6.30 PB 143 284

The design, construction, and testing of a new electron source is described. This source incorporates an electrostatic analyzer for velocity selection on the electron beam before scattering. Several electron impact spectra are included and discussed.

Ohio State U. Research Foundation, Columbus.
ENERGY MOMENT TREATMENT OF THE QUANTUM MECHANICAL ASYMMETRIC ROTATOR, by Paul M. Parker and L. Carlton Brown. Technical note no. 6 on Contract AF 18(600)772. 1958, 109p. AFOSR TN-58-371; AD-154 277.
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Quantum mechanical rotators are classified as spherical, symmetric, and asymmetric tops. If the equilibrium values of all three principal moments of inertia of the top are equal it is called a spherical top; if two are equal but different from the third it is called a symmetric top; if all are different it is called an asymmetric top; the special case of a symmetric top whose unique moment is very much smaller than its other two moments is the case of the linear molecule. The present work is principally concerned with deducing certain sum rules relating energies of the asymmetric top to some of the physical constants of the molecule. Augmented by the sum rules already given by Mecke, these rules permit in many cases the computation of the effective values of the principal moments of inertia of the molecule investigated with much less effort than is usually met in either numerical approximation methods or perturbation calculations if the latter are applicable at all.

Padova U. (Italy).
ON THE ELECTRONIC AND MICROWAVE SPECTRUM OF FORMYL FLUORIDE, by G. Semerano. Final technical rept. for 1 Jan-30 Dec 58 on Contract DA 91-508-EUC-275. [1958] 31p. 9 refs. AD-214 792.
Order from LC mi$3.00, ph$6.30 PB 143 052

Spectroscopy Lab., Pennsylvania State U., University Park.
TECHNICAL REPORT, 1 JULY 1956-1 JULY 1958. Rept. on Contract Nonr-656(12). [1958] 99p. 80 refs.
Order from LC mi$5.40, ph$15.30 PB 143 097

Institute of Mathematical Sciences, New York U., N. Y.
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Field Emission Lab., Pennsylvania State U., University Park.
A SEARCH FOR POLARIZATION OF FIELD-EMITTED ELECTRONS, by Walter T. Pimbley. Technical rept. no. 10 on Study of Metal Surfaces by the Field Emission Microscope, Contract AF 18(600)672. 62p. 35 refs. AFOSR-TN-622, AD-217 686.
Order from LC mi$3.90, ph$10.80 PB 143 174

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High resolution with a diffraction grating. D. H. Rank, A. H. Guenther, C. R. Burnett and T. A. Wiggins

Tertiary interferometric wavelength standards from measurements on lines of the 2-0 band of carbon monoxide and derived wavelength standards for some lines of the 1-0 band of carbon monoxide. The velocity of light serived from a band spectrum method, IV. D. H. Rank, A. H. Guenther, G. D. Saksena, J. N. Shearer and T. A. Wiggins

l-type doubling in three Π - Π bands HCN. D. H. Rank, J. N. Shearer, A. H. Guenther and T. A. Wiggins

Shrinkage effect in grating resolution measurement. D. H. Rank

Dispersion of a double-pass spectrograph. T. A. Wiggins and G. D. Saksena

Shape or an emission line of CH produced in an oxy-acetylene flame. D. H. Rank, G. D. Saksena and T. A. Wiggins

Internuclear distance and l-type doubling in carbon bisulfide. A. H. Guenther, T. A. Wiggins and D. H. Rank

Measurements of the dispersion of air from 3651 to 15300 angstroms. D. H. Rank, G. D. Saksena and T. K. McCubbin, Jr.

An analysis of the data on the index of refraction of germanium. D. H. Rank and T. A. Wiggins

Optics

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE PROOF OF CERTAIN LAWS OF OPTICS USED IN SOLAR FURNACE CALCULATIONS, by Alfred W. Simon. Mar 59, 11p. 3 refs. AFMDC-TN-59-1; AD-209 326.
Order from LC mi$2.40, ph$3.30 PB 138 733

Several laws of optics assumed without proof in a previous report dealing with calculations on the solar furnace are proved in detail. They are (1) that the fractional part of the light reflected at each point of reflection of a plane parallel glass plate is the same, (2) that the fractional part of the light refracted at each point of refraction of a plane parallel glass plate is the same, and (3) that the sum of the fractional part of the light incident on any surface of a plane parallel glass plate reflected therefrom and the fractional part refracted therefrom is equal to unity. Finally the laws of reflection of a metallic surface with a glass superstrate are deduced.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
LENS SYSTEM DESIGNED FOR WATER-TO-AIR VISION IN THE SUBMERGED HUMAN EYE, by T. D. Duane, R. J. Emrich, and Herbert G. Shepler. Rept. no. 3 on Proj. NM 11 03 12.2. 2 Sep 58, 14p. 1 ref. NADC-MA-5810.
Order from LC mi$2.40, ph$3.30 PB 139 147

Since the human eye is primarily adapted to air vision, the requirements demanded in water-to-air vision presents a challenging problem. One method of accomplishing this task is reported in this study. The method reported involves the use of a lens system which is a combination of a plano-convex lens 4.0 cm. in diameter, 12 diopters in strength mounted on the right side of a standard spectacle frame. Superimposed on the fixed lens was a moveable 52 diopter biconvex lens 2.0 cm. in diameter. The smaller lens could be moved farther from the fixed lens resulting in variations extending from 64 to 80 plus diopters.

Cruft Lab., Harvard U., Cambridge, Mass.
THE ELECTROMAGNETIC THEORY OF LIGHT. II, by Tai Tsun Wu and S. R. Seshadri. Scientific rept. no. 22 on Contract AF 19(604)786. 10 Nov 58, 25p. 5 refs. AFCRC-TN-58-575; AD-117 050.
Order from LC mi$2.70, ph$4.80 PB 138 613

A systematic procedure is given for the determination of the asymptotic series for the field in the shadow region of a convex cylinder illuminated by a plane wave. The first two terms in the series are explicitly evaluated.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
SUGGESTED METHOD FOR MEASURING LOW-LIGHT-LEVEL LUMINANTS, by Robert Davis and Jesse Tyroler. July 59, 17p. Technical rept. 2619; AD-214 770.
Order from LC mi$2.40, ph$3.30 PB 143 296

Low-level-luminosity measurements have in the past been carried out by a subjective photometric comparative method. Measurements made by this procedure are inherently inaccurate. This report suggests a system for absolute comparison which uses a defined spectral visibility curve for low-level-luminosity (scotopic) measurements. The suggested system does not employ visual observations and consequently its deviations arise only from experimental error. It also has the advantage of enabling the operator to positively observe smaller deviations in luminosity during testing. This system makes it possible for rigid specifications to be drawn by any agency concerned with the measurement of low-level luminosities.

Institute for the Study of Metals, U. of Chicago, Ill.
A METHOD OF PREPARING THIN FILMS OF ALLOYS SUITABLE FOR OPTICAL STUDIES, by L. G. Schulz. Rept. on Contract AF 18(600)1489. Feb 59, 17p. 8 refs. AFOSR TN-59-25; AD-208 755.
Order from LC mi$2.40, ph$3.30 PB 138 702

The components of the desired alloy are evaporated successively and the alloy is then produced by diffusion. This results in a sample of approximately uniform thickness with pure metal components at the ends and with a composition gradient in between.

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
OPERATING CHARACTERISTICS OF A LEAD SULFIDE CELL WITH VARYING BACKGROUND BRIGHTNESS, by Paul Brannon. 25 Sep 57. 18p. USL Research rept. no. 363; AD-205 883.
Order from LC mi$2.40, ph$3.30 PB 143 425

An elementary study was made of the operating characteristics of an Eastman Kodak "Ektron" 2 mm x 2 mm, lead sulfide, photo-conductive detector against varying background brightness. The signal from a tungsten lamp, chopped at 1000 cps, was reflected by means of a small plane mirror into a receiver pointed either at the sky or at an artificial background. Measurements of signal-to-noise ratio, detector resistance voltage and current, and brightness of the background were made for varying background and load resistance. The effect of placing an infrared filter in front of the receiver was also determined. It was found that a cell load resistance of about 1 megohm and a cell current of 20 microamperes gave the best operating signal-to-noise ratio over a sky background which varied from 0 to 10,000 foot-lamberts. By placing an infrared filter in front of the receiver, the ratio was increased for background brightness above 30 foot-lamberts and was decreased below this value of brightness.

Visibility Lab., U. of California, San Diego.
CANONICAL FORMS OF THE EQUATION OF TRANSFER, by R. W. Preisendorfer. Rept. on Contract NObs-72092. 1 July 58, 16p. 4 refs. SIO Ref. no. 58-47; AD-201 548.
Order from LC mi$2.40, ph$3.30 PB 143 324

The purpose of this note is to present a reformulation of the equation of transfer which appears to be of help in the task of collating and understanding the experimentally obtained properties of the optical medium. Quite interestingly, this reformulation appears to hold the key to the solution of one of the long-standing theoretical problems of this field, namely the problem of the existence and form of the asymptotic radiance distribution in an arbitrary medium with arbitrary external lighting conditions.

Solid State Physics

Battelle Memorial Inst., Columbus, Ohio.
PROPERTIES OF SOLID OXIDES, by C. G. Harman, L. D. Loch and C. R. Austin. Special rept. June 48, 258p. 459 refs. NEPA-808; BMI-N-16
Order from LC mi$11.10, ep$42.60 PB 143 943

A survey was made of the properties of all known solid oxides, which are described in the literature, and the assembled information is presented in this report for ready reference to facilitate the progress of the NEPA program. In the preparation of this report, particular attention was directed toward presentation of the information in a systematic and useful form. The data are arranged in the order in which the elements appear in the periodic table. Some of the data are very old, and are of limited usefulness, but are included for the sake of completeness. It should be pointed out that, even after inclusion of all published data without regard to reliability, many important gaps exist in the literature on the properties of many of the materials.

Brown U., Providence, R. I.
RESEARCH DIRECTED TOWARD THE INVESTIGATION OF SILICON AND SILICON-CARBIDE SURFACES, by J. A. Dillon, Jr. and R. M. Oman. Scientific rept. no. 3, 1 Apr-30 June 59, on Contract AF 19(604)4568. July 59, 11p. 5 refs. AFCRC-TN-59-384.
Order from LC mi$2.40, ph$3.30 PB 143 632

Investigation of the properties of SiC surfaces following chemical treatments. Differences in etching is presumably due to the asymmetry in atomic species on opposite faces. There appeared to be no correlation between this etching behavior and such gross surface properties as defect density and stepped structure. (See also PB 140 823)

Cornell U., Ithaca, N. Y.
OXIDATION OF MAGNESIUM SINGLE CRYSTALS AND EVAPORATED FILMS, by Richard R. Addiss, Jr. Technical rept. no. 1 on Contract Nonr-401(31). May 58, 95p. 35 refs.
Order from LC mi$5.40, ph$15.30 PB 138 822

Apparatus and techniques were developed for measuring the oxidation of magnesium single crystals at high temperatures, and evaporated magnesium films at room temperature, with a sensitive microbalance capable of operating in an ultra-high vacuum. Single crystals were oxidized at an oxygen pressure of 2.5 mm Hg and temperatures of 400 and 440° C.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
THE FORMATION OF SURFACE PITS BY THE CONDENSATION OF VACANCIES, by P. E. Doherty and R. S. Davis. Rept. on Contract Nonr-1866(27). 5 May 58, 13p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 138 820

The formation of these pits during cooling is attributed to the condensation of vacancies at specific location of the free surface. A definite and constant supersaturation of vacancies is required before condensation begins.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE USE OF FOURIER TRANSFORMS FOR THE STUDY OF SINGULAR POINTS IN THE FREQUENCY SPECTRUM OF A CRYSTAL, by J. Peretti and A. Maradudin. Rept. on Contract AF 18(600)1315. Nov 58, 11p. 4 refs. Technical note BN-155; AFOSR TN-59-21; AD-208 751
Order from LC mi$2.40, ph$3.30 PB 138 783

Institute of Optics, U. of Rochester, N. Y.
RESEARCH ON OPTICAL AND ELECTRICAL PROPERTIES OF SOLIDS, by David Dutton. Final rept. on Contract AF 18(600)193. Sep 58, 8p. 31 refs. AFOSR TR-58-100; AD-162 214.
Order from LC mi$1.80, ph$1.80 PB 138 653

Abstracts of 16 reports which have been published by Technical societies by the authors on experimental studies of photoconductivity, luminescence, and optical absorption in various materials including the alkali and silver halides, the thallous halides, cadmium sulfide, lead sulfide, and lead selenide.

Materials Research Lab., Watertown Arsenal, Mass.
A REFORMATION OF THE TEMPERATURE DEPENDENCE OF THE DEBYE CHARACTERISTIC TEMPERATURE AND ITS EFFECT ON DEBYE-WALLER THEORY, by Arthur Paskin. Apr 57, 12p. 10 refs. MRL rept. no. 27.
Order from LC mi$2.40, ph$3.30 PB 127 593

Zener and Bilinsky have explained the observed high-temperature deviations from the Debye-Waller theory of the temperature dependence of the intensity of x-ray diffraction spectra in terms of the changes in Θ, the Debye characteristics temperature, as the temperature is raised. Their formulation for the temperature dependence of Θ is in terms of an empirical constant and the lattice enthalpy. We here give an alternative formulation in terms of the Grüneisen constant and the volume. The two formulations of the temperature dependence of Θ are found to yield approximately the same results for NaCl and KCl. The Debye-Waller factor has also been modified so as to yield a relationship linear in a reduced temperature scale that compensates for the change in Θ as the temperature is changed. The x-ray data when appropriately plotted do yield a straight line in agreement with the modified Debye-Waller factor. The slope of the straight line can be used to find the room temperature value of Θ. The values found for NaCl and KCl are in reasonable agreement with values for Θ obtained from specific heat measurements.

Naval Research Lab., Washington, D. C.
SOME STRUCTURAL GUIDES TO THE DEVELOPMENT OF HIGH DIELECTRIC CONSTANT ESTERS FOR CAPACITORS, by J. B. Romans and C. R. Singleterry. 18 Sep 59, 25p. 39 refs. NRL rept. 5350
Order from OTS $1.00 PB 151 797

It has been found possible to use molecular structure as an effective guide to the synthesis of practical liquids of high dielectric constant. For this purpose, dipole moments estimated from molecular structure by the generalizations listed are inserted in the Onsager equation relating dipole moment and dielectric constant. In order to obtain liquids of high dielectric constant, the dipole moment content per unit volume must be at a maximum. This is achieved with fluoroesters through the use of the lower telomeric fluoroalkyl groups containing the $-CF_2H$ terminal group and by increasing the number of ester groups to three. High dielectric constants are also significantly favored by the presence of groups, such as aromatic rings or chlorine substituents, which have high electronic polarizability. The application of these principles has led to the synthesis of five fluoroesters having dielectric constants of 8 or above. A route is indicated for the preparation of stable esters having dielectric constants at least as high as 12.

Pacific Semiconductors, Inc., Culver City, Calif.
SOLID STATE DIFFUSION IN SEMICONDUCTOR MATERIALS, RESEARCH ON, by T. J. LaChapelle. Final technical rept. no. 2, 1 Aug 57-31 July 58, on Contract AF 18(603)117. [1958] 58p. PSI rept. no. 3000:5-10-F.
Order from LC mi$3.60, ph$9.30 PB 137 815

High purity p-type pulled ingots as well as floating zone silicon were used in the studies. Diffusion of phosphorus from the elemental form was carried out at 1039, 1105 and 1155°C. All silicon having surface damage, in spite of careful lapping, produced abnormal impurity distributions which could not be matched to the expected error function complement curves. Diffusion coefficients for the micron-thin runs seemed to be at least a factor of 2 or 3 higher than the current literature, probably mainly because of either surface damage or bulk structural imperfections or both.

Pennsylvania State U. Coll. of Mineral Industries, [University Park].
HYDROTHERMAL CRYSTAL STUDIES, by Rustum Roy, R. C. DeVries and others. Final rept. for 1 Apr-30 June 54 on Contract DA 36-039-sc-5594. 15 July 54, 153p. 8 refs.
Order from LC mi$7.50, ph$24.30 PB 143 126

Phase equilibrium studies of titanate systems and new equilibrium diagrams for several different types of systems involving $BaTiO_3$. Hydrothermal techniques have been used in two main areas of work: determination of trivalent oxide-water systems and a study of the formation, properties and stability of the layer silicates; the chlorites and disilicic micas. (See also PB 140 195)

Pennsylvania State [U.] Mineral Industries Experiment Station] [University Park]
HYDROTHERMAL CRYSTAL STUDIES, by Rustum Roy and E. F. Osborn. Final rept. for 1 July 51-30 June 54 on Contract DA 36-039-sc-5594. [1954] 12p.
Order from LC mi$2.40, ph$3.30 PB 143 124

The entire three-year period is summarized briefly. Seventeen technical reports are listed. Possible utilization or further study of some of the phases of the work is discussed. (See also PB 143 126)

Stanford Research Inst., Menlo Park, Calif.
LUMINESCENCE OF SOLIDS PRODUCED BY SURFACE RECOMBINATION OF ATOMS, by Kenneth M. Sancier, William J. Fredericks and others. Technical rept. no. 1 on Contract AF 49(638)353. 15 June 59, 40p. 17 refs. AFOSR TN-59-716.
Order from LC mi$3.00, ph$6.30 PB 143 297

During the heterogeneous recombination of atoms on surfaces of solid lumophors the energy released in the process may be converted to luminous energy of the lumophor. The purpose of the present investigation is the elucidation of the mechanism and efficiency of energy transfer. Included in this investigation are the effects of atom species, atom concentration, lumophor temperature, and lumophor composition. A model is

presented which describes the processes of chemical reaction and energy transfer associated with luminescence produced by heterogeneous atom recombination.

Technical Research Group, Syosset, N. Y.
DEVELOPMENT OF THE PERIODIC SHOCK WAVE TECHNIQUE AND ITS APPLICATION TO THE PREPARATION OF SEMICONDUCTOR SILICON CARBIDE. Final rept. for 15 Aug 57-14 Aug 58 on Contract AF 19(604)2665. [1958] 65p. 27 refs. AFCRC TR-58-193; AD-160 872.
Order from LC mi$3.90, ph$10.80 PB 138 704

Contents:
Literature search
Development of periodic shock technique
  Experiments with piston-driven tubes
  Jet resonance tube
  Jet resonance tube pressure measurement
  Temperature measurements
Experimental
  Synthesis of silicon carbide from silicon tetrachloride and hydrocarbon
  Synthesis of silicon carbide from methyltrichlorsilane
  Analysis of methyltrichlorsilane

Uppsala U. (Sweden).
THE CRYSTAL STRUCTURE OF $SeOCl_2.2C_5H_5N$, by Günther Nahringbauer and Ingvar Lindqvist. Technical note no. 2 on Contract AF 61(052)43. 20 Dec 58, 17p. 19 refs. AFOSR TN-59-64; AD-209 608.
Order from LC mi$2.40, ph$3.30 PB 138 710

The crystal structure of the addition compound $SeOCl_2.2C_5H_5N$ has been determined and refined using three-dimensional X-ray data.

Theoretical Physics

Maryland U., College Park.
UNIQUENESS OF SOLUTIONS TO DISPERSION RELATIONS AND AN ITERATIVE SCHEME, by David Y. Wong. Rept. on Contract AF 49(638)24. July 57, 11p. Physics Dept. Technical rept. no. 85; AFOSR TN-57-468; AD-136 459.
Order from LC mi$2.40, ph$3.30 PB 129 566

For a given set of low energy limits of the S-matrix, the solution of the dispersion relation for the scattering of light is shown to be non-unique even if one fixes all but the s-wave phase shift. Here the unitarity condition is also implied. It is known [D. Y. Wong and J. S. Toll, Annals of Phys. 1, 91 (1957)] that if one further assumes the convergence of the usual perturbation method, then the low energy limits do determine the physical solution uniquely. An alternative iterative scheme is suggested without recourse to the expansion in powers of a coupling parameter. The procedure is illustrated by the example of the scattering by a hard sphere.

Microwave Lab., Stanford U., Calif.
THE LAGRANIAN AND THE ENERGY MOMENTUM TENSORS IN THE PERTURBATION THEORY OF CLASSICAL ELECTRODYNAMICS, by E. L. Chu. Scientific rept. no. 12 on Contract AF 19(604)1930. May 59, 29p. 18 refs. M. L. rept. no. 599; AFCRC TN-59-199; AD-216 104.
Order from LC mi$2.70, ph$4.80 PB 142 983

The theory of infinitesimal transformations is incorporated in the variational principle for the solution of perturbation problems in classical electrodynamics. Every variable quantity is transformed to the unperturbed coordinate system and expanded into a power series of a small perturbation parameter. The Lagrangian of any given order of magnitude in the unperturbed coordinate system characterizes a closed physical system. This is proved by showing that the total energy-momentum tensors of the first and second orders are symmetric. The proof for the higher orders is obtained by deduction.

Scuola di Perfezionmento in Fisica Teorica e Nucleare, Mostra d'Oltremare, Naples (Italy).
SPECIAL TOPICS IN THEORETICAL PHYSICS. Final Technical rept. no. 1 for 1 May 58-30 Apr 59 on Contract DA 91-508-EUC-306. [1959] 10p. 4 refs.
Order from LC mi$1.80, ph$1.80 PB 143 111

An account is given, without formal developments - for which reference is made to the Scientific Reports already submitted or in elaboration - of the results obtained thus far in our investigation of the renormalization problem in field theory.

Syracuse U. [Research Inst.] N. Y.
DISTRIBUTION FUNCTIONS FOR NON-COMMUTING OPERATORS, by A. O. Barut. Technical note P-10 on Contract AF 18(600)459. July 57, 19p. AFOSR-TN-57-435; AD-136 425.
Order from LC mi$2.40, ph$3.30 PB 129 563

The properties of a certain class of functions f $(\alpha', \beta', \gamma',)$ of non-commuting observables $\alpha, \beta, \gamma,$ are investigated. They have all the usual properties of distribution functions, except that they are complex. They satisfy simple Markoff-type stochastic equations and permit to find the expectation values unambiguously. Conversely quantum theory can be formulated in terms of such distribution functions having the prescribed properties.

Thermodynamics

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DEVIATIONS FROM THERMAL EQULIBRIUM IN SHOCK WAVES, by H. A. Bethe (Cornell U.) and E. Teller (George Washington U.) [1940, reprinted 1959]. 81p. 5 refs.
Order from OTS $2.25 PB 161 102

Ballistic Research Labs., Aberdeen Proving Ground, Md.
TABLES OF THERMODYNAMIC AND SHOCK FRONT PARAMETERS FOR AIR, by R. E. Shear and B. D. Day. May 59, 29p. 8 refs. Memo rept. no. 1206.
Order from LC mi$2.70, ph$4.80 PB 143 329

From the reports: "Tables of Thermal Properties of Gases," National Bureau of Standards Circular 564 and, "Tables of Argon Free Air up to 15000°K," Arnold Engineering Development Center, TN-56-12, by Hilsenrath et al., tables of the thermodynamic properties of air, such as, density, internal energy, temperature and sound velocity have been obtained as a function of pressure at constant entropy. In addition, shock front parameters, as functions of shock velocity, were calculated. The initial state of the air is taken to be at rest, $u_0^* = 0$, at a pressure of one atmosphere and a temperature of 300°K. The remaining quantities, such as c_0^*, ρ_0^*, are given by the ideal gas relationships. The value of R_0^* is 2.83286 $\frac{\text{atm}\cdot\text{cm}^3}{\text{g}\ ^\circ\text{K}}$.

Battelle Memorial Inst., Columbus, Ohio.
THE DESIGN OF A HEAT EXCHANGER FOR COOLING GASES WHICH CONTAIN LARGE QUANTITIES OF PARTICULATE MATERIAL, by A. A. Putnam and J. M. Allen. Rept. on Contract AF 40(600)710. Oct 58, 39p. 4 refs. AEDC-TR-58-16; AD-203 562.
Order from LC mi$3.00, ph$6.30 PB 143 277

This report is one of a group of four resulting from research on the deposition of particles from a flowing gas stream. The phenomenon of particular concern herein is the deposition of small boron oxide particles onto heat-exchanger elements. The particles, which are extremely small in size, are generated in large concentrations from the combustion of boron-containing, high-energy fuels.

General Electric Co., Cincinnati, Ohio.
HIGH TEMPERATURE HEAT TRANSFER FROM GASES TO CYLINDERS AND NOZZLES, by I. E. Kanter, F. Martinek and M. L. Ghai. Technical note for 1 Feb 58-28 Feb 59 on Contract AF 49(638)243. [1959] 137p. 29 refs. AFOSR-TN-59-488; AD-215 841.
Order from LC mi$6.90, ph$21.30 PB 143 597

A gas stabilized plasma generator operating with nitrogen gas and water cooled metal electrodes has been successfully operated to supply the hot gas necessary for this study. The required instrumentation has been, or is being, developed to measure the various temperatures, flow velocities, and power consumption rates experienced with the generator and associated equipment. Preliminary temperature traverses and photographic studies have been made to investigate the flow field of the effluent gas. Calculations are presented for the thermodynamic properties of nitrogen gas at high temperatures including the pressure effect. Also included are the general considerations on experimentation and data reduction as pertains to this study.

Massachusetts Inst. of Tech., Cambridge.
FURTHER STUDIES OF THERMAL CONVECTION, by Hsiao-lan Kuo. Scientific rept. no. 7 on General Circulation Project, Contract AF 19(604)1000. 1 Feb 57, 50p. 21 refs. AFCRC-TN-57-267.
Order from LC mi$3.30, ph$7.80 PB 127 915

Part I is concerned with the stability of the thermally driven motions in a rotating fluid. In part II some aspects of fluid motions produced by horizontal differential heating are discussed by applying energy integrals. In part III the mean temperature distribution resulting from the thermal convection produced by uniform heating from below is determined by applying the thermal energy integrals.

Naval Research Lab., U. of Wisconsin, Madison.
THE CONTRIBUTION OF BOUND, METASTABLE, AND FREE MOLECULES TO THE SECOND VIRIAL COEFFICIENT, by Daniel E. Stogryn and Joseph O. Hirschfelder. Rept. on Contract N7onr-28511. rev. 4 Nov 58. 71p. 18 refs. WIS-ONR-32a; AD-207 790.
Order from LC mi$4.50, ph$12.30 PB 143 486

The second virial coefficient for molecules interacting with a spherically symmetric potential is divided into three parts: (1) a contribution B_b, related to the equilibrium constant for the formation of bound double molecules; (2) a contribution B_m, related to the equilibrium constant for the formation of metastably bound double molecules; and (3) a contribution B_f, due to molecules which interact but are free to separate after the interaction. Equations are given for determining each of the three parts of the second virial coefficients. A detailed treatment of these three contributions is presented for the square well, Sutherland, and Lennard-Jones (6-12) potentials.

Pomona Coll., Claremont, Calif.
FUNDAMENTAL STUDY OF SOLID SURFACES, by R. Nelson Smith. Final rept. on Contract N8onr-54700. 31 Dec 57, 10p. 27 refs. AD-151 322.
Order from LC mi$1.80, ph$1.80 PB 138 631

Thermodynamics of adsorption: Adsorption isotherms were determined for various adsorbates on a pure nonporous graphite at different temperatures. Differential net heats of adsorption were calculated by the isosteric method. The results indicated that these net heats decreased rapidly with coverage and persisted through several statistical layers of adsorbate. An equation is proposed for type II multilayer adsorption. A new type isotherm was observed for MeOH on graphite and Graphon. The structure of porous solids: Several arguments are described which were put forth to show that previous BET (Brunauer, Emmett, and Teller) surface areas for porous solids were unrealistically high by a factor of 4 to 20. Hysteresis effects in desorption phenomena are discussed. Studies showed that steam activation enlarges the capillary pores of charcoal instead of creating more pores of the same diameter. The nature of adsorbed films: Consideration is given to the adsorption of benzene and cyclobenzene by nonporous graphite and of H_2O and NO by carbon. Carbon surface complexes: The catalytic oxidation of CO by N_2O on carbon surfaces was studied between 300° and 500°C. The C-O surface complexes did not appear to act as intermediates in the reaction. The nature and mechanism of the reaction between NO and carbon surfaces was investigated above room temperature. The products are substantially N and CO_2.

Wave Propagation

Carnegie Inst. of Mathematics, Pittsburgh, Pa.
DIFFRACTION BY TWO HALF PLANES WITH LINE SOURCE EXCITATION, by Robert C. Gast. Technical rept. no. 25 on Mathematical Analysis of Electrical and Mechanical Systems, Contract DA 36-061-ORD-490. May 56, 46p. 4 refs. CIT-ORD-6D-TR25; AD-95 360.
Order from LC mi$3.30, ph$7.80 PB 130 623

The problem considered is that of a monochromatic, electromagnetic wave being emitted by a line source which is parallel to the edges of two semi-infinite, parallel, perfectly conducting plates of zero thickness. The edges of the plates are infinite straight lines which are parallel to the z-axis of a Cartesian coordinate system and intersect the y-axis at $y = \pm \frac{a}{2}$. The plates are of infinite extent in the positive x-direction.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
MICROWAVE TRANSHORIZON PROPAGATION. Final rept. on Contract AF 30(602)1408. 1 Dec 56, 10p. Research rept. EE-320; RADC TR-57-47; AD-114 323.
Order from LC mi$1.80, ph$1.80 PB 138 652

The diversity parameters on which techniques are based are space, angle, frequency, and time. Progress has been made during this period with regard to space and angle diversity. This progress is described in detail.

New York U., N. Y.
A STUDY OF THE GENERATION AND DETECTION OF ELECTROMAGNETIC WAVES IN THE MILLIMETER WAVE REGION, by J. H. Rohrbaugh. Scientific rept. no. 2, 1 Dec 57-28 Feb 58, on Millimeter Wave Project, Contract AF 19(604)2673. 1 Mar 58, 17p. AFCRC TN-58-157; AD-152 388.
Order from LC mi$2.40, ph$3.30 PB 138 655

The new experiments on magnetron harmonics are now fully operative. They will involve a study of third harmonic production as the magnetic field distribution at the tube is varied. The new spectrometer has had necessary modifications made to the output optical beam. Its drying tower has been substantially completed while work was going on on its amplifiers and its detecting circuit.

Syracuse U. Research Inst., N. Y.
METHODS OF GENERATION AND CHARACTERISTICS OF CIRCULARLY POLARIZED WAVES, by David K. Cheng, Richard E. Gildersleeve, and Thomas M. Maher. Final rept. for 1 Jan 56-30 Sep 57 on Contract AF 30(602)1463. 31 Oct 57, 138p. 39 refs. SURI rept. no. EE393-5710F; RADC-TR-58-41; AD-148 659.
Order from LC mi$6.90, ph$21.30 PB 143 489

This contract had three major objectives, namely: (1) study of the general properties of elliptically polarized waves; (2) survey of the methods of generating circularly polarized waves and analysis of the more promising methods; and (3) investigation of the effects of distorted reflectors and defocused primary sources on the polarization and radiation characteristics.

Syracuse U. Research Inst., N. Y.
STUDY ON THE SCATTERING OF ELECTROMAGNETIC WAVES BY A PARABOLOID OF REVOLUTION, by Alfred T. Villeneuve. Task rept. no. 3 on Contract AF 30(602)1640. 20 Dec 57, 41p. 13 refs. SURI rept. EE492-5712T3; RADC-TN-58-79; AD-148 642.
Order from LC mi$3.30, ph$7.80 PB 143 525

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly rept. no. 2 for period ending 31 Mar 54. Aug 54, 112p. 11 refs. NOLC rept. 184.
Order from LC mi$6.30, ph$19.80 PB 143 789

Contents:
DART
Ferromagnetic resonance
DC-FM converter
Infrared sources
Small antenna investigation

Stanford U., Calif.
NOTE ON ESTIMATING INFORMATION, by Colin R. Blyth. Technical rept. no. 17 on Contract Nonr-225(21) 24 Jan 58, 19p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 139 170

Estimation of the Shannon-Wiener measure of information. Low bias estimates are obtained, and their bias and variance.

Communication Theory

Air Force Cambridge Research Center, Bedford, Mass.
SIGNAL TO NOISE IMPROVEMENT THROUGH CODING, by John C. Mott-Smith. May 59, 20p. 2 refs. AFCRC-TR-59-143; AD-215 115.
Order from LC mi$2.40, ph$3.30 PB 143 493

The error rate of a binary symmetric memoryless channel is a function of an "effective" signal-to-noise ratio that combines the input signal-to-noise ratio with the time bandwidth product. The capacity of this channel is found for four different error rate expressions corresponding to correlation detection under varying assumptions. The derived capacity is interpreted as the maximum rate achievable through digital encoding while satisfying an arbitrary reliability requirement. The results are presented in terms of the maximum signal-to-noise ratio improvement achievable by such codes as a function of the maximum allowable error rate. The practical limitations of the simple model are briefly discussed. An example illustrates the conclusions to be drawn through this type of analysis.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SUGGESTIONS ON A DEVICE FOR DIGITAL ENCODING OF RUSSIAN SCIENTIFIC TEXT, by Martin H. Weik. June 58, 22p. Memo rept. no. 1150.
Order from LC mi$2.70, ph$4.80 PB 138 880

Various suggestions are made concerning an encoding device for the digital encoding of Russian Cyrillic scientific text. The device is intended as an input unit for mechanical translation equipment.

New York U. Coll. of Engineering, N. Y.
GENERALIZATION OF SHANNON-FEINSTEIN THEOREM TO COMMUNICATION SYSTEMS WITH FADING AND FEEDBACK, by S. S. L. Chang, B. Harris, and L. S. Schwartz. Scientific rept. no. 7 on Contract AF 19(604)1964. 30 Apr 59, 52p. 10 refs. AFCRC-TN-59-197; AD-215 937.
Order from LC mi$3.60, ph$9.30 PB 143 557

The noisy channel coding theorem is extended to systems having fading and feedback. The communication channel is presumed discrete with finite memory, and the varying channel conditions are described explicitly by a stochastic parameter. Of particular interest is the maximum rate at which information can be sent error-free over the channel. This rate is compared with the stationary and the ergodic capacities of the channel.

Radio Corp. of America, Camden, N. J.
DESIGN AND STUDY OF CORRELATION INSTRUMENTATION FOR SPEECH ANALYSIS AND SYNTHESIS, by G. F. Jacoby, G. J. Duscheck, and F. L. Putzrath. Scientific rept. no. 1 on Contract AF 19(604)4128. 31 Mar 59, 84p. 15 refs. AFCRC-TN-59-173; AD-214 415.
Order from LC mi$4.80, ph$13.80 PB 143 396

This report covers the studies leading to the selection of an optimum analog instrumentation for processing the output signal of a Vocoder for digital transmission over a standard voice channel. The system is based upon the matching of the incoming voice events against a catalog of speech patterns so that only the pattern number, rather than the speech event itself, need be transmitted. In the receiver, the proper speech pattern is retrieved from a similar memory and generates the required voltages for the Vocoder synthesizer. The recommended system features completely analog processing so that small deviations in the patterns can readily be accommodated. To minimize the number of electronic components and thus increase the equipment reliability, time sequential rather than parallel pattern matching is employed. A single magnetic storage drum is used as the pattern catalog. In duplex operation, it can serve simultaneously as part of the analyzer or synthesizer and can handle any desired number of voice channels.

Photographic Equipment

Air Force Missile Development Center, Holloman AFB, N. Mex.
POWER SPECTRAL ANALYSIS OF SLED VIBRATION DATA, by Herbert R. Lotze. Sep 58, 34p. 4 refs. AFMDC TN-58-12; AD-154 106.
Order from LC mi$3.00, ph$6.30 PB 138 861

A description is given of the analysis and processing of vibration data which originated from a sled run on the AFMDC Track. Different procedures of analysis are explained and compared with respect to applicability. Practical results were validated by the fact that the spectral densities obtained from analog and digital analysis show a very similar frequency characteristic.

Consolidated Electrodynamics Corp., Pasadena, Calif.
A MASS SPECTROMETER SYSTEM FOR MATERIALS: RESEARCH SUMMARY REPORT. PHASE I, by Charles F. Robinson, George D. Perkins, and Norton W. Bell. Rept. for 1 Apr 58-Jan 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5571. July 59, 31p. 17 refs. WADC Technical rept. 59-107; AD-216 714.
Order from OTS $1.00 PB 161 073

There are three areas in which mass spectrometry may be expected to contribute importantly to science and technology within the foreseeable future. They are (1) identification and estimation of minor components and trace impurities in solids; (2) structural studies of high-molecular weight materials; (3) identification and estimation of unknown materials by precise measurement of molecular weight. No mass spectrometer useful in all three of these fields has yet been built; however, the requirements on the instrumentation for these fields have sufficient similarity to encourage the belief that a single high-performance mass resolving system, together with a limited number of ion source and ion detector modules, might be adaptable to any of these fields. This discussion is a report of the progress made during the first phase of a three-phase program of research and development on such a system.

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS, JANUARY-MARCH 1959. Quarterly rept. June 59, 74p. 16 refs. NOLC rept. 454; NAVORD rept. 5955.
Order from LC mi$4.50, ph$12.30 PB 143 249

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SOCIAL SCIENCES

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General

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Test on models of nuclear reactor elements. III. Head losses in core sub-assemblies, by J. S. McNown, R. A. Yagle, and A. Spengos. Michigan. Univ., Engineering Research Institute, Ann Arbor, Mich. July 57. 22p. Order from LC. Mi $2.70, ph $4.80. AECU-3757 (Pt. III)

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An investigation of B_4C-zircaloy-2 size distributions using the cintel flying spot particle resolver, by R. J. Allio, P. A. Oldow, and L. G. Wisnyi. Knolls Atomic Power Lab., Schenectady, N. Y. July 59. Contract W-31-109-Eng-52. 32p. Order from LC. Mi $3.00, ph $6.30. KAPL-M-RA-4

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Collision probabilities and resonance integrals for lattices, by W. Rothenstein. Brookhaven National Laboratory, Associated Universities, Inc., Upton, N. Y. June 59. 18p. Order from OTS. 75 cents. BNL 563 (T-151)

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Neutron cross sections of tellurium, by C. J. Heindl. Pupin Cyclotron Laboratory and George B. Pegram Laboratory, Columbia University, N. Y. June 1959. Contract AT(30-1)-GEN-72. 75p. Order from OTS. $2.00. CU-192

IBM-650 routine IV: Solution of heat diffusion equation, by R. R. Haefner. E. I. du Pont de Nemours & Co. Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. Car. July 59. Contract AT(07-2)-1. 70p. Order from OTS. $2.00. DP-384

The influence of specular reflection on the permability of porous media, by D. N. Lassettre. Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Sep 56. Contract W-7405-eng-26. 32p. Order from LC. Mi $3.00, ph $6.30. K-1258

A small magnetic core digital computer for special applications, by E. W. Hagen. Union Carbide Nuclear Company, Division of Union Carbide Corporation, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 131p. Order from OTS. $2.75. K-1434

Hydraulic instability of reactor parallel-plate fuel assemblies, by E. B. Johansson. Knolls Atomic Power Laboratory, Schenectady, N. Y. July 59. Contract W-31-109-Eng-52. 43p. Order from LC. Mi $3.30, ph $7.80. KAPL-M-EJ-9

Some formulae for average self-shielding factors, J. H. Smith. Knolls Atomic Power Laboratory, Schenectady, N. Y. June 59. Contract W-31-109-Eng-52. 12p. Order from LC. Mi $1.80, ph $1.80. KAPL-M-JHS-6

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NILT--Numerical inversion of Laplace transforms, by C. R. Mullin and R. A. Pfeiffer. Knolls Atomic Power Laboratory, Schenectady, N. Y. Aug 59. Contract W-31-109-52. 15p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-RAP-1

Hafnium slab rod experiments in the PMA, by T. F. Ruane. Knolls Atomic Power Laboratory, Schenectady, N. Y. July 59. Contract W-31-109-Eng-52. 16p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-TFR-11

Numerical methods for solving linear systems and applications to elliptic difference equations, by C. E. Lee and P. M. Stone. Los Alamos Scientific Laboratory, University of California, Los Alamos, N. Mex. Sep 58. Contract W-7405-ENG-36. 96p. Order from OTS. $2.50. LA-2314

An optical fallout analogue, by G. L. Felt. Los Alamos Scientific Laboratory, N. Mex. Oct 55. Contract W-7405-eng-36. 77p. Order from LC. Mi $4.50, ph $12.30. LAMS-1961

Pressure balance in a toroidal pinch, by B. R. Suydam. Los Alamos Scientific Laboratory, N. Mex. Dec 58. Contract W-7405-eng-36. 17p. Order from LC. Mi $2.40, ph $3.30. LAMS-2282

Floco II manual, by B. G. Carlson, C. S. Kazek, Jr., and C. E. Lee. Los Alamos Scientific Laboratory, University of California, Los Alamos, N. Mex. Aug 59. Contract W-7405-ENG-36. 55p. Order from OTS. $1.50. LAMS-2339

Concerning the $\tau/N \to 1/3$ resonance, V analysis of the equation $\frac{d^2v}{ds^2} + \left(\frac{2\tau}{N}\right)^2 v - \frac{b}{2}(\cos 2s)\, v^2 - \lambda\left(\cos\frac{2s}{3}\right) = 0$, by L. J. Laslett and S. J. Wolfson. Midwestern Universities Research Association, Madison, Wis. Aug 59. Contract AT(11-1)-384. 40p. Order from OTS. $1.00. MURA-497

Theory of the fixed frequency cyclotron, by G. Parzen. Midwestern Universities Research Association, Madison, Wis. Aug 59. Contract AT(11-1)-384. 5p. Order from OTS. 50 cents. MURA-498

Background in the neighborhood of a colliding beam region, by D. B. Lichtenberg and L. W. Jones. Midwestern Universities Research Association, Madison, Wis. Aug 59. Contract AT(11-1)-384. 19p. Order from OTS. 50 cents. MURA-499

Measurement of the SRE and KEWB prompt neutron lifetime using random noise and reactor oscillation techniques, by C. W. Griffin and J. G. Lundholm, Jr. Atomics International. A Division of North American Aviation, Inc. Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 32p. Order from OTS. $1.00. NAA-SR-3765

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Calif. Oct 59. Contract AT(11-1)-GEN-8. 16p. Order from OTS. 50 cents. NAA-SR-4039

The power noise transfer function of a reactor, by M. N. Moore. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT (11-1)-GEN-8. 15p. Order from OTS. 75 cents. NAA-SR-4197

Use of an IBM 650 to calculate cloud chamber events, by R. Bingham, D. Tyoko, and L. McDermott. Columbia University. Nevis Cyclotron Laboratories, Irvington-on-Hudson, N. Y. Nov 57. Contract N6-ori-110, Task No. 1 and AT(30-1)-1932. 27p. Order from LC. Mi $2.70, ph $4.80. NEVIS-59

Quasi-tridiagonal matrices and type-insensitive difference equations, by S. Schechter. New York University. Atomic Energy Commission Computing and Applied Mathematics Center, N. Y. May 59. 25p. Order from LC. Mi $2.70, ph $4.80. NYO-2542

Nuclear characteristics of spherical, homogeneous, two-region, molten-fluoride-salt reactors, by L. G. Alexander, D. A. Carrison, H. G. MacPherson and J. T. Roberts. Oak Ridge National Laboratory, Reactor Projects Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 21p. Order from OTS. 75 cents. ORNL-2751

The fast-neutron multiplication effect of beryllium in reactors, by W. Häfele. Oak Ridge National Laboratory, Neutron Physics Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 36p. Order from OTS. $1.25. ORNL-2779

Thermoluminescence studies of the gamma-irradiated ferroelectrics Rochelle salt and guanidine aluminum sulfate hexahydrate, by J. W. Gilliland, Jr. Oak Ridge National Laboratory, Health Physics Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 51p. Order from OTS. $1.50. ORNL-2783

Preliminary report on measurement of soil stresses caused by an underground explosion, by W. R. Perret. Sandia Corporation, Albuquerque, N. Mex. Mar 52. 16p. Order from OTS. 75 cents. SC-2278(TR)

Sandia dust tube: Development and an experiment, by J. R. Banister and W. T. Parker. Sandia Corporation, Albuquerque, N. Mex. Sep 59. 35p. Order from OTS. $1.25. SC-4333(TR)

Radial eigenfunctions, phase shifts, total elastic, differential elastic, and momentum transfer cross sections for electrons scattered from oxygen and nitrogen atoms, by W. J. Byatt, F. O. Lane, Jr., and L. D. Watkins. Sandia Corporation, Albuquerque, N. Mex. Oct 59. 44p. Order from OTS. $1.25. SC-4363(TR)

Atomospheric turbulence, by H. A. Panofsky. Sandia Corporation, Research Colloquium, Albuquerque, N. Mex. Sep 59. 17p. Order from OTS. 50 cents. SCR-118

Results of a force test of four configurations of the Hi-Lo instrumented and chaff rockets in the Sandia Corporation 12 x 12 inch transonic wind tunnel (program III-46), by J. W. Arnold. Sandia Corporation, Albuquerque, N. Mex. Sep 59. 61p. Order from OTS. $1.50. SCTM 299-59(51)

An analytical and experimental investigation of the steady-state flow in small bore tubing with reduced size straight-through fittings connected at the tubing extremities, by A. L. Ducoffe. Sandia Corporation, Albuquerque, N. Mex. July 59. Contract AT(29-1)-789. 31p. Order from LC. Mi $3.30, ph $7.80. SCTM-222-59(57)

One-dimensional compressible flows of magneto-hydrodynamics. II, by O. G. Owens. Sandia Corporation, Albuquerque, N. Mex. Nov 55. 13p. Order from LC. Mi $2.40, ph $3.30. SCTM-239-55(51)

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The price of containing radioactivity in digging craters, by B. F. Murphey. Sandia Corporation, Albuquerque, N. Mex. Oct 58. Decl. Apr 59. Contract AT(29-1)-789. 6p. Order from LC. Mi $1.80, ph $1.80. SCTM-384-58-51

The problem of measuring the absolute yield of 14-Mev neutrons by means of an alpha counter, by J. Benveniste, A. C. Mitchell, C. D. Schrader, and J. H. Zenger. University of California, Lawrence Radiation Laboratory, Livermore, Calif. June 59. Contract W-7405-eng-48. 22p. Order from OTS. 75 cents. UCRL-5619

Antiproton interactions in hydrogen and carbon below 200 Mev, by L. E. Agnew, Jr. University of California. Lawrence Radiation Laboratory, Berkeley, California. July 59. Contract W-7405-eng-48. 93p. Order from OTS. $2.50. UCRL-8785

Multiple meson production in nucleon-antinucleon annihilations and polarization effects in cascade showers, by L. F. Cook, Jr. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. July 59. Contract W-7405-eng-48. 72p. Order from OTS. $2.00. UCRL-8841

Inversion of the angular-momentum expansion of meson photoproduction amplitudes, by J. A. Ball. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Aug 59. Contract W-7405-eng-48. 11p. Order from OTS. 50 cents. UCRL-8858

Span-2 - an IBM-704 code to calculate uncollided flux outside a circular cylinder, by P. A. Gillis, T. J. Lawton, and K. W. Brand. Bettis Plant, Westinghouse Electric Corporation, Bettis Atomic Power Division, Pittsburgh, Pa. Aug 59. Contract AT-11-1-GEN-14. 44p. Order from OTS. $1.25. WAPD-TM-176

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Progress report for January, February, March 1959 to the United States Atomic Energy Commission. Pupin Cyclotron Laboratory and George B. Pegram Laboratory, Columbia University, N. Y. Contract AT-30-1-GEN-72. 34p. Order from LC. Mi $3.00, ph $6.30. CU-191

Quarterly status report of the LASL plasma thermocouple development program for period ending September 20, 1959, by S. Glasstone. Los Alamos Scientific Laboratory. University of California, Los Alamos, N. Mex. Oct 59. Contract W-7405-ENG-36. 15p. Order from OTS. 50 cents. LAMS-2364

Applications of ultrasonic energy. Progress report no. 14 covering period from February 1, 1959 to March 31, 1959. Aeroprojects, Inc., West Chester, Penna. Apr 59. Contract AT(30-1)-1836. 45p. Order from LC. Mi $3.30, ph $7.80. NYO-2568

Semiannual progress report for the period ending June 30, 1959. University of California. School of Medicine, Los Angeles, Calif. 1959. Contract AT-04-1-GEN-12. 82p. Order from LC. Mi $4.80, ph $13.80. UCLA-444

A review of the laboratory's activities and program. Progress report for period ending July 31, 1959, by R. S. Stone and others. Radiological Laboratory, University of California, School of Medicine, San Francisco, Calif. Sep 59. Contract AT-11-1-GEN-10. 46p. Order from OTS. $1.50. USCF-19

Radiation Effects on Materials

The radiolysis of prospective organic reactor coolants. Report no. 13, by W. W. West and others. California Research Corporation, Richmond, Calif. Aug 59. Contract AT(11-1)-174. 34p. Order from OTS. $1.00. AECU-4295

Fundamentals of fission damage, by J. A. Brinkman. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 34p. Order from OTS. $1.00. NAA-SR-4164

Radioactive Waste

Study of liquid and solid waste disposal requirements, by M. Armando, R. Corcoran and others. Allis-Chalmers Manufacturing Company, Nuclear Power Department, Milwaukee, Wis. July 59. Contract AT(11-1)-589. 75p. Order from OTS. $2.00. ACNP-5916

Corrosion film removal as an indication of decontamination effectiveness, by R. D. Weed. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Nov 58. Contract AT(45-1)-1350. 20p. Order from LC. Mi $2.40, ph $3.30. HW-58126

Quarterly progress report research and development activities radioactive waste fixation, January - March, 1959, by D. W. Pearce and others. Hanford Atomic Products Operation, Chemical Research and Development Operation, Richland, Wash. Apr 59. Contract W-31-109-Eng-52. 14p. Order from OTS. 50 cents. HW-60584

Reactors—General

Circulating loops for testing organic coolants, by J. G. Carroll. California Research Corporation, Richmond, Calif. June 59. Contract AT(11-1)-

174. 75p. Order from OTS. $2.00.
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Physics analyses of the treat reactor design, by Haig P. Iskenderian. Argonne National Laboratory, Lemont, Ill. Aug 59. Contract W-31-109-eng-38. 48p. Order from OTS. $1.50.
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Calculation of the temperature dependence of Pu^{239}/U^{235} fission ratio for a graphite-U^{235} system, by D. Meneghetti and K. E. Phillips. Argonne National Laboratory, Lemont Ill. Sep 59. Contract W-31-109-eng-38. 13p. Order from OTS. 50 cents.
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Chemical processing methods and economics for various liquid metal fuel reactors, by R. D. Pierce, W. E. Miller, and H. E. Zellnik. The Babcock & Wilcox Company, Atomic Energy Division, Mar 58. Contract AT(30-1)-1940. 94p. Order from OTS. $2.25.
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Liquid metal fuel reactor experiment. Quarterly technical report for July through September 1958. The Babcock & Wilcox Company, Atomic Energy Division. 1958. Contract AT(30-1)-1940. 172p. Order from OTS. $3.00.
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Liquid metal fuel reactor experiment. The effect of slurry inhomogeneity on nuclear stability of liquid metal fuel reactors, January 29, 1959, by H. E. Zellnik, W. E. Miller, and C. E. Thomas. The Babcock & Wilcox Company, Atomic Energy Division. Contract AT(30-1)-1940. 37p. Order from OTS. $1.25.
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Lecture notes on reactor controls, by C. S. Walker. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 54. Contract W-7405-eng-26. 182p. Order from LC. Mi $8.40, ph $28.80.
CF-59-6-90

Investigation of temperature coefficients obtained from pressure test reactor, by G. D. Hickman and J. A. Bistline. Knolls Atomic Power Laboratory, Schenectady, N. Y. July 59. Contract W-31-109-Eng-52. 39p. Order from I C. Mi $3.00, ph $6.30.
KAPL-M-GDH-1

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Survey of the physics, metallurgy, and engineering aspects of reactor control materials, by Vallecitos Atomic Laboratory and Engineering Section, Atomic Power Equipment Department, San Jose, Calif. June 59. Contract AT(04-3)-189. 398p. Order from OTS. $3.50.
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Metal-water reactions: III. Fuel element stresses during a nuclear accident, by K. M. Horst. Atomic Power Equipment Department, General Electric Company, San Jose, Calif. July 59. Contract AT(04-3)-189. 27p. Order from OTS. 75 cents.
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Physics of intermediate reactors. Supplement, by C. B. Mills. Los Alamos Scientific Laboratory, University of California, Los Alamos, N. Mex. Apr 59. Contract W-7405-ENG-36. 79p. Order from OTS. $2.00.
LAMS-2288(Suppl. 1)

Experimental evaluation of a concentric-cylinder, spiral-flow heat exchanger, by J. S. McDonald. Atomics International. Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 34p. Order from OTS. $1.00.
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A siphon break as a blocking valve, by J. McDonald and W. Marten. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 30p. Order from OTS. 75 cents.
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Industrial process and space heat from nuclear reactors. A literature search, by J. M. Jacobs. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Oct 59. 9p. Order from OTS. 50 cents.
TID-3537

U. S. Papers of the Sixth International Congress and Exhibition of Electronics and Atomic Energy at Rome, Italy. Division of International Affairs United States Atomic Energy Commission, Oak Ridge, Tenn. Oct 59. 83p. Order from OTS. $2.25.
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Nuclear materials control system, Phase II. The feasibility of an annular core reactor as a reactor fuels measuring device, by G. E. Putman. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh, Pa. May 59. Contract AT (30-1)-2176, Task 1. 75p. Order from LC. Mi $4.50, ph $12.30.
WCAP-1192

Nuclear materials control system, Phase II. The feasibility of an annual nuclear core as a reactor fuels measuring facility, by J. A. Vreeland. Westinghouse Electric Corp., Atomic Energy Dept., Pittsburgh, Pa. June 59. Contract AT930-1)-2176, Task 1. 25p. Order from LC. Mi $2.70, ph $4.80.
WCAP-1221

Nuclear materials control system, Phase II. A design for the evaluation of a reactor fuels measurement facility, by W. J. Rusnack. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh, Pa. June 59. Contract AT(30-1)-2176. 31p. Order from LC. Mi $3.00, ph $6.30.
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Reactors—Power

Decay heat removal system. Section I. Second performance. First issue. Duquesne Light Co., Shippingport, Pa. May 59. 3p. Order from LC. Mi $1.80, ph $1.80.
AECU-4213

Core I control rod drive mechanisms periodic tests. Section I. Eight performance. First issue. Duquesne Light Co., Shippingport, Pa. May 59. 11p. Order from LC. Mi $2.40, ph $3.30.
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Fuel defect test - borax - IV, by R. F. S. Robertson and V. C. Hall, Jr. Argonne National Laboratory, Reactor Engineering Division. Oct 59. Contract W-31-109-eng-38. 42p. Order from OTS. $1.25.
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HRT mockup iodine removal and recombiner tests, by P. H. Harley. Oak Ridge National Laboratory, Oak Ridge, Tenn. Jan 58. Contract W-7405-eng-26. 12p. Order from LC. Mi $2.40, ph $3.30.
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Summary of HRT run 14, by J. R. Engel, P. N. Haubenreich, J. O. Kolb, and D. M. Richardson. Oak Ridge Natinnal Laboratory, Tenn. June 59. Contract W-7405-eng-26. 79p. Order from LC. Mi $4.50, ph $12.30.
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Investigation of mechanical methods of scale removal from HRT heat exchangers, by C. H. Gabbard, D. M. Eissenberg, J. C. Moyers, and I. K. Namba. July 59. Contract W-7405-eng-26. 8p. Order from LC. Mi $1.80, ph $1.80.
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Heavy water moderated power reactors. Quarterly progress report for February, March, and April 1959, by D. F. Babcock and L. Isakoff. E. I. du Pont de Nemours & Co. Explosives Department, Atomic Energy Division, Technical Division, Wilmington, Del. July 59. Contract AT(07-2)-1. 115p. Order from OTS. $2.50.
DP-385

Process development pile measurements of lattice parameters of natural uranium in heavy water, by N. P. Baumann and others. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. Car. July 59. Contract AT(07-2)-1. 31p. Order from OTS. $1.00.
DP-407

Army gas-cooled reactor systems program. Preliminary hazards summary report for the ML-1 Nuclear Power Plant. Aerojet-General Nucleonics, San Ramon, Calif. Apr 59. Contract AT(10-1) 880. 213p. Order from OTS. $3.50.
IDO-28537

Development of the SRE thimble-type control rods Mark I and II, by A. E. Miller. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 62p. Order from OTS. $1.75.
NAA-SR-2011

Fuel programming for sodium graphite reactors, by T. J. Connolly. Atomics International. A Division of North American Aviation, Inc. Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 34p. Order from OTS. $1.00.
NAA-SR-4040

Induction heating tests in the hallam nuclear power facility development program, by H. W. Lohman. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 31p. Order from OTS. 75 cents. NAA-SR-4206

Aluminum chloride as a thermodynamic working fluid and heat transfer medium, by M. Blander, L. G. Epel, A.P. Fraas, and R. F. Newton. Oak Ridge National Laboratory, Reactor Projects Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 29p. Order from OTS. $1.00. ORNL-2677

A preliminary study of a direct-cycle steam-cooled reactor for merchant ship propulsion, by H. L. Falkenberry, R. S. Holcomb, and G. Samuels. Oak Ridge National Laboratory, Reactor Projects Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 17p. Order from OTS. 75 cents. ORNL-2759

Small-sized organic moderated reactors (10 - 40 MWE). Atomics International. A Division of North American Aviation, Inc., Canoga park, Calif. Oct 59. 43p. Order from OTS. $1.25. TID-8511

Evaluation of ion exchange resins for use in the Yankee reactor. Westinghouse Electric Corp., Atomic Power Department, Pittsburgh, Pa. July 59. Contract AT(30-3)-222, Subcontract No. 1. 36p. Order from LC. Mi $3.00, ph $6.30. YAEC-115

Yankee Project. Quarterly progress report for the period January 1 to March 31, 1959, by H. E. Walchli. Westinghouse Electric Corp., Atomic Power Department, Pittsburgh, Pa. May 59. Contract AT(30-3)-222. 75p. Order from OTS. $2.25. YAEC-125

Stable Isotope Separation

Thermal diffusion: A bibliography, by G. R. Grove. Monsanto Chemical Company, Mound Laboratory, Research and Engineering Division, Miamisburg, Ohio. June 59. Contract AT-33-1-GEN-53. 58p. Order from OTS. $1.75. MLM-1088

Technology—Feed Materials

Oxide fluorination tower, by L. C. Peoples. Goodyear Atomic Corporation, Technical Division, Chemistry Department, Portsmouth, Ohio. Aug 59. Contract AT(33-2)-1. 24p. Order from OTS. 75 cents. GAT-252

Process development quarterly report, by J. U. Shepardson and J. A. Nelson. Mallinckrodt Chemical Works, Uranium Division, Weldon Spring, Mo. Nov 59. Contract W-14-108-Eng-8. 101p. Order from OTS. $2.50. MCW-1433

De-entrainment of organic extract by electrostatic precipitation, by W. C. Philoon and J. T. Krieg. Mallinckrodt Chemical Works, Uranium Division, Weldon Spring, Mo. Nov 59. Contract W-14-108-Eng-8. 9p. Order from OTS. 50 cents. MCW-1437

Engineering evaluation of semi-works ADU production, by D. J. Loudin. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Mar 59. Contract AT(30-1)-1156. 24p. Order from OTS. $1.00. NLCO-786

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Aluminum chloride as a thermodynamic working fluid and heat transfer medium, by M. Blander, L. G. Epel, A.P. Fraas, and R. F. Newton. Oak Ridge National Laboratory, Reactor Projects Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 29p. Order from OTS. $1.00. ORNL-2677

A preliminary study of a direct-cycle steam-cooled reactor for merchant ship propulsion, by H. L. Falkenberry, R. S. Holcomb, and G. Samuels. Oak Ridge National Laboratory, Reactor Projects Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 17p. Order from OTS. 75 cents. ORNL-2759

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Yankee Project. Quarterly progress report for the period January 1 to March 31, 1959, by H. E. Walchli. Westinghouse Electric Corp., Atomic Power Department, Pittsburgh, Pa. May 59. Contract AT(30-3)-222. 75p. Order from OTS. $2.25. YAEC-125

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Thermal diffusion: A bibliography, by G. R. Grove. Monsanto Chemical Company, Mound Laboratory, Research and Engineering Division, Miamisburg, Ohio. June 59. Contract AT-33-1-GEN-53. 58p. Order from OTS. $1.75. MLM-1088

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Engineering evaluation of semi-works ADU production, by D. J. Loudin. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Mar 59. Contract AT(30-1)-1156. 24p. Order from OTS. $1.00. NLCO-786

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U.S. Government RESEARCH REPORTS

Vol. 33, No. 2, Pp. 111-229 February 12, 1960

AGRICULTURE

Armour Research Foundation, Chicago, Ill.
TOXICITY OF BORON-OXYGEN COMPOUNDS TO PLANTS AND SOIL BACTERIA, by A. Shefner and R. Ehrlich. Final rept. on [Contract NOas-52-1024-c]. 30 May 57, 16p. 1 ref. CCC-1024-TR-251.
Order from LC mi$2.40, ph$3.30 PB 143 /12

A determination has been made of the response of various plants to various levels of applied boron compounds, in terms of yields of fresh weight of beans, radishes, lettuce, beets, and oats. The effects of adding boron at different stages of growth and the effectiveness of different methods of application were investigated. Boron adversely affected the growth of the plants tested when applied at levels between 8 and 32 pounds of boron per acre (lb. B/acre). Application of boric acid solutions to a variety of seeds germinating in pure quartz sand resulted in serious reduction in germination frequency. The effect of boron on the growth of three soil microorganisms, Azotobacter chroöcoccum, Streptomyces sp., and Rhizobium meliloti, was also determined.

ASTRONOMY

Astrophysics

Centro di Studio per la Fisica Delle Microonde (Italy).
THE DECELERATION OF METEORS DURING THEIR PASSAGE THROUGH THE EARTH'S ATMOSPHERE, by F. Verniani. Technical note no. 2 on Contract AF 61(052)227. June 59. 6p. 3 refs. AFCRC-TN-59-752.
Order from LC mi$1.80, ph$1.80 PB 143 922

The deceleration of meteors is computed theorically as a function of the characteristic quantities of evaporation, in particular, of velocity. It is shown that for over 3/4 of all meteors, the deceleration increases until the end of evaporation, and that, at the point of maximum rate of evaporation, the deceleration, as a first approximation, may be assumed the same for all meteors.

Harvard Coll. Observatory, Cambridge, Mass.
CLASSIFICATION OF SOLAR PROMINENCES-VII-1954, by Donald H. Menzel and F. Shirley Jones. Scientific rept. no. 13 on Contract AF 19(604)1394. [1958] 93p. AFCRC-TN-58-620; AD-206 783.
Order from LC mi$5.40, ph$15.30 PB 137 947

A tabulation and analysis is presented of the behavior classification of prominences observed at the High Altitude Observatory at Climax, Colorado, for the month of January, 1954, and at the Sacramento Peak Observatory, Sunspot, New Mexico, for the period January 23 to December 31, 1954. (See also PB 136 881)

Iowa State U., Iowa City.
OBSERVATIONS OF LOW ENERGY SOLAR COSMIC RAYS FROM THE FLARE OF 22 AUGUST, 1958, by K. A. Anderson, R. Arnoldy, and others (U. of Minnesota). [1959] 49p. 26 refs. SUI-59-9.
Order from LC mi$3.30, ph$7.80 PB 143 068

Observations have been made of protons at balloon altitudes in the energy range 100 to 300 Mev following a solar sequency of optical flare, r-f noise bursts and long enduring noise storm. Other particles are shown to have low upper limits to their abundance. The flare particles continue to be observed for at least 2 days and arguments are given to show that their storage and emission takes place in the solar atmosphere. The differential energy spectrum is derived from ionization versus atmospheric depth data and is found to be E^{-5} dE. Observations by riometer and VHF scatter propagation paths over the polar regions indicate that solar acceleration of protons up to roughly 100 Mev energy is rather frequent.

Maryland U., College Park.
FARADAY ROTATION OF RADIO WAVES WITHIN THE CRAB NEBULA, by Howard Laster and Allen M. Lenchek. Rept. on Contract AF 49(638)530, Feb 59, 5p. 10 refs. AFOSR-TN-59-164; AD-211 143.
Order from LC mi$1.80, ph$1.80 PB 144 029

Minnesota U. School of Physics, Minneapolis.
THE FLUX AND ENERGY SPECTRUM OF COSMIC RAY α-PARTICLES DURING SOLAR MAXIMUM, by P. S. Freier, E. P. Ney, and C. J. Waddington. Technical rept. on Cosmic Ray Program, Contract Nonr-710(19). Dec 58, 39p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 143 861

The fluxes of primary cosmic ray α-particles over Minnesota and Texas have been measured during the present period of maximum solar activity. A value of 136 ± 9 α-particles/m^2 sec ster was measured over Minnesota and of 68 ± 4 α-particles/m^2 sec ster over Texas. In both cases these values are significantly lower than those observed at solar minimum. The energy spectrum of these particles has been determined between 200 Mev/nucleon and 3.0 Bev/nucleon. It is shown that the slope of the integral spectrum is less than that observed at solar minimum and that a significant number of low energy particles is still present. A possible mechanism for these changes is discussed briefly. The determination of energies of particles from a measurement of their ionization is discussed in detail in an appendix.

Minnesota U. School of Physics, Minneapolis.
THE LITHIUM, BERYLLIUM AND BORON IN THE PRIMARY COSMIC RADIATION, by P. S. Freier, E. P. Ney, and C. J. Waddington. Technical rept. on Cosmic Ray Program, Contract Nonr-710(19). Dec 58, 29p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 143 932

In order to resolve the controversy concerning the abundance of the light elements ($3 \leq Z \leq 5$) in the primary cosmic radiation a further experiment has been performed. The charge spectrum of the cosmic radiation has been determined on October 19, 1957 in a stack of nuclear emulsions exposed nearer the top of the atmosphere than before. The results of the experiment prove that these light elements make up an appreciable fraction of all those nuclei with $Z \geq 3$ present in primary cosmic radiation.

Rochester U., N. Y.
SOME CONSIDERATIONS ON THE ANALYSIS OF PRIMARY COSMIC RAY INTENSITY EXPERIMENTS, by A. Engler, M. F. Kaplon, and J. Klarmann. Rept. on Contract AF 49(638)303. [1958] 34p. 22 refs.
AFOSR-TN-58-970; AD-205 597.
Order from LC mi$3.00, ph$6.30 PB 144 001

A discussion is given of the procedures employed in the analysis of primary cosmic ray intensity experiments and the assumptions inherent in their use, with particular emphasis on nuclear emulsion as a detector. Explicit formulas for extrapolation of particle intensities for various geometries employed in emulsion work are given. Some discussion of geomagnetic effects is given and data are presented showing that the earth's shadow cone is not appreciably present at a geomagnetic latitude of 40°.

BEHAVIORAL SCIENCES

Human Engineering

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
A GUIDE TO COLOR BANDING FOR INDICATORS (METERS), by William Wokoun and Gerald Chaikin. Mar 59, 11p. Technical Memo. 2-59.
Order from LC mi$2.40, ph$3.30 PB 143 130

This report presents a rationale for color-coded banding of meters. The principles set forth are illustrated, and swatches of the four colors which are considered maximally discriminable are given.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE EFFECT OF DIFFERENT PROPORTIONS OF MONITORED ELEMENTS ON OPERATOR PERFORMANCE IN A SIMULATED RADAR AIR TRAFFIC CONTROL SYSTEM, by Robert G. Kinkade and J. S. Kidd. Rept. on Contract AF 33(616)3612. June 59, 17p. 11 refs. WADC Technical rept. 59-169.
Order from OTS $0.50 PB 161 111

A simulated radar approach control system was utilized to evaluate the influence of different levels of monitoring on system performance. Monitoring level was varied by manipulating the proportion of aircraft in the system having airborne position information (API) equipment. The API-equipped aircraft did not require active control of their approach path as did those aircraft without such equipment. Four conditions were compared: (a) 100%, (b) 63%, (c) 37%, and (Behavioral Sciences--Human Engineering, 12 Feb 60) (d) 0% of aircraft with API equipment. Eight laboratory-trained controllers participated. Results indicated an approximately linear increase in system performance as proportion of API-equipped aircraft was increased. Recommendations for future utilization of API in terminal operations were considered.

Personnel and Training

American Inst. for Research, Pittsburgh, Pa.
STUDIES OF NAVY GUIDED MISSILE TEAMS, by David J. Klaus and Robert Glaser. Final rept. for 1 May 51-31 May 58 on Contract N7onr-37008. 31 Dec 58, 26p. 47 refs.
Order from LC mi$2.70, ph$4.80 PB 143 615

This report consists of a brief summary of activities conducted as a research project and includes a digest of project activities, a short administrative history of the project, and an annotated bibliography of reports produced by the project staff.

Applied Psychological Services, Wayne, Pa.
POST-TRAINING PERFORMANCE CRITERION DEVELOPMENT AND APPLICATION: DEVELOPMENT AND APPLICATION OF TBCL CRITERIA TO THE SESR PROGRAM FOR THE AIR CONTROLMAN AND THE PARACHUTE RIGGER RATINGS, by Authur I. Siegel, Milton Richlin, and Philip Federman. Rept. on Contract Nonr-2279(00). Oct 58, 131p. 2 refs.
Order from LC mi$6.90, ph$21.30 PB 143 388

This is the second of a series of reports by Applied Psychological Services on the post-training performance of the enlisted personnel in certain naval aviation ratings. The present research had two general purposes: (1) measurement of the effects of the Selective Emergency Service Rate program (SESR) on the quality of the technical performance of the Air Controlman Tower (ACT) and Parachute Rigger Survival (PRS) ratings. (2) development of a criterion instrument applicable to the on-going measurement of the proficiency level of ACTs and PRSs who are graduates of the respective schools of the Naval Air Technical Training Command. Separate Technical Behavior Check Lists which seem to possess the attributes of analyzability, relevance, comprehensiveness, and correct weighting of elements were prepared for each rating. Adequate reliabilities were demonstrated for the lists. (See also PB 142 120 and 136 699)

Clark, David, Co., Inc., Worcester, Mass.
INTEGRATION OF PERSONAL EQUIPMENT. Rept. on Contract AF 33(616)3329. [Aug 59] 36p. WADC technical rept. 59-382.
Order from OTS $1.00 PB 161 132

This report covers the efforts, methods of approach and solutions to some of the problems of integrating items of aircrew personal equipment. The major problem of integration is the combining of the various individual items which have specific functions with each other without complicating these combinations beyond their effectiveness limits. Practical solutions were achieved in some areas, but additional work is required in others.

Washington U., Seattle.
THE SELECTION OF PREDICTORS FOR SOME EVALUATIONS OF FACULTY PERFORMANCE, by Clifford E. Lunneborg. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C2). Dec 57, 115p. 13 refs.
Order from LC mi$6.00, ph$18.30 PB 138 635

Relationships between some evaluations of faculty effectiveness and a number of items of information extracted from the background records of certain faculty members were investigated. Major emphasis in the study was placed upon the selection of predictors from among the items of background information to provide the best estimations of the faculty evaluations. An iterative predictor selection procedure was employed to select only those predictors which made significant independent contributions to these estimations. A criterion is presented, and was applied, for restricting the number of variates selected to prevent reliance of the obtained predictions on small sample error variance in the criterion measures. The results of these predictor selections are reported. Finally, explanations of certain of the findings and suggestions for extension of the research were offered.

Psychology

Applied Mathematics and Statistics Lab., Stanford U., Calif.
CHAINS OF INFINITE ORDER AND THEIR APPLICATION TO LEARNING THEORY, by John Lamperti and Patrick Suppes. Technical rept. no. 18 on Contract Nonr-225(17). 15 Oct 58, 29p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 143 701

The purpose of this paper is to study the asymptotic behavior of a large class of stochastic processes which have been used as models of learning experiments. By applying a theory of chains of infinite order, or "chaînes à liaisons complètes" namely, certain limit theorems for stochastic processes whose transition probabilities depend on the entire past history of the process, but only slightly on the remote past. A self-contained discussion of these and some additional results is the content of Section 2.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
FOUNDATIONS OF STATISTICAL LEARNING THEORY, I. THE LINEAR MODEL FOR SIMPLE LEARNING, by W. K. Estes (Indiana U.) and Patrick Suppes. Technical rept. no. 16 on Contract Nonr-225(17). 20 Nov 57, 101p. 14 refs.
AD-149 728.
Order from LC mi$5.70, ph$16.80 PB 137 998

Primitive notions, the axiomatic structure, and general theorems are presented of a model which formalizes and generalizes models for simple learning; the mathematical foundations of these models are examined. The formulation draws upon the concepts and methods developed by R. R. Bush and F. Mosteller (Stochastic models for learning, New York, 1955) and W. K. Estes and C. J. Burke (Psychol. Rev. 60:276-286, 1953). A study is made of the sample spaces of the stochastic processes involved, and the methods of defining events and probabilities. The theorems are derived by set-theoretical and probabilitic techniques. The discussion is limited to linear models. The level of generality is that of a model broad enough to include as special cases all of the particular linear models which have been applied to learning experiments.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
A PRELIMINARY STUDY OF THE MOTIVATIONAL PROPERTIES OF COLD STRESS, by Robert B. Payne. Apr 59, 13p. 12 refs. Technical rept. 58-9.
Order from LC mi$2.40, ph$3.30 PB 143 345

An experiment was conducted for the purpose of noting (a) whether cold exposure can be regarded as having drive properties sufficient for the motivation of a rote learning process, and (b) whether the drive properties of cold exposure are modified by the factor of cold acclimatization. Five male subjects underwent thermophysiological changes characteristic of cold acclimatization by means of rigorous physical training followed by prolonged field exposure to sub-zero temperatures. The temperature effect was significant at the 5 percent level, but only for the acclimatized subjects. They learned faster under the lower temperature condition on both occasions. The results agree well with those observed in the operant behavior of rats in low temperatures under radiant heat reinforcement, and they lend themselves to the interpretation that cold exposure generates a more effective drive stimulus for acclimatized subjects because acclimatized subjects actually lose more heat under cold stress than do their nonacclimatized controls.

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
RELATIONSHIPS OF INTERMITTENT NOISE, INTER-SIGNAL INTERVAL AND SKIN CONDUCTANCE TO VIGILANCE BEHAVIOR, by Joseph F. Dardano and Irving Mower. July 59, 29p. 11 refs. Technical Memo. no. 7-59.
Order from LC mi$2.70, ph$4.80 PB 143 531

Relationships of intermittent, low intensity, ambient, white noise, inter-signal interval variability and basal skin conductance to prolonged observation were investigated. Observers were required to differentiate a total of 180 critical signals which differed from periodically blinking background signal only by a larger amplitude. Performance was measured by reaction time. Monitoring performance did not deteriorate with low variability of inter-signal intervals, 50 to 70 sec. Intermittent noise impaired performance with this schedule by slightly increasing reaction times during the entire session. With a greater variability of inter-signal intervals, performance deteriorated continuously during the vigil and was unaffected by intermittent noise. A minimum interstimulus interval of 30 sec. resulted in an inverse relationship between reaction time and length of interstimulus interval, at least up to the mean interval. Basal skin conductance was negatively correlated with logarithm of reaction time when performance deteriorated under a signal schedule requiring continuous observation.

Bethany Coll., W. Va.
ON THE SPAN OF A SEARCH MECHANISM IN PROBLEM SOLVING, by Wilbert S. Ray. Technical rept. no. 1 on Contract Nonr-2315(00). Dec 58, 9p 2 refs.
Order from LC mi$1.80, ph$1.80 PB 143 927

This paper reports an attempt to manipulate the span of the search mechanism, and the size of the relation to be discovered. The size of the relation is defined as the number of elements among which the relation holds.

Harvard Graduate School of Education, Cambridge, Mass.
STAGES IN THE DEVELOPMENT OF VOCATIONAL SELF CONCEPT IN ADOLESCENCE, by Robert P. O'Hara (Boston College) and David V. Tiedeman. Rept. no. 7 on Harvard Studies in Career Development; Technical rept. no. 3 on Contract Nonr-1866(31). Nov 58, 23p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 143 461

In an attempt to give an empirical formulation to self concept theory in the realm of vocational development, we have defined self concept as an individual's evaluation of himself. Using this definition we have investigated the areas of aptitude, interest, social class, and values. Previous research has shown that these areas are important in the development of careers. The research reported here not only measures the individual's standing in these four areas but adds a further dimension - a measure of the person's ability to evaluate his standing. Such a dimension is essential to an understanding of the way in which a person solves the occupational choice problem which he is facing. Hence it further illuminates the influence of these factors in occupational choice.

Illinois U., Urbana.
INTERPERSONAL PERCEPTION AND INTERPERSONAL RELATIONSHIPS IN THERAPEUTIC COUNSELING, by J. McV. Hunt. Annual rept. no. 2 on Contract Nonr-1834(11). 15 Nov 58, 56p. 11 refs.
Order from LC mi$3.60, ph$9.30 PB 143 434

Points covered are:
Introduction
Notation
D^2 - correlations as a function of item-correlations
Correlation studies of D^2
Method
Summary of factor construction
Calculation of components and their intercorrelation
Results: Comparison of Cross-Factor Correlations
Summary of D^2 "generality" as opposed to component "generality"
Correlations of D^2 with its components
Discussion
Suggested research program
Appendix A: Derivations
Appendix B: Summary of errors
Appendix C: Example of reversal of correlations
Bibliography

Human Resources Research Center, Lackland AFB, San Antonio, Tex.
PSYCHOMOTOR PERFORMANCE AS A FUNCTION OF INITIAL LEVEL OF ABILITY, by Bradley Reynolds and Jack A. Adams. Oct 53, 28p. 14 refs. Research bulletin 53-39.
Order from LC mi$2.70, ph$4.80 PB 144 211

The present study was designed to test the hypothesis that the general laws of learning are independent of individual differences in the field of psychomotor learning. The plan of the study reported has involved training a group with massed practice and a group with distributed practice. Upon completion of this study, each group was divided into subgroups on the basis of initial level of ability in the task. The acquisition curves obtained for the ability subgroups were examined for systematic differences in performance. Tables and graphs present the results.

Institute for Research in Social Science, U. of North Carolina, Chapel Hill.
ANNUAL TECHNICAL REPORT. Rept. on Contract Nonr-855(04). Nov 58, 9p. 10 refs. AD-205 750.
Order from LC mi$1.80, ph$1.80 PB 143 471

Contents:
Psychological set and social conformity
The effect of threat to group status on group performance strategies
Surveillance and trust
Reaction to unfavorable personal evaluation as a function of the evaluator's perceived adjustment
The group member's response to hostility as a function of his perceived support for its instigation
A self-scored measure of achievement and affiliation motivation
The effects of 3 schedules of reinforcement and individual motivation on perception of performance and risk-taking behavior
Political orientation and the perceptual effect of an anticipated interaction
The adaptiveness of groups of changing task demands under various conditions of social communication
Communication and social control
Types of learning in 3-person interaction
Group structure and communication
The American University as a behavioral system

Laboratory for Research in Social Relations, U. of Minnesota, Minneapolis.
COGNITION, MOTIVATION AND TIME PERCEPTION, by Peter Schönbach. Technical rept. no. 2 on Research Studies on the Relation Between Cognition and Behavior, Contract N8onr-662(16). Nov 58, 20p. 15 refs.
Order from LC mi$2.40, ph$3.30 PB 143 421

An exploratory study by Schachter on social isolation suggested two hypotheses: (1) The force acting on a person in a barrier situation to reach a goal (G) is an increasting function of the person's need for G "times" the relevance of this person's ideation with respect to G. (2) The greater within limits the magnitude of the force acting on a person in a barrier situation to reach a goal, the greater will be this person's estimate of the time spent in that barrier situation.

Michigan State U., East Lansing.
MATHEMATICAL MODELS FOR HUMAN GROUP ORGANIZATION, by Leo Katz. Final rept. on Contract Nonr-785(00). 12 June 58, 45p. 5 refs.
Order from LC mi$3.30, ph$7.80 PB 143 120

Personnel Lab., Wright Air Development Center, Lackland AFB, Tex.
PREDICTION OF CREATIVITY IN A SAMPLE OF RESEARCH SCIENTISTS, by Cecil J. Mullins. Feb 59, 17p. 6 refs. WADC Technical note 59-36; AD-211 039.
Order from LC mi$2.40, ph$3.30 PB 144 210

In an attempt to identify test predictors of scientific creativity, two criteria of creativity were used: supervisors' ratings and number of publications. An interest questionnaire, a vocabulary test, and nine tests of the Guilford Creativity Battery were administered to 131 research physical scientists. Of 42 test scores derived from the battery, four were significantly related to the rating criterion and seven to the publications criterion. The two criteria were not significantly with both criteria. A composite predictor gave promise of increasing effective prediction of the ratings criterion, but not of the publications criterion.

Washington U., Seattle.
A COMPARISON OF EPPES SCORES OBTAINED FROM THE STANDARD FORCED-CHOICE PROCEDURE AND A RATING-SCALE PROCEDURE, by Chadwick Karr. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). Oct 58, 96p. 28 refs.
Order from LC mi$5.40, ph$15.30 PB 143 711

The present investigation is concerned with two separate problems arising from Wright's work. Can one devise a method of scoring responses given to separate EPPS (Edwards Personal Preference Schedule) statements such that the scores for variables will correlate more highly (than Wright's normative-ipsative scores) with conventional EPPS scores for corresponding variables? Wright showed that the factor structure of the matrices of variable scores for the rating scale and the EPPS were not identical. Presumably, one of the major differences lay in the presence of one or more SD factors in the rating-scale score matrix. Can one determine more precisely what reliable systematic variance is present in variable scores from statements rated one at a time which is not present in forced-choice EPPS variable scores, and vice versa?

Yale U., New Haven, Conn.
FIVE STUDIES OF THE RELATION BETWEEN SEX-ROLE IDENTIFICATION AND ACHIEVEMENT IN PROBLEM SOLVING, by G. Alexander Milton. Technical rept. 3 on Contract Nonr-609(20). Dec 58, 76p. 17 refs. AD-218 597.
Order from LC mi$4.50, ph$12.30 PB 143 847

Contents:
Achievement in problem solving as related to sex-role identification
Sex differences in problem solving and role appropriateness of problem content
Choice of strategy for solving problems and sex role
Sex differences in problem solving as related to role appropriateness of problem content and to availability of manipulative materials
Sex differences in problem solving and role appropriateness of problem content: a replication

Yale U., New Haven, Conn.
RESEARCH PROGRAM ON AFFECTIVE AND COGNITIVE ASPECTS OF ATTITUDE CHANGE, by Milton J. Rosenberg. Annual rept. for Sep 57-Dec 58 on Contract Nonr-609(27). [1959] 17p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 143 862

Contents:
Cognitive reorganization in response to the hypnotic manipulation of attitudinal affect
Investigations into the dynamics of the hypnotic process
Investigations into structural and dynamic aspects of "cognitive balancing"
The relation of variation in self-esteem to opinion change

BIOLOGICAL SCIENCES

Iowa State U. of Science and Tech., Ames.
SOME FAMILIES OF CONTAGIOUS DISTRIBUTIONS, by S. K. Katti and John Gurland. Rept. on Contract AF 49(638)43. [1958] 46p. 10 refs. AFOSR-TN-59-4; AD-208 184.
Order from LC mi$3.30, ph$7.80 PB 143 362

The purpose of the research in this paper includes the consideration of the following questions: To study some families of contagious distributions from the point of view of their derivation. To compare these distributions using characteristics such as skewness, kurtosis, and the ratio of frequencies. To estimate the parameters by various methods in order to gain some empirical evidence about their relative merits. To compare fits using chi-square and to see if any general conclusions can be suggested on an empirical basis regarding the best fit.

Pennsylvania U., Philadelphia.
PROPERTIES OF BIOLOGICAL MATERIALS, by Herman P. Schwan. Annual progress rept. for 1958 on Contract Nonr-551(05). 5 Dec 58, 8p.
Order from LC mi$1.80, ph$1.80 PB 143 850

Summary of work done to measure and analyze the electric and acoustic impedance of biological material in the electrical frequency range from 10 Mc to 1000 Mc and in the acoustic frequency range from 200 Kc to 10 Mc.

School of Aviation Medicine, Randolph AFB, Tex.
BIOASTRONAUTICS: ADVANCES IN RESEARCH. Mar 59, 184p. 15 refs.
Order from LC mi$8.40, ph$28.80 PB 143 923

In this publication fifteen special progress reports are published which deal with problems immediately applicable in rocket flight and satellite flight. Others report about progress in fields which will be of usefulness in more advanced space operations. All of these special reports may serve as a source of information for physiologists and physicians working in space medicine or bioastronautics, and also to the physical scientists, rocket engineers, military officials and government administrators concerned with the national space program.

Anatomy and Physiology

California U., Los Angeles.
TECHNICAL STUDIES ON CARGO HANDLING, VI. BIBLIOGRAPHY OF HUMAN ENERGY EXPENDITURE LITERATURE, by Frank C. Hale. Rept. on Contract Nonr-233(07). Oct 58, 116p. 880 refs. Dept. of Engineering rept. 58-68.
Order from LC mi$6.00, ph$18.30 PB 143 700

A bibliography of literature related to human energy expenditure, its parameters and measures, is presented through December 1957. A cross reference index is provided. (See also PB 133 230)

California U., Los Angeles School of Medicine.
THE EFFECT OF VARIOUS STRESSES ON THYROID FUNCTION IN MAN AND IN ANIMALS, by David H. Solomon, Leslie R. Bennett, and Delores E. Johnson. Annual progress rept. for 1 Apr 58-31 Mar 59 on Contract Nonr-233(36). 1 Dec 58, 7p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 143 845

Cornell U. [Ithaca, N. Y.]
OPTICAL MOTIONS AND TRANSFORMATIONS AS STIMULI FOR VISUAL PERCEPTION. Research rept. on Visual Perception of Motion and Space, Contract Nonr-401(14). Sep 56, 15p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 128 818

Human Resources Research Center, Lackland AFB, San Antonio, Tex.
TESTS OF MOTOR ABILITY OR GROSS MUSCULAR COORDINATION, by Merrell E. Thompson, Jean P. Thompson, and E. Ralph Dusek (U. of Arkansas). Rept. on Contract AF 33(038)22948. July 53, 39p. 255 refs. Research bulletin 53-25.
Order from LC mi$3.00, ph$6.30 PB 144 212

The descriptive material of the present review is primarily concerned with those tests which are currently being used with males of military age and which appear to measure, primarily, some aspect of gross muscular coordination. In terms of the conventional categories set up by the physical education writers, this has meant, in general, the inclusion of tests of motor educability, motor capacity, motor fitness, motor ability, and strength (where measured by some activity rather than by dynamometers); and the exclusion of endurance tests, specific skill or achievement tests, and cardiovascular tests of fitness. In the interest of completeness, a number of early tests are briefly described and the early testing movement is outlined. Certain tests which have been developed and standardized primarily for use with high school boys, are included in Appendix B. Other tests, less pertinent to the inquiry, have been indicated only in the Bibliography.

Institute of Optics, U. of Rochester, N. Y.
STUDY OF VISUAL STEREOSCOPIC ACUITY, by V. J. Carpenter and N. D. Miller. Final technical rept. for 15 June 56-15 Feb 58 on Contract DA 44-009-eng-2882. 15 Mar 58, 53p. 1 ref.
Order from LC mi$3.60, ph$9.30 PB 143 663

This report presents the analysis of 47,000 of the settings made by thirty of the observers after their training and practice sessions, using seventeen different viewing conditions. The targets used in the comparison of conditions were six miniature tents photographed against a model of hilly terrain and oriented such that their ridges were in the direction of flight. Ten settings were made on each target in random order by each observer for every viewing condition. The standard deviations for the individual targets were computed and averaged to yield an index of the accuracy of measurement for the different conditions.

Iowa State U., Iowa City.
THE TRANSFER OF ENERGY ACROSS THE COCHLEA, by Juergen Tonndorf. Mar 59, 12p. 14 refs. AFSAM rept. 59-49.
Order from LC mi$2.40, ph$3.30 PB 143 370

Two concepts concerning different aspects of cochlear function are in an apparent conflict: the pressure-wave concept (which maintains that the acoustic energy entering the cochlea by the oval window must leave in toto by the round window) and the traveling-wave concept of Bekesy. If the latter would really entail the progression and dissipation of energy in the direction of the helicotrema (according to the common definition of wave travel), this energy would have to be diverted from the pressure wave. The dilemma is solved by consideration of fluid motion in cochlear models. Energy is transferred from the vestibular scala across the partition to the tympanic scala. In this process the partition responds to the velocity of the fluid motion.

The latter fact accounts for the shape of the envelope over the traveling waves. The finding that the amplitude of fluid motion in both scalae decreases in a fenestro-apical direction is accounted for by the Reciprocity Theorem of Helmholtz.

Vision Research Labs., U. of Michigan, Ann Arbor.
APPLICATION OF PROBIT ANALYSIS TO PSYCHOLOGICAL DATA: I. TECHNIQUES FOR DESK COMPUTATION, by W. M. Kincaid and H. R. Blackwell. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Sep 58, 24p. 14 ref. Rept. no. 2144-283-T.
Order from LC mi$2.70, ph$4.80 PB 143 415

Psychophysical data collected in studies of visual detection are routinely subjected to probit analysis. This analysis involves fitting a cumulative normal distribution function to the experimental data, in accordance with the principle of maximum likelihood. The application of this principle required the solution of a set of simultaneous equations. An iterative procedure for solving these equations with the aid of desk calculators is described in the present report.

Vision Research Labs., U. of Michigan, Ann Arbor.
APPLICATION OF PROBIT ANALYSIS TO PSYCHOPHYSICAL DATA: II. TECHNIQUES FOR THE MICHIGAN DIGITAL AUTOMATIC COMPUTER (MIDAC), by Anne B. Moldauer and Wilfred M. Kincaid. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Jan 59, 16p. 3 refs. Rept. no. 2144-289-T.
Order from LC mi$2.40, ph$3.30 PB 143 443

The Vision Research Laboratories have successfully developed two programs for carrying out probit analyses of visual detection data on high-speed computers. The first procedure, patterned closely on that used with desk computers, proved to have a number of drawbacks; the second procedure, more specifically adapted for automatic computers, proved successful when used on the Michigan Digital Automatic Computer (MIDAC). (See also PB 143 415)

Vision Research Labs., U. of Michigan Ann Arbor.
THE DESIGN AND CALIBRATION OF A SPECTRAL COMPARATOR FOR MEASURING VISUAL LUMINOSITY FUNCTIONS, by B. S. Pritchard. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Nov 58, 19p. 1 ref. Rept. no. 2144-336-T.
Order from LC mi$2.40, ph$3.30 PB 143 445

The Spectral Comparator is an instrument which has been developed for measurement of the luminosity functions of human observers. The optical system is described, and the methods are explained by which the radiances of the two visual fields were measured for various settings of the controls on the instrument. The results of the measurements are presented in tabular and in graphical form for use in studies of the luminosity function to be reported subsequently from these laboratories.

Vision Research Labs., U. of Michigan, Ann Arbor
THE DETECTABILITY OF TARGETS CONTAINING INTERNAL LUMINANCE GRADIENTS, by A. B. Kristofferson and R. H. O'Connell. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Sep 58, 17p. 9 refs. Rept. no. 2144-297-T.
Order from LC mi$2.40, ph$3.30 PB 143 414

Detection thresholds were measured for thirteen nonuniform targets consisting of a circular area approximately 60 minutes in diameter, on the center of which a circular luminance increment approximately 4 minutes in diameter was super-imposed. The ratio of center to annular luminance ranged between 1.0 and infinity. Predictions of the luminance of the center area required for the entire target to be at detection threshold were made from the values of threshold luminance of the center and annulus presented singly, on the basis of several variants of the element contribution hypothesis. The prediction which assumes that effective sensory excitation increases with the square of target luminance was favored over the prediction assuming a linear relation.

Air Force Missile Development Center, Holloman AFB, N. Mex.
CENTRIFUGE EXPERIMENTS ON HIGH-G LOADS IN MICE AND THEIR POSSIBLE ALLEVIATION BY MULTIDIRECTIONAL ANTI-G DEVICES, by H. J. von Beckh and Grover J. D. Schock. Aug 58, 18p. 8 refs. AFMDC TN-58-10; AD-154 104.
Order from LC mi$2.40, ph$3.30 PB 138 951

Using the centrifuge, time-tolerance limits on transversely positioned mice were studied and the results compared with longitudinal G-tolerance values reported by other authors. The possibilities of a multidirectional G-protection during escape trajectories and the re-entry phase are discussed.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
AFOOT IN THE DESERT: A CONTRIBUTION TO BASIC SURVIVAL, by Alonzo W. Pond. Mar 51, rev. Apr 56, 62p. 17 refs. Publication no. D-100.
Order from LC mi$3.90, ph$10.80 PB 143 817

Recent scientific studies on water and heat exchanges in the human body make the old desert theories about thirst and ancient ideas on desert travel out of date. This report is written to bring men in the Air Force up to date on desert living conditions. It is intended to provide basic information for escape and evasion in desert regions. It makes available the most recent, reliable information concerning survival needs of the human body in the deserts of the world.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
DOWN IN THE NORTH: AN ANALYSIS OF SURVIVAL EXPERIENCES IN ARCTIC AREAS, by Richard A. Howard. Apr 53, 55p. Publication no. A-103.
Order from LC mi$3.60, ph$9.30 PB 143 820

This analysis of Arctic survival narratives will be indispensable to all those concerned with Arctic operations. The planners, the instructors, the briefers, and above all those who have the privilege of going into the North will benefit most from the accomplishments and profit best from the mistakes of those who went before.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
999 SURVIVED: AN ANALYSIS OF SURVIVAL EXPERIENCES IN THE SOUTHWEST PACIFIC, by Richard A. Howard. 1958, 66p. 36 refs. Pub. no. T-100.
Order from LC mi$3.90, ph$10.80 PB 143 819

This study is an instructive and eminently readable account of survival incidences in the Southwest Pacific and China-Burma-India theatres and an important source of information to all concerned with briefing fliers and passengers for travel in the regions under consideration, and to all instructors of survival techniques; furthermore, it will be a reliable guide in shaping the course programs of survival training schools.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
SUN-SAND AND SURVIVAL: AND ANALYSIS OF SURVIVAL EXPERIENCES IN DESERT AREAS, by Richard A. Howard. Jan 53, 50p. 10 refs. Publication no. D-102.
Order from LC mi$3.30, ph$7.80 PB 143 818

Sun, Sand and Survival will contribute materially to the briefing of pilots and crews who operate over desert terrain. It gives firsthand information on what to expect in a great variety of desert areas. It shows definitely that deserts are not all alike. Used in connection with ADTIC Publication D-100 Afoot in the Desert (PB-143 817) and Air Force Manual 64-5 Survival (PB-112 819) it gives the reader a thorough grasp of techniques and procedures of desert survival.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
G TOLERANCE IN PRIMATES: II. OBSERVATIONS IN THE RELATIONSHIP OF CAROTID PRESSURE AND END POINT DURING ACCELERATION, by George H. Kydd, Richard L. Fenichel, and Richard J. Crosbie. Rept. no. 2 on Proj. NM 11 01 12.9. 29 May 59, 18p. 6 refs. NADC-MA-5903.
Order from LC mi$2.40, ph$3.30 PB 143 432

Observations have been made simultaneously of the occurrence of an end point of unconsciousness and carotid pressure in Rhesus monkeys during centrifugation. The data indicate that the carotid pressure is influenced initially by a maneuver which gives rise to a positive wave of pressure that is well coordinated with the onset of tangential G. Following this, there is a phase of pressure drop that can be described by a single time constant which varies with G. The data indicate that the end point occurs at a constant time following this occurrence of the pressure minimum and therefore is related to the slope of the blood pressure curve. The significance of this observation with respect to the blood supply is discussed.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
RELATIONSHIPS BETWEEN SEMICIRCULAR CANAL FUNCTION AND OTOLITH ORGAN FUNCTION, by R. F. Gray. Rept. no. 8 on Proj. NM 17 01 12.1. 8 Sep 59, 17p. 7 refs. NADC-MA-5911.
Order from LC mi$2.40, ph$3.30 PB 143 825

Data are reviewed indicating human response which may be the combined result of stimulation of both the otolith organs and the semicircular canals. Also some responses attributed to semicircular canals are shown to be similar to those attributed to otolith organ stimulation and vice versa.

Biochemistry

Illinois U. Coll. of Medicine, Chicago.
CHOLESTEROL METABOLISM, by A. C. Ivy. Final rept. for 15 Aug 57-14 Jan 58 on Contract AF 49(638)242. 1 July 59. 58p. 84 refs. AFOSR-TR-59-79; AD-219 391.
Order from LC mi$3.60, ph$9.30 PB 143 736

Six hundred thirty-eight one-week old chicks were fed for 12 weeks a basal diet (B.D.) containing 23% protein, 3% fat and 0.05% cholesterol. Seventy-seven were fed the B.D. alone. The remainder were divided into groups of 25 or more and given cholesterol (2%), or beef tallow (5%) (m.p. 42° C), or stearic acid (10%), or palmitic acid (20%, 5 wk.); or cholesterol (2%) plus tallow, or soya oil (5%), or safflower oil (5%), or hydrogenated soya oil (5%) (m.p., 33° C); or niacin (1%) plus cholesterol (2%), or niacin (1%) plus cholesterol (2%) plus either tallow, soya oil, or safflower oil. Chemical analyses of the blood serum for cholesterol, and of the liver and arteries for cholesterol and total lipids were made. The arteries were graded for the severity of macroscopic atheromatosis. Like all ordinary food fats, soya and safflower oil and tallow enhanced the hypercholesterolemic and atherogenic effects of cholesterol. Stearic and palmitic acid slightly decreased these effects of cholesterol. When the concentration of cholesterol in the diet is greater than 1% by weight, the concentration of cholesterol in the liver, serum and arteries plateaus, indicating the existence of an intestinal capacity to absorb cholesterol. Our evidence and that in the literature indicates that at a 0.25% (dry weight) level of cholesterol in the diet, cholesterol starts to accumulate in the liver, blood serum and arteries. This is before the intestinal capacity for the absorption of cholesterol in the chicken is reached and without hepatic synthesis being suppressed by dietary cholesterol. The accumulation of cholesterol in the body starts when a 1900 gm cockerel absorbs about 48 mg/day which is twice the average amount of digitonin precipitable sterol excreted daily by the chicken on a sterol-free diet, namely, 24mg. According to this, a normal 150 lb man should show little or no slow accumulation of cholesterol in the body until the daily average dietary intestinal absorption is above 400 or 600 mg and the intake is from 800 to 1000 mg. A good correlation exists between the concentration of cholesterol in the liver and arteries. Niacin (1%) reduced the accumulation of cholesterol in the arteries, liver and serum when cholesterol was fed alone or with soya or safflower oil but not with tallow.

St. Luke's Hospital, New York.
PROTEIN AND AMINO ACID NUTRITION, by Anthony A. Albanese. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-1167(00). 15 Dec 58, 14p.
Order from LC mi$2.40, ph$3.30 PB 143 860

Although prime concern remains with human needs for proteins and specific amino acids under various pathological and physiological conditions, this report shows that more and more attention is being given (a) to the effects of proteins and amino acids on other body constituents, and (b) to the effects of various agents on the nitrogen needs of man.

New York U., N. Y.
STUDIES OF ENZYME SYSTEMS INVOLVED IN BIOLOGICAL OXIDATIONS AND SYNTHESES, by Severo Ochoa. Terminal rept. for 1957-1958 on Contract Nonr-285(31). [1958] 9p.
Order from LC mi$1.80, ph$1.80 PB 143 851

The problems investigated are: Enzymatic mechanisms of propionic acid oxidation in animal tissues; Enzymatic synthesis of ribonucleic acid, and Protein biosynthesis.

General Biology

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A STABLE CONTINUOUSLY RECORDING ELECTRODE SYSTEM FOR THE DETERMINATION OF OXYGEN DISSOLVED IN PROTEIN SOLUTIONS, by Freeman W. Cope. Rept. no. 7 on Proj. NM 11 01 12.7. 20 July 59, 13p. 4 refs NADC-MA-5912.
Order from LC mi$2.40, ph$3.30 PB 143 431

A system is described that will continuously measure the concentration of oxygen dissolved in a protein solution. The system is stable within 2% for periods of 30 minutes or more. The circuit diagram of a suitable amplifier is given. To attain stability of electrode current it is necessary that the amplitude of vibration of the silver-platinum electrode pair be kept constant by mechanical and electrical methods. The electrodes must be coated with collodion to prevent poisoning by proteins. A coating of silver salt must be deposited on the silver electrode before use.

Pacific Science Board, National Research Council, Washington, D. C.
ATOLL RESEARCH BULLETIN NOS. 48-50. Rept. on Contract N7onr-29154. 30 June 56, 252p. 55 refs.
Order from LC mi$11.10, ph$39.60 PB 128 595

Contents:
Bull. 48. The Geography of Kapingamarangi Atoll in the Eastern Carolines, by Herold J. Wiens
Bull. 49. Bioecology of Kapingamarangi Atoll, Caroline Islands: Terrestrial Aspects, by William A. Niering
Bull. 50. Geology of Kapingamarangi Atoll, Caroline Islands, by Edwin D. McKee
(See also PB 123 203)

Microbiology

[Army] Chemical [Warfare] Labs. [Army Chemical Center] Md.
PRINCIPLES AND PRACTICE OF BW DECONTAMINATION. 4. AN EVALUATION OF THE USE OF MEMBRANE FILTERS IN QUANTITATIVE BACTERIOLOGY, by Dorothy M. Portner, Elizabeth C. Mayo and Saul Kaye. 4 June 53, declassified 25 Jan 54, 50p. 15 refs. Biological Labs. Interim rept. no. 32.
Order from LC mi$3.30, ph$7.80 PB 143 534

The work here reported, which constitutes a necessary preliminary to an investigation of the use of membrane filters for the quantitative evaluation of disinfectants, covers a study of the relative bacterial recoveries obtainable, by several different techniques, with MF's and with pour plates. Bacterial recoveries are compared by statistical analysis of the experimental data. Although essentially the same bacterial recovery is obtained by any of the three MF techniques used ("1 ml direct", "1 ml in 4", and "1 ml in 4 / Rinses"), the "1 ml in 4" MF technique is the most generally satisfactory for the recovery of bacteria exposed to a disinfectant where the use of pour plates is undesirable. This technique involves placing 1 ml of the suspension to be counted in 4 ml of diluent and pouring the whole volume through the MF. The standard "1 ml direct" pour plate technique gives a better estimate of the number of bacteria in the control samples than does the "1 ml in 4" pour plate technique. All three MF techniques give lower bacterial recoveries than the "1 ml direct" pour plate technique and higher recoveries than the "1 ml in 4" pour plate technique. The bacterial recovery obtained differs with the test organism used. The use of "fresh" rather than stored slants of vegetative organisms seems to be advisable when high accuracy is desired. The relative bacterial recoveries of MF's and pour plates are summarized by straight line equations. These equations provide a means whereby, within the experimental range, any MF of pour plate values from tests involving B globigii spores of M pyogenes var aureus may be interconverted, with the degree of dependability represented by the appropriate 95% confidence limits also given.

[Army Chemical Warfare Labs., Army Chemical Center,] Md.
A SURVEY IN THE PHILADELPHIA AREA OF THE OCCURRENCE AND DISTRIBUTION OF BACILLUS ANTHRACIS IN TEXTILE MILLS USING GOAT HAIR AND WOOL, by Charles H. Harp, David F. Hershey, and Frank Novak. Oct 55, 27p. Special rept. 240.
Order from LC mi$2.70, ph$4.80 PB 143 695

This survey was made to obtain background information for guidance in formulating the test program for evaluating the anthrax vaccine. Table I summarizes available information on the number of infections. Part of the survey consisted of taking swab samples of the hands and arms, face and neck, and the external nares of the employees. Figures 1 and 2 show the physical layout of Plants A and B respectively with regard to each of the processes described. A brief description of each of the processes is given together with procedures of survey, isolation and identification of B Anthracis and results.

Chicago U., Ill.
FACTORS RESPONSIBLE FOR RESISTANCE TO ENTERIC INFECTION. THE ROLE OF THE INTESTINAL MICROFLORA IN RESISTANCE TO ENTERIC INFECTION, by C. Phillip Miller. Final rept. on Contracts N6ori-020(59) and N6ori-020(49). [1958] 4p.
Order from LC mi$1.80, ph$1.80 PB 143 419

An explanation for the enhanced susceptibility of mice to Salmonella infection which follows treatment (by mouth) with streptomycin.

Neurology and Psychiatry

California U., Los Angeles, School of Medicine.
NERVOUS CONTROL OF SHIVERING; A MANUAL FOR THE CONSTRUCTION, USE AND INTERPRETATION OF RECORDS FROM STAINLESS STEEL MICROELECTRODES, by Walter J. Freeman and Allan Hemingway. May 59, 37p. 38 refs. Arctic Aeromedical Lab. technical rept. 58-1; AD-220 680.
Order from LC mi$3.00, ph$6.30 PB 143 528

Detailed instructions are given for the construction and use of stainless steel microelectrodes. Information is also given on the recognition of noise and artifacts, on the analysis of action potentials recorded by this means, and on the problems likely to be encountered in localizing cell discharges in the brain and correlating them with physiological changes in other parts of the body.

Yale U. School of Medicine, New Haven.
TRANSFER FUNCTION OF A BIOLOGICAL PHOTORECEPTOR: ONE OF A SERIES OF REPORTS PERTAINING TO CYBERNETIC STUDIES OF A BIOLOGICAL PHOTORECEPTOR, by Lawrence Stark. Rept. on Research on Physics and Chemistry of Neurosensory Processes, Contract AF 33(616)5708. Aug 59, 29p. 20 refs. WADC Technical rept. 59-311.
Order from OTS $0.75 PB 161 131

A biological transducer of electromagnetic radiation energy to pulse rate modulated nerve impulse signals has been selected for study because of its lack of complex specialized accessory mechanisms. This simple crayfish photosensitive ganglion was subjected to a steady state analysis relying mainly on sinusoidal input light signals. The output signals of the population of nerve fibers were analyzed to yield a linear transfer function over the frequency range studied.

$$G(s) = \frac{ke^{-0.5s}}{(1+1.1s)}$$

The significance of these results, their context in neurophysiology, and possible direction for further investigations are discussed.

Pathology

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A PHYSIOLOGICAL END POINT FOR THE STUDY OF THE TOLERANCE OF SMALL MAMMALS TO HIGH ACCELERATION STRESS, by William C. Sipple and B. David Polis. Rept. no. 1 on Proj. NM 11 02 12.15. 17 June 59, 13p. 2 refs. NADC-MA-5906.
Order from LC mi$2.40, ph$3.30 PB 143 430

By means of a transistor amplifier mounted before the slip rings of an animal centrifuge it was possible to obtain recordings of the "EKG" of rats under acceleration stress. With this information a physiological end point for the tolerance of the rat to 20 G (positive acceleration) was defined as the time to reduce the heart rate of the animal from an initial state ranging from seven to nine beats per second to a final moribund state of 2 beats per second. The instrumentation and techniques employed permit the option of recovering the animal alive after approaching the limit of tolerance to acceleration.

Duke U. School of Medicine, Durham, N. C.
FINAL REPORT, by James V. Warren. Rept. on Contracts AF 18(600)1542 and 41(657)208. [1959] 11p. 15 refs. AFOSR-TR-59-102.
Order from LC mi$2.40, ph$3.30 PB 143 505

A comprehensive study of the nature of vasodepressor syncope (the common faint) has been undertaken. A critical review of the available information regarding this phenomenon has been carried out. In addition, experimental studies aimed primarily at the circulatory nature of vasodepressor syncope and, in particular, dealing with the precipitating and predisposing factors, has lead to observations on the effects of various humoral substances such as norepinephrine on the vascular system, as well as the effect of drugs such as atropine and isoproterenol. Additional observations were made on the nature of abnormal heart sounds in a variety of clinical conditions.

Kansas U., Lawrence.
STUDIES ON THE PATHOGENESIS AND IMMUNITY OF TULAREMIA, by Cora M. Downs. Final rept. for 1 July 51-21 Dec 58 on Contract N6onr-26007. [1958] 17p. 18 refs.
Order from LC mi$2.40, ph$3.30 PB 143 616

An extensive study of smooth and non-smooth variants and their antigenicity was undertaken and showed that the non-smooth avirulent variants and the smooth avirulent variants were lacking in immunegenicity and in the ability to incite antibodies. Immune Rabbit serum even with high agglutinative powers was not bactericidal. An extensive test of vaccines prepared from cultures of Bacterium tularense and killed by various chemical and physical means showed that they produced what seemed to be a good degree of immunity provided the mice were challenged with the partially virulent strain 425. If challenged with the virulent Schu(Sm_4) strain no or very little protection was evident. The work reported on heat stable extracts from tissue and cultures indicated that a great part of the antigenic properties of the organism resided in these extracts. An intensive study was made of the culture extracts and mouse tissue extracts. Methanol precipitation was found to be effective in purifying the extracts and since 1956 an intensive study has been made using chemical and physical methods.

Naval School of Aviation Medicine, Pensacola, Fla.
CARDIOVASCULAR PROBLEMS IN AVIATION MEDICINE: EVALUATION OF HEART MURMURS, by John M. Packard and Ashton Graybiel. 24 May 51, 30p. 5 refs. Proj. NM 001 059.06.05.
Order from LC mi$2.70, ph$4.80 PB 143 811

The importance of proper interpretation of a heart murmur by the flight surgeon is emphasized. The elicitation of the physical characteristics of a murmur, and the evaluation of the murmur based on these characteristics, is described in detail. Brief analysis is made of 1090 service personnel seen in consultation at the cardiovascular laboratory at School of Aviation Medicine, Pensacola, Florida. About one fifth (192 cases) were referred for the evaluation of a murmur. These cases may be divided into four groups: one group of 15 cases in which extra cardiac sounds were mistaken for murmurs, a second group of 33 cases in which the murmurs were clearly related to some type of underlying heart disease, a

or mixed-type hearing loss, the remaining 87 percent being perceptive-type hearing loss; that 35 out of 75 individuals in Class B and Class C groups expressed a preference for an ear and of these 35 individuals, 25 chose the better ear correctly.

Radiobiological Lab., U. of Texas, Austin.
ACUTE EFFECTS OF GAMMA RADIATION IN PRIMATES, by Ralph G. Allen, Frank A. Brown and others. Apr 59, 24p. 8 refs. AFSAM rept. 59-41.
Order from LC mi$2.70, ph$4.80 PB 143 740

In an excellent paper on the acute radiation syndrome in man, Gerstner described a dose - survival time curve containing three "plateaus" or dose-independent regions. This curve, reproduced in figure 1, has been estimated for man from clinical data and animal experiments. These "plateau regions" are ascribed to three different pathogenic mechanisms - death being caused in the low-dose region by hematopoietic depression, in the mid-dose region by gastrointestinal denudation, and in the high-dose region by a failure of the central nervous system.

Texas U., Austin.
RELATIVE HEARING LEVELS AND TYPES OF HEARING LOSS AMONG FOUR SELECTED GROUPS OF AIR FORCE PERSONNEL, by Lennart L. Kopra, Duilio T. Pedrini, and Roger W. Fullington. Apr 59, 12p. 9 refs. AFSAM rept. 59-51.
Order from LC mi$2.40, ph$3.30 PB 143 371

Results showed: good agreement between median and mean thresholds at almost all test frequencies; no significant differences between right and left ears within groups; that the Class Ann and A median and mean thresholds were within a few decibels of the American Standard reference normal; that the Class B group deviated from the Class A groups only at 3000, 4000, and 6000 cps; that, with the exception of Class B at 4000 and 6000 cps, the Class C group was significantly different from the other groups at all test frequencies; that approximately 13 percent of Class B and Class C groups had either conductive third group of 12 cases in whom a definite decision could not be reached and a fourth group of 132 cases in whom an innocent murmur was heard. In five persons who were referred for reasons other than the evaluation of a murmur pathological murmurs were heard which had been overlooked by the referring physician. These murmurs were all diastolic in time. A final analysis is made of the systolic murmurs which were heard. The innocence of most pulmonic systolic murmurs is stressed. The disposition of service personnel with a faint apical systolic murmur, which is the most difficult murmur to evaluate, is discussed.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
EXCRETION AND LOCALIZATION IN THE RAT OF C^{14} ADMINISTERED AS 3,4-BIS(p-DIETHYLAMINOETHOXYPHENYL)-3-HEXENE DIMETHIODIDE (879C) by J. Henry Willis and Sarah C. Kalser. Technical rept. for 1 Apr 55-30 Nov 57 on Pharmacology of Toxic Compounds, Sep 58, 21p. 18 refs. CWLR 2243; AD-[illegible]
Order from LC mi$2.70, ph$4.80 PB 139 142

The rat excretes, within a mean of 4.9 hours, a mean of 7.3 per cent of C^{14} injected as 879C. Fecal excretion accounts for probably some 30 per cent of the administered C^{14}. Kidney, liver, small intestine, lung, spleen, heart and adrenal glands are particularly active in taking up C^{14}; low in uptake are the brain and spinal cord. Blood is almost free of C^{14} one and three-fourths hours after the intravenous injection of labeled 879C. Respiratory muscles absorb more C^{14} of 879C than limb muscles. Both liver and kidney may alter the molecule.

Army Chemical [Warfare] Labs., Army Chemical Center, Md.
THE INFLUENCE OF SPONTANEOUS PULMONARY DISEASE IN A TOXICO-PATHOLOGICAL STUDY OF CHRONIC DIBORANE TOXICITY IN RATS, by A. J. McAdams. May 55, 15p. Medical Labs. Research rept. no. 362.
Order from LC mi$2.40, ph$3.30 PB 143 539

Rats at different ages were exposed to diborane at 6 ppm for six weeks. Detailed examination of the lungs of these animals revealed an incidence of chronic murine pneumonia in both the control and exposure groups precluding any conclusion concerning the possible toxicity of diborane to the lung at this concentration. The problem of evaluation of pathological changes of an experimental nature from those of spontaneous origin is emphasized.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE INTRAVENOUS TOXICITY OF FIVE OXIMES IN DOGS, by James W. Crook and Paul Cresthull. July 59, 20p. 13 refs. CWLR-2284; AD-220 253.
Order from LC mi$2.40, ph$3.30 PB 144 037

The intravenous LD50's of five oximes were determined in dogs. The prominent toxic signs observed in the dogs were staggering, collapse, convulsions, flaccid paralysis, and death. Flaccid paralysis occurred less frequently with 2-PAM than with the other compounds. It is concluded that 2-PAM is the least toxic of the five oximes studied. There is a significant difference between the toxicities of EA 1814 and EA 1813 using 90% confidence limits. EA 1814 is approximately three times more toxic to dogs than 2-PAM while EA 1813 is approximately five times more toxic than 2-PAM. There is no significant difference between the toxicities of EA 1941 and EA 1811 using 95% confidence limits. These two oximes are approximately 9 and 13 times, respectively, more toxic to dogs than 2-PAM.

Army Chemical Warfare Labs., Army Chemical Center, Md.
TOXIC CHEMICAL WARFARE AGENTS: REPORT OF SYMPOSIUM IX, VOLUME I, CONDUCTED BY U. S. ARMY CHEMICAL WARFARE LABS. 25, 26, 27 JUNE 1958. May 59, 71p. 22 refs. CWL Special Pub. 3.
Order from LC mi$4.50, ph$12.30 PB 143 503

The following papers are reported: Structure and chemistry of viruses; Chemical model of drug action; A new approach to the study of neuromuscular transmission; Kinetics of enzyme catalyzed reactions in the presence of inhibitors; Natural asymmetry and optical isomerism; The structure of enzymes; Incapacitation by anesthetic agents; The pharmacology of psychochemical compounds; The psychological effects of psychochemical compounds; Isolation and properties of certain marine toxics; Snake venoms; Bacterial toxins; Mechanisms of incapacitation; and Screening procedures for incapacitating compounds.

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
TOXICITY OF CERTAIN ENGINE OILS, HYDRAULIC FLUIDS, AND BASE OILS FOR THE COMPOUNDING OF BOTH HYDRAULIC FLUIDS AND ENGINE OILS, by Colborn T. Blaisdell. Mar 54, declassified 14 Feb 58. 23p. 5 refs. Medical Labs. Research rept. no. 256.
Order from LC mi$2.70, ph$4.80 PB 144 207

The intrinsic toxicities of these compounds in rabbits and rats are relatively low as manifested by intravenous LD50's between 0.05 cc./kg. and 1.5 cc./kg. The hazard to humans incurred by swallowing these compounds would appear almost negligible. The hazard from an accidental splash in the eye of one of these compounds appears to be slight. The chief hazard involved in the use of these compounds would appear to necessitate continued cutaneous exposure. The worst of them, notably compounds No. 4, 7, 9, 10, and 12, could cause some erythema, and hardening and cracking of the skin on prolonged contact, however, all of these changes appear reversible and will probably disappear if exposure to the compounds is discontinued.

Institute for Experimental Cancer Research, U. of Heidelberg (West Germany)
ACTION OF KINETIN AND OTHER AMINO PURINE DERIVATIVES ON CELLS IN TISSUE CULTURE, by Hans Lettre. Final technical rept. no. 1, 29 Apr 57-9 May 59, on Contract DA 91-508-EUC-188. [1959] 36p. 29 refs.
Order from LC mi$3.00, ph$6.30 PB 143 410

The compounds investigated are listed under the numbers 1 - 83. Though the field of purine derivatives had been studied very intensively in search for chemotherapeutical agents, our observations show that it is still an unexplored field. The compounds are active only in the system of tissue culture. Starting from out present results one can expect to find more compounds with this quality. On the other hand it must be stated that only a small percentage of all compounds has an activity at all and even a smaller percentage has this differential activity. Future work have not been shown to be contributing factors in the etiology of motion-induced emesis.

Radiobiological Lab., U. of Texas, Austin.
A FURTHER STUDY OF THE INTERACTION OF ELECTROCONVULSIVE SHOCK WITH CHLORPROMAZINE AND RESERPINE, by Claude B. Elam, Edward C. Wortz, and W. Lynn Brown. June 59, 7p. 3 refs. AFSAM rept. 58-144.
Order from LC mi$1.80, ph$1.80 PB 143 384

Five dose levels for each of the drugs were examined and compared with appropriate control conditions. These effects were studied with the subjects in an atmosphere of 95 percent O_2 + 5 percent CO_2 as well as under normal atmospheric conditions. A synergic relationship is obtained when electroconvulsive shock is administered in conjunction with either reserpine or chlorpromazine. When an atmosphere of 95 percent O_2 + 5 percent CO_2 is made available to an animal immediately prior to and during electroconvulsive shock procedures, there is a significant reduction in the probability of death.

School of Aviation Medicine, Randolph AFB, Tex.
THE EFFICACY OF TRILAFON IN POTENTIATING BONAMINE MOTION SICKNESS PROPHYLAXIS IN DOGS, by Howard R. Unger and Lawrence J. Milch. June 59, 5p. 15 refs. Rept. 59-78; AD-226 474.
Order from LC mi$1.80, ph$1.80 PB 143 581

Susceptible animals were randomly placed in three treatment groups — namely, placebo, bonamine^R, and the combination of bonamine^R with trilafon^R. Bonamine^R and the combination of bonamine^R with trilafon^R exhibited a protective effect against swing-induced emesis. Trilafon^R, a potent tranquilizer, has no protective effect when used along and in combination with bonamine^R affords a degree of protection which is no greater than the effect shown by bonamine^R alone. It is therefore concluded (a) that the action of trilafon^R does not contribute to the protection afforded by bonamine^R against swing-induced vestibular stimulation and, there, (b) that stimuli arising from those brain centers affected by trilafon^R should be done in the direction of (1) derivatives with a direct substitution of carbon atomes to C-6 of the purine system; (2) derivatives combining two substituted amino groups in the purine system, and (3) ribotides of compounds found to be active. Further the study of the mechanism of the action of these compounds on cells seems to be important. Up to now work in this direction has been done on the morphological basis, but it should be extended to the biochemical events causing the morphological changes.

Radiobiology

Radiobiological Lab., U. of Texas, Austin.
RADIATION-INDUCED CENTRAL NERVOUS SYSTEM DEATH: A STUDY OF THE PATHOLOGIC FINDINGS IN MONKEYS IRRADIATED WITH MASSIVE DOSES OF COBALT-60 (GAMMA) RADIATION, by Stephen G. Wilson, Jr. Apr 59, 19p. 11 refs. AFSAM rept. 59-58.
Order from LC mi$2.40, ph$5.30 PB 143 679

This report presents circumstantial evidence indicating that gastrointestinal damage is also an important part of the syndrome of "radiation-induced central nervous system death." Also, the observed central nervous system changes are compared to those described by other authors. The concept of "leukocyte devitalization" is introduced.

Radiobiological Lab., U. of Texas, Austin.
SOME EFFECTS OF NUCLEAR RADIATION EXPOSURE ON PRELIMINARY WGTA TRAINING PERFORMANCE OF RHESUS MONKEYS, by A. A. McDowell, W. Lynn Brown, and James E. Wicker. May 59, 5p. 13 refs. AFSAM rept. 59-53.
Order from LC mi$1.80, ph$1.80 PB 143 741

Wisconsin General Test Apparatus (WGTA). The investigation, in addition, studies the same animals with respect to simple object-quality discrimination learning unconfounded by previous training of a similar nature.

Oregon State Board of Health, Portland.
A REVIEW OF SOVIET RESEARCH ON THE CENTRAL NERVOUS SYSTEM EFFECTS OF IONIZING RADIATIONS, by Walter R. Stahl. [1958] 49p. 73 refs.
Order from LC mi$3.39, ph$7.80 PB 143 558

Brief reviews are presented of a number of Soviet scientific papers on the CNS effects of radiation, most of which are not available in translation. The Soviets consider the CNS as being highly sensitive to radiation and have reported work implicating it at general levels of a few or tens of roentgens, several hundred r and 500-1000 r. It appears presently impossible to reach a final conclusion on the question of a threshold.

USAF Radiation Lab., U. of Chicago, Ill.
EFFECTS OF BETA-AMINOETHYLISOTHIOUREA (AET) ON ENZYMES OF ANIMAL TISSUES, by Gerald R. Zins, Ann B. Raymund, and Kenneth P. DuBois. Apr 59, 15p. 31 refs. AFSAM rept. 59-34.
Order from LC mi$2.40, ph$3.30 PB 143 380

The effects of the radioprotective compound β-aminoethylisothiourea (AET) on sulfhydryl enzymes of mammalian tissues have been determined, in an effort to obtain information regarding the biologic activity of the drug. A number of enzyme systems involved in oxidative carbohydrate metabolism of rat tissues were inhibited in vitro by concentration of AET within the predicted in vivo range following sublethal doses. The results of this study demonstrate the feasibility of a theory of radioprotective mechanisms involving the formation of radioresistant complexes between the protective agent and important biologic sulfhydryl groups.

Washington U., Seattle. School of Medicine.
THE COMBINED EFFECTS OF IONIZING RADIATION AND HIGH TEMPERATURE ON THE LONGEVITY OF THE WHITE RAT, by L. D. Carlson and B. H. Jackson. Mar 59, 12p. 17 refs. AFSAM rept. 58-156.
Order from LC mi$2.40, ph$3.30 PB 143 744

Male Sprague-Dawley rats, individually caged, were exposed to low level irradiation from a Co^{60} source for 16 hours a day. The animals were selected by weight and growth rate, and divided into eight groups of 22 rats. Four groups were kept at $28^{o} \pm 1^{o}$ C. and were exposed to 0.29, 0.64, 2.60, and 4.18 r/day during the irradiation period, which lasted from 4 to 16 months of age. The other groups were kept at $35^{o} \pm 1^{o}$ C. during the period of irradiation which lasted from 4 to 16 months of age, and were exposed to 0.28, 0.60, 2.57, and 3.96 r/day. At 35° C. the ET_{50} for 0.29 r/day was 310; 0.64 r/day was 490; 2.60 r/day was 540; and 4.18 r/day was 510. At 28° C. the ET_{50} for 0.28 r/day was 493; 0.60 r/day was 510; 2.57 r/day was 810; and 3.96 r/day was 590. With the exception of the relation between 0.60 and 0.28 r/day, the data are statistically significant at the 5 percent level. From a previous experiment at 26° C. the ET_{50} for 0 r/day was 445 and 0.8 r/day was 585. It is suggested that the effects of ionizing irradiation interact with the effects of environment in intluencing longevity.

Zoology

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE CHEMISTRY OF FISH BLOOD, A BIBLIOGRAPHY, by Joseph B. Hunn. May 59, 20p. 194 refs. CWL Special Pub. 2-22.
Order from LC mi$2.40, ph$3.30 PB 143 536

The present bibliography attempts to bring together most of the important papers on piscine blood chemistry. It is possible that some important material has been omitted. It is hoped that these references will be a help and stimulus to further basic research in fish physiology.

Narragansett Marine Lab., U. of Rhode Island, Kingston.
AN OUTLINE OF SOUNDS PRODUCED BY FISHES IN ATLANTIC COASTAL WATERS, SOUND MEASUREMENTS AND ECOLOGICAL NOTES, by Marie Poland Fish. Technical rept. no. 12 on Biological Oceanography Project, Contract Nonr-396(02). 28 Oct 58, 32p. 1 ref. Reference no. 58-8.
Order from LC mi$3.00, ph$6.30 PB 143 702

Available fishes in representative faunal areas are subjected to a series of carefully controlled situations and stimulations as a means of evaluating their sound-making ability. Positive results are analyzed for amplitude, frequency range and principal frequency components, and the recordings of each species assembled in the form of a reference file. The tables present data on 24 species of North Atlantic coastal fishes investigated at the Narragansett Marine Laboratory and 19 species of typical subtropical Atlantic species auditioned at the Bermuda Government Aquarium and the Bermuda Biological Station for Research. Geographical, seasonal and vertical distribution are included since these data are essential in predicting the occurrence of the sounds of each species. Where available, breeding details are added inasmuch as sound production among many fishes is synchronized with this cycle.

CHEMISTRY

Illinois Inst. of Tech., Chicago.
THE CHEMISTRY OF SILICON AND GERMANIUM HYDRIDES, by Sei Sujishi. Final rept. for 1 Feb 58-31 Aug 59 on Contract AF 49(638)276. 18 Aug 59, 117p. 8 refs. AFOSR-TR-59-137.
Order from LC mi$6.00, ph$18.30 PB 143 572

In order to obtain further data regarding the relative basicities of methyl- and silylamines, the reactions of silyldimethylamine, methyldisilylamine, and trisilylamine were studied with the strong Lewis acids diborane, trimethyl-aluminum, and trimethylgallium. A study of the reactions between trisilylamine, disiloxane, and silyl fluoride with trimethylgallium under comparable conditions indicated that at -78.5° the one to one complex, disiloxane-trimethylgallium, exists. This suggests the relative basicities for these

compounds to be $(SiH_3)_3N < (SiH_3)_2O > SiH_3F$. This order has been interpreted in terms of silicon-nitrogen and silicon-oxygen π bonding.

Metal Hydrides, Inc., Beverly, Mass.
THE PREPARATION OF TRANSISTOR GRADE SILICON FROM SILANE OR ANALOGOUS COMPOUNDS, by Charles H. Lewis, Mario B. Giusto, and Sidney Johnson. Final rept. on Contract AF 19(604)3464. 30 Oct 59, 36p. 10 refs. AFCRC-TR-59-354.
Order from OTS $1.00 PB 161 261

The preparation, purification and thermal decomposition of silane have been investigated for the purpose of preparing transistor grade silicon. Yields of 94 to 100% silicane are obtained by the reduction of silicon tetrachloride with various hydrides. The reactivity of silane with substances proposed as purifying agents has been studied. Variables in the thermal decomposition of silane have been evaluated with particular emphasis on purity of elemental silicon plus efficiency of dissociation and deposition rate. Silane has been dissociated on an inductively heated single crystal substrate, producing silicon deposits large enough for single crystal evaluation and neutron activation analysis. A process has been developed whereby silicon can be made continuously from silane using induction heating.

Wisconsin U., Madison.
THE STUDY OF PYRIDINIUM IODIDE CHARGE-TRANSFER BANDS, by Edward M. Kosower. Rept. on Contract AF 49(638)282. 29 Sep 59, 10p. 20 refs. AFOSR-TN-59-812; AD 226 711
Order from LC mi$1.80, ph$1.80 PB 143 641

The general nature of pyridinium iodide light absorption is discussed. It is pointed out that the high sensitivity of this electronic transition to internal and external influences makes detailed study very rewarding with respect to information on electrical, steric, and solvent effects.

Inorganic Chemistry

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
REVISION OF FEDERAL SPECIFICATION P-S-751 STEAM CLEANING COMPOUND, by A. Mankowich. 9 Sep 59, 8p. 4 refs. Rept. no. CCL-82.
Order from LC mi$1.80, ph$1.80 PB 143 575

Federal Specification P-S-751 was revised to include the latest improvements in technology with the principal changes being in the areas of: (1) Deletion of percentage phosphates requirement. (2) Prohibition of carbonates. (3) Clarification of aluminum corrosion test. (4) Modification of solubility test. (5) Modification of free caustic test. (6) Addition of full scale, caking-storage test. (7) Recommendation of procurement in air-tight metal containers. Other possibilities such as the use of anhydrous salts and borates were explored.

Institute for the Study of Metals, U. of Chicago, Ill.
THERMAL AND MAGNETIC PROPERTIES OF $MnBr_2$ AT LOW TEMPERATURES, by J. W. Stout, Wayne B. Hadley and C. L. Brandt. Technical rept. no. 4 on Contract N6ori-02051. Nov 58, 7p. 6 refs.
Order from LC mi$1.80, ph$1.80 PB 143 420

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME PROPERTIES OF NITRIC ACID, NITROGEN DIOXIDE, NITRIC OXIDE, WATER, AND THEIR MIXTURES, by B. H. Sage. Rept. on Contract DA 04-495-ORD-18. 15 Oct 57, 157p. 104 refs. Rept. no. 20-107; AD-203 044.
Order from LC mi$7.50, ph$24.30 PB 143 889

A number of the properties of nitric acid, the oxides of nitrogen, and their mixtures with water have been reviewed, and a summary account of the results is given in a systematic form, utilizing the units of measurement commonly encountered in industry. Information concerning the volumetric and phase behavior of the components, their binary mixtures, and the nitric acid-nitrogen dioxide-water ternary system is presented for both physical and physicochemical equilibrium, as well as for the approach to physicochemical equilibrium while at physical equilibrium. Data pertaining to the electrical conductance and optical absorbance of some of these systems are set forth, together with transport properties, such as the viscosity of the liquid phase. In addition, information related to the volumetric and phase behavior of the nitrogen dioxide-nitric oxide system and to the behavior of pure nitric oxide has been included.

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by W. C. Schumb and C. N. Satterfield. Quarterly periodic status rept. on Contract Nonr-1841(11). 31 Dec 58, 25p.
Order from LC mi$2.70, ph$4.80 PB 145 934

Contents:
Stability studies
Heterogeneous catalysis in liquid hydrogen peroxide
Burning velocities of the H_2O_2 decomposition flame at low pressures
Heterogeneous catalysis of hydrogen peroxide vapor
Hydrogen peroxide from the partial oxidation of propane in a porous-walled reactor
Summary of reports
(See also PB 142 086)

Organic Chemistry

Central Inst. for Industrial Research (Norway).
THE STRUCTURE OF LINEAR POLYMERS: LOWER n-HYDROCARBONS, by Nico Norman and Hans Mathisen. Final technical rept. no. 1, 1 July 58-30 June 59, on Contract DA 91-508-EUC-377. July 59, 98p. 74 refs.
Order from LC mi$5.40, ph$15.30 PB 143 454

The immediate purpose of the present work is to study and to compare the structure of the lower normal paraffins in the gaseous, liquid, and solid state. As

proper substances are chosen n-pentane, n-hexane; n-heptane, and n-octane. The second and perhaps - most important purpose of the started investigations is to gain experience as to the usefulness of the electron- and different X-ray diffraction techniques for the study of linear polymers. For most high polymers it is impossible to grow good enough crystals for single crystal X-ray diffraction work. It is hoped that a comparison of the results obtained for the relatively simple n-paraffins will give an indication of the structural information one may expect to get from electron and X-ray diffraction studies on these more complicated compounds.

Edinburgh U. (Gt. Brit.)
REACTIONS RELATED TO OXIDATION, by W. E. Falconer, J. H. Knox, and A. F. Trotman-Dickenson. Final technical rept. no. 1, Sep 58-Sep 59, on Contract DA 91-508-EUC-372. 28 Sep 59, 14p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 143 898

The competitive oxidations of cyclopropane-ethane and methane-ethane mixtures have been studied, and the relative rates of disappearance of reactants have been determined. The experimental technique is described. The oxidation of ethane alone has been studied and the products analyzed for methane and ethylene. Suggestions for future research have been proposed.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DILUTE SOLUTION PROPERTIES OF POLY-(N-LAURYL METHACRYLATE), by Suresh N. Chinai and Rudolph A. Guzzi. Oct 59, 34p. 12 refs. Technical rept. 2649.
Order from LC mi$3.00, ph$6.30 PB 142 487

Poly-(n-lauryl methacrylate) was prepared by the emulsion technique and fractionally precipitated by using benzene as the solvent and isopropanol as the precipitant to yield nine sharp fractions. The weight-average molecular weight dependence of the intrinsic viscosity $[\eta]$, and the root mean square end-to-end distance in an ideal (poor) solvent (isopropyl acetate at 13°C) and in a nonideal (good) solvent (n-butyl acetate at 23°C) were established. The relationship between the osmotic second virial coefficient A_2 and the weight-average molecular weight M_w in the nonideal solvent (n-butyl acetate at 23°C) was also determined. The effect of the size of the pendent group on the degree of chain extension is evident in the following order of decreasing chain extension:
PLMA > PHMA > POMA > PBMA > PEMA > PMMA.
Huggins constant k' was calculated for poly-(n-lauryl methacrylate) in the ideal and nonideal solvent. The molecular expansion factor α and the Flory universal constant ϕ were calculated for poly-(n-lauryl methacrylate).

Naval Research Lab., Washington, D. C.
SURFACE ACTIVITY OF FLUORINATED ORGANIC COMPOUNDS AT ORGANIC-LIQUID/AIR INTERFACES. PART II. SURFACE TENSION VS CONCENTRATION CURVES, ADSORPTION ISOTHERMS AND FORCE-AREA ISOTHERMS FOR PARTIALLY FLUORINATED CARBOXYLIC ESTERS, by N. L. Jarvis and W. A. Zisman. Interim rept. 8 Oct 59, 19p. 13 refs. NRL rept. 5364.
Order from OTS $0.50 PB 151 808

This investigation was undertaken to study the ability of a series of partially fluorinated carboxylic esters to depress the surface tension of a group of pure organic liquids. The surface activity of these solutes in the different solvents was shown to vary with the hydrocarbon content, fluorocarbon content, and the number and position of associating groups in the solute. The balance between these organophilic and organophobic groups in the solute molecules which gave maximum surface tension depression varied with the surface tension of the solvent and the solubility of the solute in it. In this report surface tension vs concentration curves, adsorption vs concentration isotherms, and graphs of monolayer film pressure vs area per molecule of adsorbed solute are given for each fluorochemical in the various organic solvents. Theoretical calculations from these data give the extent of adsorption and explain the orientation and packing of the molecules adsorbed at the interface of liquid and air. A discussion is given of the effect of the organophobic and organophilic constituents of the solute molecules on the extent of adsorption and on the tendency to associate with the various solvents.

Naval Research Lab., Washington, D. C.
TAUTOMERISM IN PHOSPHORUS CHEMISTRY. PART III. HYDROGEN ISOTOPE EXCHANGE IN PHENYLPHOSPHINIC ACID AND ITS ANION, by R. B. Fox. Final rept. 20 Oct 59, 13p. 22 refs. NRL rept. 5393.
Order from LC mi$2.40, ph$3.30 PB 142 450

A study has been made of prototropy in the P(O)H system as found in phenylphosphinic acid. Hydrogen isotope exchange has been used as a measure of the extent to which prototropy may occur in such phosphorus derivatives. In aqueous solutions, the exchange has been found to be both acid- and base-catalyzed, with a prototropic equilibrium probably governing the rate of the acid-catalyzed reaction. Exchange takes place to only a negligible extent in buffered neutral solutions over periods up to six weeks, which makes unlikely a termolecular attack as a significant factor in the mechanism of the reaction. A comparison of exchange rates with those found in aqueous acetone solutions indicates that the proportions of enol in both systems is of the same order of magnitude. (See also PB 140 391)

Pennsylvania U., Philadelphia.
THE INTERACTION OF DIBORANE WITH SILYL CYANIDES. Technical rept. no. 3 on Contract Nonr-551(21). 22 Oct 58, 19p. 21 refs.
Order from LC mi$2.40, ph$3.30 PB 143 047

The interaction of diborane with silyl cyanide or trimethylsilyl cyanide results in the formation of the adducts $H_3SiCN.BH_3$ and $(CH_3)_3SiCN.BH_3$, respectively. When these are heated the corresponding silyl hydrides are eliminated and the polymeric compound $(BH_2CN)_x$ is formed.

Pennsylvania U., Philadelphia.
THE INTERACTION OF ALKYL BORINES WITH TRIMETHYLSILYL CYANIDE. Technical rept. no. 5 on Contract Nonr-551(21). 15 Oct 58, 14p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 143 219

The interaction of $(n\text{-}C_4H_9)_2BCl$ with $(CH_3)_3SiCN$ results in the formation of polymeric $(n\text{-}C_4H_9)_2BCN$, which is a viscous liquid. This substance reacts with sodium in liquid ammonia to produce monomeric $(n\text{-}C_4H_9)_2BNH_2$. $(CH_3)_3B$ and $(CH_3)_3SiCN$ react to produce substances which spontaneously polymerize or condense.

Wisconsin U., Madison.
PYRIDINIUM COMPLEXES. I. THE SIGNIFICANCE OF THE SECOND CHARGE-TRANSFER BAND OF PYRIDINUM IODIDES, by Edward M. Kosower. Rept. on Contract AF 49(638)282. 29 Sep 59, 21p. 28 refs. AFOSR-TN-59-813.
Order from LC mi$2.70, ph$4.80 PB 143 589

In a previous paper, the existence of a second pyridinium iodide charge-transfer absorption band was mentioned. The present paper shows how the existence of the second band is in accord with the current model for pyridinium iodide charge-transfer transitions.

Wisconsin U., Madison.
PYRIDINIUM COMPLEXES. III. CHARGE-TRANSFER BAND OF POLYALKYLPYRIDINIUM IODIDES, by Edward M. Kosower. Rept. on Contract AF 49(638)282. 29 Sep 59, 40p. 59 refs. AFOSR-TN-59-811.
Order from LC mi$3.00, ph$6.30 PB 143 599

A study of the first (long wavelength) charge-transfer band of twenty different alkylpyridinium iodides under carefully standardized conditions has established that (1) increasing the number of methyl groups raises the transition energy (2) changing a methyl group from the 3- to the 2- to the 4-position increases the transition energy (3) varying the nature of the alkyl group from methyl to t-butyl on the 4-position has virtually no effect upon the transition energy and (4) the solvent sensitivity of 1-methylpyridinium iodide is appreciably greater than that of 1-ethyl-4-carbomethoxypyridinium iodide, as might have been expected on the basis of a previously proposed model. (See also PB 143 589)

Physical Chemistry

Aeronutronic Systems, Inc., Glendale, Calif.
EMISSIVITY OF THE 4.3 MICRON BAND OF CARBON DIOXIDE, by Gilbert N. Plass. Scientific rept. no. 2 on Contract AF 19(604)2166. 31 July 58, 39p. 13 refs. ASI pub. no. U-238; AFCRC TN-58-604.
Order from LC mi$3.00, ph$6.30 PB 138 860

The spectral emissivity of carbon dioxide in the 4 to 5 micron region is calculated as a function of temperature, pressure and amount of emitting gas. It is assumed that the electric moment matrix element can be calculated by using the harmonic oscillator approximation to represent the vibrational states. The emission of the isotopic molecule $C^{13}O_2$ is taken into account. The choice of a proper model to represent the CO_2 emission is discussed.

Amherst Coll., Mass.
AN ATTEMPT TO ESTABLISH THE EXISTENCE OF AND POSSIBLY THE NATURE OF THE COMPOUNDS $Na_2N_2O_x$ (x = 3, 4, 5 or 6) by Earle S. Scott Final summary rept. on Contract DA 19-059-ORD-2627. 25 July 59, 11p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 143 484

The study of the reaction of sodium hyponitrite, silver hyponitrite and sodium nitrohydroxylamate with liquid dinitrogen tetroxide has yielded no evidence for the existence of anions of the type N_2O_x. X-ray diffraction patterns and chemical analyses of the solid products obtained indicate that the nitrate is in each case the predominant product and that, in the case of the two sodium salts, an appreciable but variable quantity of sodium nitrite is formed. The product NaNO obtained from the reaction of nitric oxide with a solution of sodium in liquid ammonia has been prepared and caused to react with dinitrogen tetroxide in carbon tetrachloride at 0° C. Attempts were also made to prepare a third compound reported to be NaNO by the direct reaction of molten sodium with nitric oxide. To date, the conditions required to get a reproducible product have not been established.

Barnes Engineering Co., Stamford, Conn.
SPECTRALLY SELECTIVE INFRARED DETECTOR DEVELOPMENT, by Andrew C. Rudomanski. Final rept. for June 57-May 58 on Contract DA 18-108-cml-6386. 11 June 58, 41p.
Order from LC mi$3.30, ph$7.80 PB 143 340

Spectrally Selective Thermistor Detectors have been developed to be incorporated in a simplified gas alarm system. Detectors are responsive in narrow spectral intervals matched to generic absorption bands, thus eliminating the need of dispersive optics. Two detectors have been made, one sensitive at 9.8 μ and the other to intervals above and below 9.8 μ and can thus be used in a standard two-channel radiometer.

Battelle Memorial Inst., Columbus, Ohio.
PARTICLE-SIZE DISTRIBUTION AND CONCENTRATION OF AEROSOLS, by J. M. Pilcher, R. I. Mitchell, and R. E. Thomas. Annual rept. no. 2 for 1 Apr 53-31 Mar 54 on Contract DA 18-064-cml-1914. 31 Mar 54, declassified 26 Apr 56, 75p.
Order from LC mi$4.50, ph$12.30 PB 143 365

The performance of the Battelle No. 3 cascade impactor has been substantially improved as an instrument for determining the particle-size distribution and concentration of aerosols. A fluorometric method

of analysis, to determine the amount of aerosol particles impacted on each stage, has been developed as a substitute for the more tedious gravimetric analysis using microbalances. Analysis of variance of particle-size data obtained by gravimetric methods indicates that with suitable precautions, the procedure may be brought under statistical control. The reproducibility of weighing on microbalances is about ±9 micrograms at the five per cent level. Studies related to particle-size analysis such as (1) the performance of the Casella impactor, (2) isokinetic sampling, (3) equilibrium evaporation of SM slurry, and (4) control of BG contamination are reported. Considerable additional research is required to perfect the impactor method of particle-size analysis. Eleven recommendations are made herein.

Florida State U., Tallahassee.
ORGANIC REACTIONS OCCURRING IN OR ON MICELLES. I. KINETIC STUDIES OF THE ALKALINE FADING OF TRIPHENYLMETHANE DYES AND SULFONPHTHALEIN INDICATORS IN THE PRESENCE OF DETERGENT SALTS, by E. F. J. Duynstee and E. Grunwald. Technical rept. on Contract Nonr-988(02). 2 Dec 58, 22p. 10 refs. AD-207 095.
Order from LC mi$2.70, ph$4.80 PB 143 611

Kinetic studies were made of the fading in alkaline solution of triphenylmethane dyes and of sulfonphthalein indicators in the presence of micelle-forming salts.

Fulmer Research Inst., Ltd., (Gt. Brit.).
STUDIES AND EXPERIMENTAL INVESTIGATIONS IN THE FIELD OF MEASUREMENTS OF THE HEAT OF FREE ENERGY OF FORMATION OF THE CHLORIDES AND BROMIDES OF NIOBIUM AND TANTALUM, by P. Gross, C. Hayman and others. Final technical rept. for 1 June 57-31 May 59 on Contract DA 91-508-euc-176. 23 June 59, 46p. 12 refs. R. 115/5/23.
Order from LC mi$3.30, ph$7.80 PB 143 115

The standard heat of formation established for each compound is as follows:-
Niobium pentachloride ΔH^{o}_{298} = -190.6 kcal/mole
Niobium pentabromide ΔH^{o}_{298} = -132.85 kcal/mole
Tantalum pentachloride ΔH^{o}_{298} = -205.52 kcal/mole
Tantalum pentabromide ΔH^{o}_{298} = -142.96 kcal/mole
The total error in these values is estimated to be not greater than 0.3 kcal/mole for the pentachlorides, and not greater than 0.4 kcal/mole for the pentabromides.

General Electric Research Lab., Schenectady, N. Y.
PREPARATION OF DIBORANE BY REACTION OF LITHIUM HYDRIDE AND BORON CHLORIDE, by J. R. Elliott and G. F. Roedel. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 18 Feb 48, declassified 11 Aug 49, 11p. 1 ref. Rept. no. 55254.
Order from LC mi$2.40, ph$3.30 PB 144 264

Boron chloride gas passed into a slurry of lithium hydride in ethyl ether yields diborane of high purity.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL VERIFICATION OF THEORETICAL RELATIONS BETWEEN TOTAL GAS ABSORPTIVES AND TOTAL GAS EMISSIVITIES FOR CO, by U. P. Oppenheim. Technical rept. no. 28 on Contract Nonr-220(03). Oct 58, 19p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 143 241

An experimental study has been carried out for the purpose of verifying theoretical predictions concerning the relations between total absorptivities and total emissivities for transparent gases. The experimental conditions have been designed in such a way as to permit a direct check of theoretical relations derived for (a) non-overlapping dispersion lines and (b) spectral lines with sufficient pressure broadening to permit neglect of the rotational fine structure. The apparatus for the measurement of total gas absorptivities is described. Results for total absorptivities of carbon monoxide measured at temperatures between 300 and 500°K are given and total emissivities have been calculated in the temperature range of 300 to 1600°K. The range of total gas pressure is 0 to 515 psia.

Institute of Mathematical Sciences, New York U., N. Y.
GROWTH OF DROPS BY CONDENSATION, by Ignace I. Kolodner. Rept. on Contract DA 18-064-cml-2518. Mar 55, 30p. 4 refs. IMM-NYU-215; AD-121 943.
Order from LC mi$2.70, ph$4.80 PB 143 262

When the vapor pressure (or concentration) in air surrounding a liquid nucleus exceeds the saturation pressure for a given temperature, vapor will condense on the nucleus and the drop will grow; effort is made to determine this growth. The problem is preliminary to a more difficult study of the behavior of a collection of drops in a supersaturated medium, a situation which may serve as a model of the formation of clouds. The problem is formulated, and the results obtained are compared with those already available. The remainder of the paper is devoted to derivations and proofs.

Instituto de Quimica Fisica (Spain).
KINETICS OF THE SULPHURATION OF METALLIC SURFACES, by J. Llopis, J. M. Gamboa, and L. Arizmendi. Annual rept. no. 2 on Contract AF 61(514)1329. May 59, 48p. 11 refs. AFOSR-TN-59-597; AD-217 180.
Order from LC mi$3.30, ph$7.80 PB 143 681

Surface reaction of copper with solutions of diphenylthiourea: The kinetics of the surface reaction of copper with solutions of diphenylthiourea in xylene has been followed by the radiochemical method. This reaction yields coherent sulphide films, showing neat and uniform interference colors. In the circumstances of these experiments, the reactivity of the diphynylthiourea with copper is lower than that of thiourea in

aqueous solution and the kinetic law of the film growth is linear with time. Surface reaction of copper with solutions of diethyl polysulphides: The results of the present experiments suggest that diethyl disulphide, dissolved in dry xylene, does not react with copper, while diethyl trisulphide in the same conditions does react, giving up the three atoms of sulphur to form a film of sulphide on the surface. In the reaction of trisulphide, the kinetic law of film growth is linear with time. The films of sulphide formed are at first coherent and show interference colors; however, black circular stains soon appear and the corrosion rate increases then appreciably with time. The influence of free sulphur in mixed xylenic solutions with diethyl trisulphide has been studied. (See also PB 136 867)

John Harrison Lab. of Chemistry, U. of Pennsylvania, Philadelphia.
INVESTIGATIONS OF THE COVERAGE OF ELECTRODES WITH ADSORBED ATOMIC HYDROGEN DURING HYDROGEN EVOLUTION, by J. O'M. Bockris and F. Colum. Rept. on Contract Nonr-551(22). 31 Dec 58, 36p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 143 849

The study of the ionization of adsorbed H on noble metal electrodes carried out in alkaline solutions is described in this report. Most of the experimental procedures in this work were similar to those used in Devanathan's work.

Linfield Research Inst., McMinnville, Oreg.
RESEARCH ON ELECTROLYTIC MICROMACHINING TECHNIQUES OF REFRACTORY METALS FOR USE IN FIELD EMISSION DEVICES, by H. W. Pitman and D. C. Hamby. Quarterly progress rept. no. 1, 15 July-15 Oct 58, on Contract DA 36-039-sc-78191. [1958] 49p. 10 refs.
Order from LC mi$3.30, ph$7.80 PB 143 697

Existing literature data on the emf of the tungsten electrode in alkaline electrolytes is analyzed with a view toward establishing the electrode process responsible for the observed dependence of emf on pH and tungstate ion concentration. Coulometric measurements on the tungstic oxide layer forming process have been initiated and an estimate of the forming field required to produce oxide growth has been obtained for formations in dilute nitric acid. Initial runs in the establishment of a calibration curve for spectrophotometric tungsten analysis are being made.

Minnesota U., Minneapolis.
A MODIFICATION OF THE METHOD OF FLASH PHOTOLYSIS AND ITS APPLICATION TO THE STUDY OF LABILE INTERMEDIATES IN REACTIONS SENSITIZED BY COMPLEX MOLECULES, by Robert Livingston. Final rept. for 1 Sep 55-31 Mar 59 on Contract AF 18(600)1485. 12 Aug 59, 12p. 3 refs. AFOSR-TR-59-114.
Order from LC mi$2.40, ph$3.30 PB 143 630

This project was initiated to obtain quantitative information regarding the spectroscopic properties and reactions of photochemically-produced labile states of certain polyatomic molecules. A modification of the flash photolytic technique was used in those studies and a substantial part of our time was spent in developing and testing new apparatus. The half lives of the triplet states of chlorophyll and anthracene in solution and the quenching action of certain compounds upon these triplet states were measured.

Missouri U., Columbia.
ELECTROCHEMICAL SYSTEMS FOR USE IN LOW TEMPERATURE BATTERIES, by G. M. Arcand and J. R. Tudor. Quarterly progress rept. no. 1, 17 Mar-16 June 58, on Contract DA 36-039-sc-74994. [1958] 49p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 138 837

Progress is reported on a fundamental investigation of KSCN and water in acetonitrile, of $ZnCl_2$ in dry propionitrile. Load tests at room temperature have been made on magnesium-manganese dioxide and zinc-manganese dioxide cells employing $KSCN-H_2O-CH_3CN$ electrolytes.

Modena U. (Italy).
ANODIC BEHAVIOR OF HYDROGEN PEROXIDE ON PLATINUM ELECTRODES, by G. Bianchi, G. Caprioglio and others. Technical scientific note no. 4 on Contract AF 61(052)85. 30 Apr 59, 38p. 16 refs. AFOSR-TN-59-921.
Order from LC mi$3.00, ph$6.30 PB 143 637

The evolution of oxygen from the acid solutions of hydrogen peroxide begins on platinum at low anodic tensions (+800 mV), on account of the probable intervention of the platinum oxides. At greater current densities, the process occurs in the same conditions as on other metals, like gold, and probably requires the intervention of the adsorbed atomic oxygen. The reaction between hydrogen peroxide and adsorbed oxygen would give rise to the evolution of the oxygen. The adsorption and the formation of platinum oxides can explain the anodic phenomena of hysteresis. In alkaline solutions the oxidation of hydrogen peroxide occurs on platinum with the same mechanism as on other metals. At greater current densities the discharge of the ions OH^- and the formation on platinum of a film of adsorbed OH radicals can intervene. The radicals can react with hydrogen peroxide to give rise to the evolution of oxygen.

Modena U. (Italy).
ELECTROCHEMICAL BEHAVIOR OF GRAPHITE ELECTRODES IN SOLUTIONS OF VARIOUS pH CONTAINING OXYGEN AND HYDROGEN PEROXIDE, by G. Bianchi, G. Caprioglio and others. Technical scientific note no. 3 on Contract AF 61(052)85. 30 Apr 59, 42p. 10 refs. AFOSR-TN-59-708.
Order from LC mi$3.30, ph$7.80 PB 143 596

Polarization measurements with graphite electrodes were affected in solutions of different pH, with oxygen or CO_2 bubbling and varying the H_2O_2 concentration of the solutions from zero to 10^{-1}M. Variations of potential with time at the moment of opening and closing the polarization circuit were also registered.

The results were interpreted by considering the intervention of processes occurring on graphite, which, however, does not behave as an inert electrode with respect to oxygen and H_2O_2 processes. The intervention of the electrode is manifested under the form of processes presumably due to the presence of the superficial oxide C (O) and to adsorbed carbonates $(CO_3^{--})_{ads.}$. Such processes can substitute or superimpose those concerning H_2O_2 and oxygen particularly in the case of acid solutions.

Naval Ordnance Lab., White Oak, Md.
ON THE NUMERICAL SOLUTION OF THE ADIABATICALLY EXPANDING GAS BUBBLE OF VARIABLE MASS IN AN INFINITE LIQUID MEDIUM, by Bernard Chern and Julius W. Enig. 20 Jan 58, 14p. 20 refs. NAVORD rept. 5735.
Order from LC mi$2.40, ph$3.30 PB 143 307

This report describes the behavior of a gas bubble, free from external forces and immersed in an infinite liquid medium, when gas is added to the bubble at a constant mass rate. Numerical solutions are obtained giving the bubble pressure, radius and temperature as a function of time for different values of mass addition rate. It is shown that the gas bubble reaches a first maximum pressure $P^{(1)}_{max}$, much greater than subsequent maxima. Up to the first pressure maximum, the bubble expansion is seen to be approximately isothermal. In terms of the reduced pressure, P, and a dimensionless parameter C, the relation

$$P^{(1)}_{max} = 1 + 0.5532\, C^{0.6808} \quad ; 0 \leq C \leq 2000$$

holds over the range studied.

Naval Research Lab., Washington, D. C.
CONSTITUTIVE RELATIONS IN THE WETTING OF LOW-ENERGY SURFACES AND THE THEORY OF THE RETRACTION METHOD OF PREPARING MONOLAYERS, by Elaine G. Shafrin and W. A. Zisman. Interim rept. 21 Oct 59, 14p. 32 refs. NRL rept. 5394.
Order from OTS $0.50 PB 151 936

Earlier systematic studies of the angle of contact θ exhibited by drops of liquid on plane, solid surfaces of low surface energy have revealed a regular linear variation in cos θ with the surface tension (γ_{LV}) of a large variety of liquids; this led to the concept of the critical surface tension of spreading (γ_C) and its use in characterizing the wettability of organic solids and of high-energy surfaces coated with adsorbed organic films. The wetting properties of low-energy organic surfaces are shown to depend upon the chemical structure and the physical packing of the atom groups in the outermost layer. For hydrocarbons, wettability decreases with increasing hydrogenation. Fluorine is the most effective hydrogen substitute in decreasing γ_C, whereas Cl, Br, I, O, and N increase the wettability of organic surfaces. The "retraction method" of preparing monomolecular films from solutions on solids is shown to be a direct consequence of the above constitutive law of wetting. The same analysis, applied to a pure liquid, results in the explanation of the behavior of the autophobic liquids at room temperature and of the process of depositing a monolayer on a solid by retraction from the melt over a range of temperature.

Naval Research Lab., Washington, D. C.
METALS COATED WITH FILMS OF LOW SURFACE ENERGY AS REFERENCE ELECTRODES FOR THE MEASUREMENTS OF CONTACT POTENTIAL DIFFERENCES, by K. Bewig and W. A. Zisman. Final rept. 23 Oct 59, 15p. 23 refs. NRL rept. 5383.
Order from OTS $0.50 PB 151 994

The central problem in the measurement of the contact potentials of solid and liquid surfaces in gaseous atmospheres is the stability of the contact potential of the reference electrode to which the potential difference between the two is referred. Noble metals, such as gold or platinum, are usually employed as reference electrodes, but, in gaseous atmospheres, their contact potentials can change significantly because of vapor adsorption on the reference surfaces. This occurs even on aged metals, the effect of adsorbed water vapor being especially great. But a metal which had been coated with a low-energy film, such as Teflon or FEP Teflon resin, exhibits little change in the contact potential in a wide variety of polar and nonpolar vapors. This is demonstrated by the results of recent studies of metals in a nitrogen atmosphere in which the water-vapor content was varied from 1% to as high as 91% R. H. Teflon-coated metal reference electrodes have proved to be remarkably stable under these conditions.

Naval Research Lab., Washington, D. C.
SURFACE ACTIVITY OF FLUORINATED ORGANIC COMPOUNDS AT ORGANIC-LIQUID/AIR INTERFACES. PART III. EQUATION OF STATE OF ADSORBED MONOLAYERS AND WORK OF ADSORPTION OF A FLUOROCARBON GROUP, by N. L. Jarvis and W. A. Zisman. Interim rept. 17 Nov 59, 10p. 12 refs. NRL rept. 5401.
Order from OTS $0.50 PB 151 997

Previous investigations have demonstrated that a wide variety of partially fluorinated carboxylic esters are capable of adsorbing as unimolecular films at the interfaces between various organic liquids and air, and also that these films are usually in a gaseous or otherwise expanded state. In the present study it is shown that isotherms of film pressure (F) vs area (A) per adsorbed molecule of solute, at large values of A, obey the simple equation of state $(F + F_o)(A - A_o) = kT$. However, as the film pressures increase, the deviation from this equation increases. The two-dimensional analog of the van der Waals equation $(F + a/A^2)(A - A_o) = kT$, which includes a more definitive correction factor for the intermolecular attraction between neighboring molecules in the film, was in good agreement with the experimental data even at very low areas per molecule. The constants a and A_o of the van der Waals equation were calculated for the F vs A isotherms of solute in various solvents, and the relation of these constants to the organophobic-organophilic balance in the solute molecules and to the association of solute and solvent molecules is discussed. In addition, the work of adsorption $\Delta\lambda$ of $-CF_2-$ groups at each organic-liquid/air interface was calculated. The plot of $\Delta\lambda$ vs solvent surface tension was a straight line, which extrapolated fairly well to the value for $-CF_2-$ groups adsorbed at the water/air interface, as determined from surface tension vs concentration isotherms given in the literature for fluorinated solutes in water. (See also PB 151 808)

Ohio State U. Research Foundation, Columbus.
THE SOLUBILITY OF HYDROGEN IN DIBORANE, by Jih-Heng Hu and George E. MacWood. Technical research rept. Jan 56, 17p. 6 refs. MCC-1023-TR-196.
Order from LC mi$2.40, ph$3.30 PB 144 094

The solubility of hydrogen in liquid diborane was determined in the temperature range 113-181°K and the pressure range 0-40 atm. The solubility is found to increase with temperature. The heat of solution at infinite dilution ranges from 386-601 cal./mole.

Oregon U., Eugene.
PRESSURE BROADENING OF THE VIOLET TRIPLET OF MANGANESE IN THE PRESENCE OF ARGON AND HELIUM, by Shang-Yi Ch'en and Robert B. Bennett. Interim technical rept. no. 2, 1 Dec 57-Aug 59, on The Modification of the Shape and Positions of Spectral Lines by Foreign Gases under Well-Defined Conditions of High Pressure and High Temperature, Contract DA 04-200-ORD-713. [1959] 10p. 4 refs. AD-226 185.
Order from LC mi$1.80, ph$1.80 PB 144 026

The λ4030 absorption triplet of Mn ($3d^54s^2$, ^6S - $3d^54s4p$, ^6P) was studied under various pressures of argon and helium of relative density ranging from 1 to 30. The result indicates the inverse sixth power law of interatomic interaction and that the difference in interaction energy constant for the ground ^6S state and the excited ^6P states of Mn in argon is 3×10^{-58} erg cm^6.

Pennsylvania State U. [University Park].
REACTION OF ALKOXIDE IONS WITH CX_2 TO PRODUCE CARBONIUM ION INTERMEDIATES, by P. S. Skell and I. Starer. Technical rept. no. 3 for 15 June 58-15 June 59 on Reactivity of Methylenes (Bivalent Carbon Species), Contract DA 36-061-ORD-607. [1959] 5p. 6 refs; AD-217 886.
Order from LC mi$1.80, ph$1.80 PB 143 322

A method for producing highly reactive carbonium ion inter ediates in basic media.

Polytechnic Inst. of Brooklyn, N. Y.
CELL-VACANCY THEORY OF LIQUIDS, by Abdel S. Said and Frank C. Collins. Rept. on Study on Relation of Chemical Composition, Structure, and Physical Environment to Viscosity, Thermal Conductivity and Diffusion, Contract AF 33(616)3894. June 59, 14p. 8 refs. WADC Technical note 59-154.
Order from OTS $0.50 PB 161 109

The cell vacancy theory of Peek and Hill had been refined by spherically symmetrizing the cell density calculated from a cell potential which is unsymmetrically perturbed by the presence of an adjacent vacant cell instead of first spherically symmetrizing the cell potential before constructing the cell density as done by Peek and Hill. The refined procedure enables the enhanced density in the cell in the immediate neighborhood of the vacancy to be more fully taken into account. A variable fraction of vacancies is permitted by superposing the cell densities of a cell with no adjacent vacancies and a cell with one adjacent vacancy. In contrast to the results of Peek and Hill, minimizing the free energy in the present instance, predicts a substantial fraction of vacancies at normal liquid densities. The calculated pressure is not significantly improved. Further improvement of the cell-vacancy theory would require detailed calculations of the non-symmetrized cell density for various arrangements of multiple adjacent vacancies.

Rocketdyne, Canoga Park, Calif.
RESEARCH ON NITRIC ACID-SUPPORTED COMBUSTION, by R. J. Thompson. Final progress rept. on Contract AF 49(638)163. Mar 59, 66p. 13 refs. R-1157, [AFOSR]-TR-59-1; AD-208 301.
Order from LC mi$3.90, ph$10.80 PB 143 916

Details concerning an investigation of nitric acid flames with methane, propane, hydrogen, and acetylene are presented. Flame stability limits, flame speeds, combustion products and emission spectra were studied. (See also PB 135 609)

Stanford Research Inst., Menlo Park, Calif.
A FEASIBILITY STUDY: SUPERIMPOSED BEAMS: A TECHNIQUE FOR DETERMINING TWO-BODY REACTION CROSS SECTIONS, by Charles J. Cook and Clarence M. Ablow. Scientific rept. no. 1 on Contract AF 19(604)3475. 17 Sep 59, 54p. 38 refs. AFCRC-TN-59-472.
Order from LC mi$3.60, ph$9.30 PB 143 685

Crossed molecular beams cannot be utilized to measure two-body reaction cross sections for arbitrary reactants due to difficulties of production and detection of all but a few selected species. However, a wide range of reactants can be produced in fast (kev) beams and can be individually detected. Similarly, the reaction products resulting from superimposing two fast beams could be individually detected. The feasibility of accurately determining two-body reaction cross sections by a superimposed beam technique has been investigated. The apparatus described must be improved before accurate studies of ion-ion recombinations or sharply resonant chemical reactions can be made.

Stanford Research Inst., Menlo Park, Calif.
LATTICE ENERGIES OF THE ALKALI HALIDES AND THE ELECTRON AFFINITIES OF THE HALOGENS, by Daniel Cubicciotti. Technical note no. 4 on Contract AF 49(638)89. July 59, 24p. 27 refs AFOSR-TN-59-726.
Order from LC mi$2.70, ph$4.80 PB 143 162

The overlap repulsion parameters that occur in the Born-Mayer treatment of lattice energies have been re-evaluated for the alkali halides from recent compressibility data. With these parameters the lattice energies of the alkali halides were calculated. The lattice energies were combined with thermochemical

data to calculate the electron affinities of the halogens. The values obtained were: F 80.2; Cl 85.0; Br 79.5; I 72.5 kcal/mole.

Syracuse U., N. Y.
STUDY OF THE MIGRATION AND DESCRIPTION OF A DIMORPHIC ADSORBATE USING THE FIELD EMISSION MICROSCOPE: TITANIUM ON TUNGSTEN, by Robert C. Abbott and Allan M. Russell. Technical rept. on Contract AF 49(638)93. June 59, 49p. 31 refs. AFOSR-TR-59-89.
Order from LC mi$3.30, ph$7.80 PB 143 678

The desorption was measured by the field emission technique and the activation energies were determined. In addition, estimates were made for the average number of titanium-titanium and titanium-tungsten bonds broken during migration and desorption.

Washington U., Seattle.
RESEARCH IN HETEROGENEOUS CATALYSIS, by G. D. Halsey, Jr. Technical rept. for 15 Sep 53-15 Sep 59 on Contract AF 18(600)987. [1959] 10p. 8 refs. AFOSR-TR-59-127.
Order from LC mi$1.80, ph$1.80 PB 143 909

Papers covering the project are listed. None have been published. A summary of the present status of the problem is also given.

EARTH SCIENCES

Oregon State Coll. School of Science, Corvallis.
HYDROGRAPHY OF OREGON ESTUARIES, by Wayne V. Burt and Bruce McAlister. Data rept. no. 3, June 56-Sep 58, on Contract Nonr-1286(02). Oct 58, 20p. Reference 58-6.
Order from LC mi$2.40, ph$3.30 PB 143 699

Unpublished hydrographic data for Oregon Estuaries (Alsea, Columbia, Coos, Nehalem, Netarts, Siletz, Siuslaw, Tillamook, Umpqua, and Yaquina) are tabulated.

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
ACCURACY OF MEAN MONTHLY GEOSTROPHIC WIND VECTORS AS A FUNCTION OF STATION NETWORK DENSITY, by Henry A. Salmela. June 59, 45p. 3 refs. Air Force Surveys in Geophysics no. 112; AFCRC-TN-59-268; AD-217 034.
Order from OTS $1.25 PB 161 113

Two experiments, aimed at studying the accuracy of analyses of mean monthly contour charts at three levels, with five different densities of station network coverage in one experiment and four in the other, are described. The results of the experiments show that when geostrophic winds computed from mean monthly upper-air contour charts based on sparse data coverage are compared to those derived over areas of optimum coverage a quantitative measure of the relative accuracy is obtained.

Air Force Cambridge Research Center, Bedford, Mass.
NUMERICAL EXPERIMENTS IN FORECASTING AIR AND SOIL TEMPERATURE PROFILES, by Donald W. Stevens. July 59, 68p. 42 refs. GRD Research notes no. 12; AFCRC-TN-59-252.
Order from OTS $1.75 PB 161 151

A numerical forecasting model based on Taylor's heat-transfer equation for the atmosphere and the classical heat-conduction equation for the soil is presented. The surface energy-budget equation is solved for the surface temperature, and the equations are integrated numerically to provide 4-hour forecasts of the temperature profiles in the soil and atmosphere. Five experiments using different functional forms for eddy conductivity are described, and the results are compared with observations. The last experiment showed reasonably good agreement between the forecast and observed temperatures, the maximum error being 1.6°K. The model constants producing this result are not unreasonable in the light of present knowledge of the magnitude and vertical variation of the eddy conductivity. The shortcomings of the model are discussed, and some plans for further testing are listed. Suggestions for improving the model are presented, and a brief discussion of the potentialities of an analogue computer for solving problems of this type is given.

Air Weather Service, Washington, D. C.
MEMORANDUM ON DENSITY-ALTITUDE. Sep 57, 15p. 7 refs. AWS Technical rept. no. 105-101 (Rev. 2).
Order from LC mi$2.40, ph$3.30 PB 143 289

Basic definitions and discussions are presented.

[Army Signal] Radio Propagation Agency, Fort Monmouth, N. J.
COMPARISON OF PREDICTED AND OBSERVED SIGNALS ON A NORTH ATLANTIC PATH, by Luther C. Kelley. July 56, 16p. Proj. 419.
Order from LC mi$2.40, ph$3.30 PB 143 139

The objective of this report is to determine the accuracy of the method presented in Technical Report No. 9 (PB 103 045) for determining the monthly median received signal intensity of a high frequency radio circuit whose path crosses the North Atlantic and skirts the auroral zone. Observed data (receiver input voltage) is available for the circuit, GLH, Dorchester, England to Riverhead, Long Island, New

York. The validity of Technical Report No. 9 methods for this type of path is to be checked by comparing observed and calculated values. The period considered is January 1947 to December 1949 inclusive.

Blue Hill Meteorological Observatory, Milton, Mass.
CLOUD PATTERNS AND RELATED AIR MOTIONS DERIVED BY PHOTOGRAPHY, by John H. Conover. Final rept. on Contract AF 19(604)1589. June 59, 273p. 24 refs. AFCRC-TR-59-246; AD-215 936.
Order from LC mi$11.10, ph$42.60 PB 143 659

Under conditions of strong winds a banded structure of the troposphere, approximately parallel to the wind, may be revealed by clouds at any level. The following band types and their approximate dimensions were found at cirrus levels: large scale, 100 mi apart and up to at least 350 mi long; major bands 2.3 mi apart and up to at least 80 mi long; minor bands 0.2 mi apart and a few miles long. At altocumulus levels major bands are found. Sharp edges to extensive cirrus sheets or banded cirrus are generally found a few miles south of the jet stream core. "Streaky" cirrus denotes jets to the north and south. When banded or "streaky" cirrus is observed 50% of the time it lies on the warm side and within 200 mi of the jet core and in the entrance or neutral regions. Horizontal vortices, approximately parallel to the wind, through which the air flows in a helical motion create the major cloud bands. Adjacent vortices rotate in opposite directions. Cloud forms between vortices in rising air and spreads laterally, depending on the average shear and lapse rate through the layer of cloud formation. Cumulus cloud streets appear to be unaffected by irregularities of at least 700 ft in the earth's topography; they generally form in vortices of like rotation, the intervening vortices apparently are wiped out by the prevailing horizontal shear. The sea breeze may cause lifting to at least 16,000 ft as shown by stationary clouds at that level. Thunderstorm roll clouds rotate upward on the advancing side about a horizontal axis. Vertical motions dangerous to aircraft, operating at levels in which these rolls form, may be encountered.

Blue Hill Meteorological Observatory, Milton, Mass.
GROUND TEMPERATURE, VOLUME I, by Jen-Hu-Chang. Rept. on Contract DA 19-129-qm-348. 21 June 58, 305p. 402 refs.
Order from LC mi$11.10, ph$47.10 PB 143 364

This volume contains a comprehensive study and bibliography on the subject of ground temperature.

Chicago U., Ill.
ON THE INFLUENCE OF HEAT EXCHANGES ON MOTION AND WEATHER SYSTEMS, by Sverre Petterssen. Scientific rept. no. 10 on Contract AF 19(604) 2179. July 59, 18p. 11 refs. AFCRC TN-59-446.
Order from LC mi$2.40, ph$3.30 PB 143 027

In the present report is given a brief summary of the results of two pilot projects, the one dealing with stationary systems over the Great Lakes and the other with mobile systems on the North Atlantic Ocean.

Massachusetts Inst. of Tech., Cambridge.
NOTE ON VERTICAL VARIATIONS IN RADAR REFLECTIVITY, by C. William C. Rogers. Technical note no. 1 on Weather Radar Research, Contract AF 19(604)2291. June 59, 17p. 6 refs. AFCRC-TN-59-427.
Order from LC mi$2.40, ph$3.30 PB 143 401

This paper presents the results of a survey of the frequency of occurrence of detectable increases or decreases in radar reflectivity with height in the lower levels of the atmosphere. The survey is based on a series of RHI photographs taken by the Air Force at its AN/CPS-9 radar at Great Blue Hill. Only situations characterized by continuous non-showery precipitation were used. The total number of cases analyzed was 805; of these, 470 were in rain echoes below the bright band and 335 were in snow. It was found that by far the majority of the cases showed no detectable change in reflectivity with height in the lower levels of the atmosphere. The relationship between variations in reflectivity with height and the vertical velocity profiles is discussed. It is pointed out that larger vertical velocities and greater variations in reflectivity with height are observed in the middle atmosphere and it is suggested that in further studies of the relationship between these parameters attention should be directed toward the upper levels.

Naval Research Lab., Washington, D. C.
UPPER ATMOSPHERE RESEARCH REPORT NO. XXXIII. AEROBEE-HI REPORT NUMBER 6; SINGLE-LINE-SCAN TELEVISION FOR SPINNING ROCKETS, by F. H. Harris and J. Ainsworth. 11 Aug 58, 15p. 9 refs. NRL rept. 5168.
Order from LC mi$2.40, ph$3.30 PB 134 203

A brief experimental and theoretical study was made of the practicability of using a vidicon camera tube to measure the space orientation of spin stabilized Aerobee-Hi research rockets. The usual television camera tube xy scan was replaced by a single-line y scan and the motion of the image obtained by rotation of the television camera was used in lieu of the x scan. While ordinary television pictures are badly blurred by camera rotation, laboratory photographs which were obtained by means of a spinning, line scan camera demonstrated that this method can be used to obtain pictures whose quality is similar to those of standard television. Design equations for determining the sensitivity and resolution of a vidicon camera tube with single-line scan were derived and verified experimentally. It is concluded that with the use of a single-line scan, satisfactory sensitivity and resolution can be obtained with compact lightweight equipment, low power consumption, simplified circuitry, and reduced transmission bandwidth.

New York U. Coll. of Engineering, N. Y.
THE DIURNAL VARIATION OF TEMPERATURE NEAR TROPOPAUSE DUE TO A DIURNAL VARIATION OF TERRESTRIAL RADIATION, by Paul A. Davis. Scientific rept. no. 5 on Contract

AF 19(604)1755. June 59, 44p. 15 refs. AFCRC-TN-59-424.
Order from LC mi$3.30, ph$7.80 PB 143 592

Computations are made of the diurnal temperature variation experienced by the atmosphere in the 8-18 kilometer region as a result of the diurnal variation of terrestrial radiation reaching each layer. The methods of calculation are discussed in detail. For the two localities considered, Albuquerque, New Mexico and Bismarck, North Dakota, the diurnal ranges of temperature resulting from the terrestrial radiation were found to be less than 0.05°C. Of the three infrared absorbers considered, ozone contributed most to the diurnal temperature variation, followed by carbon dioxide and water vapor respectively. (See also PB 140 212)

New York U. Coll. of Engineering, N. Y.
VALLEY WIND STUDIES IN VERMONT, 1957, by Ben Davidson and P. Krishna Rao. Preliminary rept. on Contract AF 19(604)1971. Nov 58, 61p. 12 refs. AFCRC-TR-58-29.
Order from LC mi$3.90, ph$10.80 PB 138 594

A series of experiments, designed to isolate the effects of valley geometry and prevailing wind on the valley-wind system is described in detail.

Quartermaster Research and Engineering Center, Natick, Mass.
ATLAS OF MEAN DAILY MINIMUM TEMPERATURES, by Samuel Van Valkenburg, Henry J. Warman (Clark U.) and William C. Robison. May 59, 32p. 5 refs. Technical rept. EP-110.
Order from LC mi$3.00, ph$6.30 PB 143 788

The report, shows the worldwide variation, by seasons, of a climatic element that is a useful criterion of the degree of cold stress to be expected in a given area. The maps in this atlas have a direct application in determining clothing allowance zones and areas of issue for other items designed to meet specified temperature minima. The maps will serve as a useful reference in environmental research.

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS VII. ANALOGS OF CANAL ZONE CLIMATE IN INDONESIA, THE PHILIPPINES AND BORNEO, by Will F. Thompson. June 59, 57p. 22 refs. Technical rept. EP-116.
Order from LC mi$3.60, ph$9.30 PB 143 281

The climate of Indonesia, the Philippines, and Borneo is compared with that of two localities in the Canal Zone: Balboa Heights, representing the drier, leeward Pacific side of the Isthmus of Panama, and Cristobal, representing the wetter, windward, Atlantic side. Distribution of areas of analogy of pertinent climatic elements and combinations of these elements are shown on maps. (See also PB 137 857)

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS VIII. ANALOGS OF CANAL ZONE CLIMATE IN AUSTRALIA AND NEW GUINEA, by Walter Beale Blair and Jack V. Chambers. Rept. on Military Evaluation of Geographical Areas. July 59, 60p. 15 refs. Technical rept. EP-113.
Order from LC mi$3.60, ph$9.30 PB 143 832

The climate of Australia and New Guinea is compared with that of two locations in the Canal Zone: Balboa Heights, representing the drier, leeward, Pacific side of the Isthmus of Panama, and Cristobal, representing the wetter, windward, Atlantic side. Areas of analogy of pertinent climatic elements and combinations of these elements and combinations of these elements are shown on maps. (See also PB 143 281)

Sperry Gyroscope Co., Great Neck, N. Y.
A FLIGHT INVESTIGATION OF THE PERFORMANCE OF LOW CEILING/VISIBILITY METEOROLOGICAL EQUIPMENT. Summary rept. on Contract CCA 29773. Oct 54, 55p. Sperry rept. no. 5245-4060.
Order from LC mi$3.60, ph$9.30 PB 144 114

A general analysis of the flight test data has been performed. The results of this analysis can be used to determine what a pilot will see from the cockpit under observed meteorological and photometric conditions at any airport equipped with the ceilometer-transmissometer system. Information which is not currently available to the pilot, such as when the pilot can first see the ground, the approach lights, and the end of the runway, can be obtained from this system. This information, when used by the pilot, can provide an improvement in approach success and an increase in the safety of instrument approaches.

Stanford Research Inst., Menlo Park, Calif.
STUDY OF WEATHER STATIONS FOR ARMY USE. PHASE I: STATE OF THE ART, by I. G. Poppoff, G. B. Bell and others. Summary rept. on Contract DA 36-030-sc-78154. 15 Dec 58, 110p. 303 refs.
Order from LC mi$5.70, ph$16.80 PB 143 774

This report covers Phase I of a survey of the field of semi-automatic and automatic weather stations. Detailed results of the survey are presented as an annotated bibliography appended to this report.

Texas A. and M. Research Foundation, College Station.
SOME NON-PRECIPITATION ECHOES AS OBSERVED BY CPS-9 RADAR, by Stuart G. Bigler. Scientific rept. no. 1 on Contract AF 19(604)3864. Sep 59, 37p. 28 refs. Reference 59-12T; AFCRC-TN-59-475; AD-225 977.
Order from LC mi$3.00, ph$6.30 PB 143 590

Echoes from regions in the atmosphere where no reflecting or scattering sources could be seen are described. Such echoes, commonly called angels, include the following types, (1) thin lines associated with wind shifts in dry fronts, and preceding squall lines and air-mass showers, (2) echoes arranged in

layers aloft, (3) others which are uniform and diffuse, (4) fibrilliform echoes presumably resulting from thermals, and (5) mantle echoes which correspond to the outer boundaries of cumulus clouds. One or more of these echo types were photographed on 79% of the 37 radar operating days between 1 June and 23 July 1958. Meteorological conditions during the observations are described. First gust lines associated with scattered showers and thunderstorms are considered in some detail. Illustrations of the PPI and RHI presentations of these lines as well as wind, pressure, and temperature records are included. It is concluded that these thin lines are the boundary of mesosystems and provide another method for study of the characteristics of mesosystems.

Travelers Insurance Co., Hartford, Conn.
MULTIVARIATE STATISTICAL ANALYSIS OF ATMOSPHERIC PROCESSES, by Thomas F. Malone. Final rept. on Contract AF 19(604)3877. 1 Aug 59, 86p. 26 refs. AFCRC-TR-59-271.
Order from LC mi$4.80, ph$13.80 PB 143 519

Section I is an objective method for classifying sets of observed weather elements into groups, the classification depending upon events observed on the next day. Probabilities can be derived for various classes of events, and a screening type procedure can be applied to select the important classificatory variables. Canonical correlation, described in Section II provides a measure of the strength of the relationships between one entire set of variables and another entire set and thus may be viewed as a generalization of multiple correlation. In Section III the design of a large-scale experiment to examine this problem is described. The paper emphasizes the concept of a coordinate system moving with the storm center, outlines data-gathering procedures for the 352 cases, and presents plans for the data analysis.

Frost Science

Army Snow, Ice, and Permafrost Research Establishment [Wilmette, Ill.]
SECOND SIPRE SNOW COMPACTION CONFERENCE, 24-25 MAY 1951. June 51, 53p. SIPRE rept. no. 3.
Order from LC mi$3.60, ph$9.30 PB 143 363

Wisconsin U. [Madison.]
JUNEAU ICE FIELD RESEARCH PROJECT. Semi-annual status rept. on Contract N9onr-83001. 26 Nov 58, 7p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 143 614

A tripartite program of glaciological and related studies was conducted on Lemon Creek Glacier, on Gilkey Clacier, and on ice-dammed Tulsequah Lake.

Geodesy

Army Engineer Research and Development Labs., Fort Belvoir, Va.
A PROPOSED STEREOPHOTOGRAMMETRIC SYSTEM FOR TOPOGRAPHIC MAPPING FROM PHOTOGRAPHY TAKEN AT ALTITUDES UP TO 100,000 FEET, by J. W. Halbrook. 1 Apr 58, 18p. 1 ref. Technical rept. 1518-TR.
Order from LC mi$2.40, ph$3.30 PB 143 269

It is recognized that higher ceilings of aircraft will entail mapping for military purposes from photography taken above 50,000 ft. It is known that present day plotting equipment is not sufficiently precise to permit plotting of accurate large-scale military maps from photography taken at such altitudes. The system proposed as having a chance of meeting the requirements consists of convergent, 18-in. focal length, 9- by 9-in. format cameras with an optical projection plotting instrument to match. Magnification will be such that operator errors are smaller, percentage-wise. It is expected that the effect of reducing errors from all sources will result in sufficient accuracy to draw 20-ft contours approaching national map accuracy standards from 100,000-ft photography. It is concluded that: (a) it is possible to prepare topographic maps with 20-ft contours from photographs taken at altitudes up to 100,000 ft, (b) the proposed system is expected to produce maps that will meet emergency accuracy standards and possibly peacetime standards, and (c) the analytical method offers the best solution to the problem of triangulation.

Quartermaster Research and Engineering Center, Natick, Mass.
PREDICTIVE METHODS IN TOPOGRAPHIC ANALYSIS: II. ESTIMATING RELIEF FROM WORLD AERONAUTICAL CHARTS, by Walter F. Wood and Joan B. Snell. June 59, 23p. 3 refs. Technical rept. EP-114.
Order from LC mi$2.70, ph$4.80 PB 143 428

A method has been developed for obtaining an estimate of relief of an area from the World Aeronautical Charts (scale 1:1,000,000). This consists of determining a value for the lowest elevation and a value for the highest elevation of an area: relief of the area is the difference between these two values. The technique for determining lowest elevations is based on an assumed geometric progression of elevations along a stream; the technique for determining highest elevations depends on an arithmetic progression of elevations on a land surface. The accuracy of these methods was tested on 197 160-square-mile areas in the United States. Correlation of relief values at a scale of 1:1,000,000 with values for the same areas at a scale of 1:62,500 resulted in a coefficient of correlation of .9952. For the most part, relief from the 1:1,000,000-scale maps was within 200 feet of error. A series of regression equations has been devised which can be applied to improve these estimated values. Since it has been demonstrated that it is possible to obtain a realistic relief figure from the World Aeronautical Charts, rather serious limitations to quantitative terrain analysis, imposed by inadequate map coverage, can be overcome.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
THE D-LINE METHOD OF ANALYZING A DISTRIBUTION, by Lester E. Klimm. Technical rept. no. 3 on Contract Nonr-551(01). 1 Oct 58, 14p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 143 796

Geographers and other investigators frequently encounter the problem of making orderly analyses of distributions in which the phenomena occur as interrupted areas of varying sizes and shapes, or as points. Examples of such areas are islands, lakes, cropland, urban agglomerations, clumps of vegetation, etc. On scales suitable for analysis, phenomena such as homesteads, farmsteads, etc., are often considered as dimensionless points. Distance relations between the occurences in a phenomenon having such an interrupted distribution are important qualities of that distribution. In essence, these relations are expressable in terms of distances across the interruptions. These distances across the interruptions may be measured or sampled and statistical results arrived at in terms of maximum, minimum, mode, mean, frequency, etc. In this study, however, attention will be concentrated on the geography of the distribution; i.e., the organization of a map of the distribution into regions with objectively-determined boundaries based on distance relations across interruptions.

Geography

Central Intelligence Agency, Washington, D. C.
CHINA: PROVISIONAL ATLAS OF COMMUNIST ADMINISTRATIVE UNITS. 1959, 51p. (2 color maps will not reproduce) CIA/RR GR 59-20.
Order from OTS $5.00 PB 161 275

Pennsylvania State U., University Park.
AN ANALYSIS OF THE INDUSTRIAL GEOGRAPHY OF THE PORT OF GENOA, ITALY, by Allan L. Rodgers. Status rept. 1957 on Contract [Nonr-656(11)]. 1 Dec 57, 12p. AD-153 773.
Order from LC mi$2.40, ph$3.30 PB 137 918

The present study is concerned with (1) the role of various location factors in the development of industry in Genoa and (2) the relations of the industries of Genoa with the hinterland of the port. It is hoped that the present investigation will shed some light on the overall problem of industrial development in ports especially with respect to the effects of commodity flows through a port of industrial development. (See also PB 134 356)

Quartermaster Research and Engineering Center, Natick, Mass.
ENVIRONMENTAL HANDBOOK FOR THE CAMP HALE AND PIKES PEAK AREAS, COLORADO, by Will F. Thompson and Arthur V. Dodd. Jan 58, 93p. 42 refs. Technical rept. EP-79.
Order from LC mi$5.40, ph$15.30 PB 138 598

This report is one of a series of handbooks, prepared by the Environmental Protection Research Division, on the physical environment of sites where tests are conducted by the Quartermaster Corps and other technical services of the Army. A section on comparisons of the Camp Hale and Pikes Peak areas with other mountain areas of the world has been included to indicate worldwide applicability of the findings.

Wisconsin U., Madison.
PROCEDURES IN THE DESCRIPTIVE ANALYSIS OF TERRAIN, by Edwin H. Hammond. Final rept. on Contract Nonr-1202(01). July 58, 160p. 19 refs.
Order from LC mi$7.50, ph$24.30 PB 143 100

The project originally grew out of the principal investigator's efforts to find, primarily for teaching purposes, an approach to land form study that would be of maximum use to geographers and to other students who are interested in the use of the land. One obvious need appeared to be a method for systematically characterizing the land form in terms of its inherent nature. It was with the hope of partially filling this gap that the present investigation was conceived and proposed.

Geology

Blue Hill Meteorological Observatory, Milton, Mass.
GROUND TEMPERATURE VOLUME II, by Jen-hu-Chang. Rept. on Contract DA 19-129-qm-348. 21 June 58, 215p.
Order from LC mi$9.60, ph$33.30 PB 143 693

This volume contains a collection of ground temperature means at stations located throughout the world. Volume I contains the text of the ground temperature study. The data are arranged alphabetically within continents according to country and station. An alphabetical list of the stations is also included. The assembled data are not homogeneous since the times of observation, the ground conditions and the methods of observation all differ greatly from station to station. However, the methods of observation have been described whenever such information is available. The coordinates of most stations are given. For most stations only the long period monthly means are presented but for a few selected stations the monthly values for individual years have been listed. Only in a very, very few cases have means been computed from data that were not entirely complete.

Coastal Studies Inst., Louisiana State U., Baton Rouge.
PRELIMINARY NOTES ON CARIBBEAN BEACH ROCK, by Richard J. Russell. Technical rept. no. 11 on Contract N7onr-356(08). 1 Nov 58, 17p. Contribution no. 58-4.
Order from LC mi$2.40, ph$3.30 PB 143 423

Johns Hopkins U., Baltimore, Md.
BIBLIOGRAPHY RELATING TO VIBRATORY CUTTING, PENETRATION AND COMPACTION OF SOILS, by Stephen C. Cowin, Robert L. Kondner, and Robert S. Ayre. Technical rept. no. 2 on Contract DA 22-079-eng-210. 3 Jan 58, 41p. 212 refs.
Order from OTS $1.25 PB 161 123

An extensive search of the literature in soil mechanics, soil physics, engineering, geology and agriculture relating to the vibratory cutting, compaction and penetration of soils and on related topics such as vibrated concrete, vehicle mobility and application of ultrasonic vibration. Included in this report are 212 references, most of them with summaries.

Johns Hopkins U., Baltimore, Md.
BIBLIOGRAPHY RELATING TO VIBRATORY CUTTING, PENETRATION AND COMPACTION OF SOILS: SUPPLEMENT NO. 1, by Stephen C. Cowin, Robert L. Kondner, and Robert S. Ayre. Technical rept. no. 3 on Contract DA 22-079-eng-210. 12 Feb 59, 39p. 378 refs.
Order from OTS $1.00 PB 161 124

An extensive search of the literature in soil mechanics, soil physics, engineering, geology and agriculture relating to vibratory cutting, compaction and penetration of soils and on related topics such as vibrated concrete, vehicle mobility and application of ultrasonic vibration. Selected on the basis of primary, related, and historical interests. (See also PB 161 123)

Massachusetts Inst. of Tech., Cambridge.
METHODS AND EQUIPMENTS FOR MEASURING SOIL TEMPERATURE AND HEAT FLOW THROUGH THE SOIL: A LITERATURE SURVEY, by Richard J. Nickerson, Harry Y. Choi, and Stanley Marcus. Rept. on Contract DA 36-039-sc-78174. 15 Jan 59, 19p. 56 refs.
Order from LC mi$2.40, ph$3.30 PB 143 751

Yale U., New Haven, Conn.
POSTGLACIAL CHANGES OF SEALEVEL IN SOUTHWESTERN MAINE, by Richard Foster Flint and Arthur L. Bloom. Annual summary rept. on Contract Nonr-609(25). 1 Dec 58, 2p.
Order from LC mi$1.80, ph$1.80 PB 143 863

Physics of the Atmosphere

Geophysical Inst., U. of Alaska, College.
EXPERIMENT LUXEMBOURG, by G. C. Rumi and C. G. Little. Scientific rept. no. 1 on Contract AF 19(604)3880. Dec 58, 55p. 29 refs. AFCRC-TN-59-400; AD-216 316.
Order from LC mi$3.60, ph$9.30 PB 143 687

This report discusses the theoretical aspects of a radio wave interaction experiment designed to determine ν (the electron collision frequency), and N (the electron density), as a function of height in the artic D region. The proposed high latitude location of the observations plays an important role in the design of the experiment, which should be capable of providing continuous information on the state of the lower ionosphere in the auroral zone.

Geophysical Inst., U. of Alaska, College.
EXPERIMENT LUXEMBOURG, by G. C. Rumi. Scientific rept. no. 2 on Contract AF 19(604)3880. May 59, 35p. 11 refs. AFCRC-TN-59-471.
Order from LC mi$3.00, ph$6.30 PB 143 686

The present study is concerned with the absorption of radio waves in the D region of the ionosphere. A second section of the paper is devoted to an investigation of the electron collision frequency in the D region. It is deduced that the electron collision frequency in the D region increases during disturbed periods at auroral latitudes.

Naval Research Lab., Washington, D. C.
ATMOSPHERIC TRANSMISSION IN THE VISIBLE REGION, by J. A. Curcio and K. A. Durbin. Final rept. 6 Oct 58, 29p. 12 refs. Rept. 5368.
Order from LC mi$2.70, ph$4.80 PB 140 932

Atmospheric transmission measurements have been made over a period of one year at Washington, D. C., White Sands, New Mexico, and the east coast of Florida. Attenuation coefficients have been determined at three wavelengths (4700A, 5350A, and 6650A) by the Koschmieder contrast relationship, from about 300 sets of visual observations. Measurements were made through a variety of weather conditions including rain, drizzle, snow, and various degrees of haziness. The meteorological range varied from 1.5 to 120 km at a temperature range of 17° to 96°F and the relative humidity varied from 16 to 99 percent. Analysis of the data for the three wavelengths shows that within limits of ±15 percent the following relationship exists for all experimental conditions other than drizzle or rain: attenuation coefficient $\sim$(wavelength)$^{-1.3}$. The White Sands and Florida data are relatively small in number but appear to be similar to the Washington results. The foregoing relationship is in agreement with the particle size distribution function, $dN/d \log r = cr^{-3}$, observed experimentally by Junge. The particle size distribution appears to be independent of relative humidity and attenuation coefficient.

Naval Research Lab., Washington, D. C.
UPPER ATMOSPHERE REPORT NO. 35. GROUND STATIONS FOR NRL ROCKET STUDIES OF THE IONOSPHERE, by J. E. Jackson and G. H. Spaid. 31 Aug 59, 38p. 11 refs. NRL rept. 5342.
Order from OTS $1.00 PB 151 763

Between 1946 and 1958, a total of 23 rocket flights have been instrumented by NRL to measure electron densities in the ionosphere and to investigate various related phenomena. The measurements were based upon the transmission of cw signals from a rocket to receiving and recording stations on the ground. The nature of the experiments required phase comparisons between two harmonically related frequencies.

Since commercial receivers are unsuitable for this purpose, special receiving equipment was designed by NRL scientists to meet the experimental requirements. Particular considerations were given to bandwidth, noise, dynamic range, phase stability, signal-strength metering, and input circuitry. The extremely narrow-bandwidth operation which is possible with the cw method led to the design and use of a new type of crystal filter in the receiving system. The need for separate reception of the ordinary and extraordinary modes of propagation led to a novel adaptation of the magic T at 7.75 Mc. A two-station system, first used at White Sands, New Mexico, was later, during IGY, transferred to Ft. Churchill, Canada. A number of unusually stable, narrow-band rf sweep generators were developed to test, adjust, and calibrate the ground-station equipment. A greatly improved knowledge of the ionosphere at middle and arctic latitudes has resulted from the data acquired at these ground stations.

Naval Research Lab., Washington, D. C.
UPPER ATMOSPHERE RESEARCH REPORT NO. 36. BREAKDOWN AND DETUNING OF TRANSMITTING ANTENNAS IN THE IONOSPHERE, by J. E. Jackson and J. A. Kane. 24 Aug 59, 27p. 20 refs. NRL rept. 5345.
Order from LC mi$2.70, ph$4.80 PB 140 726

Impedance measurements made on a 7.75-Mc rocket-borne antenna during several rocket flights indicate at altitudes above 110 km a capacitance change whose magnitude can be used to determine ambient electron densities. In the 50 to 110 km region the antenna undergoes an rf glow discharge resulting in a severe resistive loading and reduction of radiated power. The properties of this breakdown were investigated both theoretically and by laboratory experiments. The use of a dc bias on the antenna was found helpful in preventing breakdown. The knowledge acquired from this project is being applied to the development of improved rf probe techniques for the direct measurements of electron densities in the ionosphere. (See also PB 151 763)

New Hampshire U., Durham.
A COMPARISON OF THE COSMIC-RAY INTENSITY AT HIGH ALTITUDES WITH THE NUCLEONIC COMPONENTS AT GROUND ELEVATION, by J. C. Henkel, J. A. Lockwood, and J. H. Trainor. Scientific rept. on Contract AF 19(604)1550. [1959] 43p. 25 refs. AFCRC-TN-59-434.
Order from LC mi$3.30, ph$7.80 PB 142 869

New York U. Coll. of Engineering, N. Y.
A CASE STUDY OF THE TROPOPAUSE, by Edward G. Albert. Scientific rept. no. 6 on Contract AF 19(604)1755. July 59, 59p. 18 refs. AFCRC-TN-59-435.
Order from LC mi$3.60, ph$9.30 PB 143 668

From detailed analyses of a warm homogeneous anticyclone it is shown that the generally accepted model of tropopause configuration away from the disturbing influences of fronts and jet streams is untenable. The tropopause is not found to be a smooth and continuous surface of lapse rate discontinuity. A deep tropopause layer containing many such surfaces, some of small horizontal extent, is indicated. Additional analyses, in sub-polar and sub-tropical regions, indicate that this complex type of tropopause layer may extend even into areas where individual soundings show a single, unmistakable tropopause.

Ohio State U. Research Foundation, Columbus.
A DETERMINATION OF THE ABUNDANCE OF NITROUS OXIDE, CARBON MONOXIDE, AND METHANE IN GROUND LEVEL AIR AT SEVERAL LOCATIONS NEAR COLUMBUS, OHIO, by John H. Shaw. Scientific rept. no. 1 on Contract AF 19(604)2259. June 59, 44p. 16 refs. AFCRC-TN-59-428; AD-225 685.
Order from LC mi$3.30, ph$7.80 PB 143 359

Studies of the infrared spectra of long path lengths of air (704 m) permitted determination of the abundances of N_2O, CH_4 and CO in ground level air. The N_2O abundance was estimated as 0.28 ± 0.04 ppm with no seasonal variation detected. Air samples from greenhouses and barns showed an N_2O abundance of 0.33 ± 0.04 ppm. The estimated abundances of CH_4 and CO in ground level air were 2.4 ppm and 1.1 ppm, respectively.

Seismology

Purdue U. Div. of Engineering Sciences, Lafayette, Ind.
RESPONSE TO TALL BUILDINGS TO RANDOM EARTHQUAKES, by A. Cemal Eringen. Technical rept. no. 12 on Contract Nonr-1100(02). Dec 57, 27p. 4 refs. AD-150 640.
Order from LC mi$2.70, ph$4.80 PB 138 182

A method of analysis is given for the calculation of mean square displacements and various correlation functions for a tall building having an arbitrary number of stories. The building is approximated by a series of masses and dashpots, and it is assumed that the mean square displacements of the earth movements are known. Mean square shearing forces and the energy present at each story are evaluated. It is indicated that Rice's formula may be used to calculate the number of times per unit time the random variable (e.g., displacements) will exceed a known, safe value. Computations concerning a ten-story building subject to purely random earthquake process were carried out on an electronic computer and are plotted.

Willow Run Labs., U. of Michigan, Ann Arbor.
WAVES IN LAKE ICE FROM IMPACTS, by D. H. Clements, D. E. Willis, and J. T. Wilson. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Aug 58, 22p. 7 refs. Rept. no. 2144-265-T.
Order from LC mi$2.70, ph$4.80 PB 143 447

A method similar to the standard seismic-refraction techniques was employed for the wave studies. The impacts of falling weights on ice produced a longitudinal plate wave and a dispersive train of flexural waves.

The observed flexural wave dispersion was consistent with theoretical dispersion curves computed from the theory of long flexural waves in an ice sheet in water of a finite depth developed by Ewing and Crary (1934) and Wilson (1955). Three groups of points on the observed dispersion curves obtained from Lake Margrethe data represent flexural waves with frequencies from 2 to 8 cps, 13 to 25 cps and 40 to 140 cps. The first and third groups exhibit dispersion appropriate for the combined thickness of the two-layer floating ice sheet. The second group demonstrates dispersion for a wave path in the upper layer only. Hammer drops on land generate in the layer of frozen ground flexural waves in the frequency range 15 to 40 cps. These waves are transmitted across the lake-shore boundary and follow a wave path in the upper layer of lake ice. The observed flexural wave dispersion curve constructed from propagation data obtained at Garrison Dam, N. D., indicates a single-layer ice sheet. The ice thickness predicted by flexural wave theory is in good agreement with the measured thickness of ice at this site.

ENGINEERING

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
FITTING TRIALS OF E52R23 and E52R24 CIVILIAN PROTECTIVE MASKS, by Robert E. Martin. Interim rept. 10 Sep 53, declassified. 20p. CRLR 249.
Order from LC mi$2.40, ph$3.30 PB 144 208

The civilian protective mask E52R23, which resulted from modifying the E52R18 by adding a temple band, using a thicker headharness, and increasing the number of sizes from four (4) to five (5), was fitted on approximately 400 subjects, including children and adults. Only three (3) subjects were unable to be satisfactorily fitted, these being Negro adults with sloping foreheads who could not be properly fitted even with field protective mask M9A1. Near the end of these tests, the masks E52R23 showed deterioration due to the continuous handling and disinfecting. Of the 115 adult subjects on whom the one size (medium) of the Kimberly-Clark civilian protective mask E52R24 was fitted, an excellent face seal was obtained on all but three (3) subjects. The improper fit on these three (3) subjects was due primarily to the fact that they had small faces and the initial model of this mask was made in only one (1) size.

Aeronautical Engineering

Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TEST OF FIRE EXTINGUISHING AGENTS FOR MAGNESIUM FIRES, by Ralph L. Hough. Mar 59, 21p. 4 refs. WADC Technical note 59-71; AD-212 631.
Order from LC mi$2.70, ph$4.80 PB 144 209

Magnesium and its alloys are frequently associated with aircraft or missile fires. Once ignited the material burns with great intensity and is supported by many materials used in ordinary fire extinguishing agents such as nitrogen, water, carbon dioxide and sulfur dioxide. Tests were conducted on five liquid agents: tricresyl phosphate (TCP), triethylene glycol and orthoboric acid (TEG-H_3BO_3), di-isodecyl phthalate and bromochloromethane in equal parts (DIDP-CB), di-2-ethylhexyl phthalate and bromochloromethane in equal parts (DOP-CB), and tri-methoxyboroxine (TMB). Of the agents tested, DOP-CB proved most effective in extinguishing the flame and inerting the metal so that it could be cooled with water. The mixture provides no handling or storage problems and is not adversely affected by extreme temperatures.

Aeronautical Instruments Lab., Naval Air [Development Center, Johnsville] Pa.
THE CALIBRATION OF CAPACITOR TYPE FUEL QUANTITY GAGES, by C. L. Bartberger. Rept. on Proj. TED NAM AE-7161. 13 Sep 51, 36p. 3 refs. Rept. no. NAES-INSTR-39-51.
Order from LC mi$3.00, ph$6.30 PB 143 433

To establish a standard basis for the calibration of capacitor type fuel quantity gages, with numerical values determined from an analysis of the Armour Research Foundation data on fuel characteristics.

Aeronautical Structures Lab., Naval Air Material Center, Philadelphia, Pa.
DEVELOPMENT OF AUTOMATICALLY ATTENUATED SHAKER EQUIPMENT; M. I. T. MULTIPLE SHAKER SYSTEM, ACCEPTANCE TESTS OF, by R. Friedman and G. Borod. 18 July 50, 69p. 4 refs. Rept. no. ASL NAM-24104.
Order from LC mi$3.90, ph$10.80 PB 143 354

Acceptance and preliminary evaluation tests were conducted on the M. I. T. Multiple Shaker Equipment to determine its suitability for use in exciting natural modes in aircraft structures. The equipment consists of a console, which contains all the necessary power supplies and controls for operating 24 shakers simultaneously, and 30 shakers, pickups and mounting stands. Each shaker has an associated vibration pick-up, the electrical output of which is used both as an aid in selecting the proper excitation and for recording purposes. Included in the console are 24 pick-up attenuator circuits and space for a multichannel oscillograph. The oscillograph itself was not furnished under the M. I. T. contract. The automatic feature of the system is the normalizer, which with the aid of an oscilloscope, enables the operator to apply to any or all 24 shakers a force proportional to the product of an assigned mass and actual vibration amplitude in accordance with the proportionality set up by a master shaker vibrating at or near a resonant frequency of the structure. Results obtained from a vibration survey on a Model SB2C-5 airplane and tests conducted on equipment components are presented.

Aerophysics Co., Washington, D. C.
AERODYNAMIC THEORY OF THE ANNULAR JET, PART I, by Gabriel D. Boehler and Robert J.

Spindler. Rept. on Contracts Nonr-2398(00) and 2747(00). Dec 58, 16/p. 37 refs. Rept. no. AR-581-R.
Order from LC mi$7.80, ph$25.80 PB 143 653

A theory is presented to describe the flow mechanics of air jets issuing from annular openings. Such jets are termed "annular jets". Two configurations are studied: (1) Annular nozzle far from the ground. The jet takes the form of a hollow tulip attached to the orifice of the nozzle and the thrust of the annular nozzle is smaller than that of the corresponding circular nozzle, since it is reduced by the negative pressure on the nozzle base plate resulting from the "jet pump" action of the "two dimensional" viscous laminar or turbulent, incompressible or compressible jet, using a "dividing streamline" concept. A solution of the three-dimensional problem is given in principle; this solution makes use of a Mangler transformation. Calculated base pressures are found to agree fairly well with those found experimentally. (2) Annular nozzle close to the ground. The annular jet, initially vertical, spreads out radially in the horizontal direction, thus creating a region of high pressure air under the nozzle base plate. The thrust of the annular nozzle is now larger than that of the corresponding circular nozzle since it is the sum of the direct jet thrust and of the pressure reaction between the ground and the nozzle base. The variation of the thrust augmentation with the distance from the ground can be explained in terms of simple momentum considerations and fairly good agreement with experimental results is found. The velocity distribution within the curved jet can only be found if viscous effects are introduced; a solution to the viscous problem is sketched in the two-dimensional case. Finally, existing experimental data are briefly reviewed and the parameters which make possible a correlation of these data are pointed out.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE REQUIREMENTS FOR MODIFICATION OF THE HUMAN CENTRIFUGE FOR HIGH PERFORMANCE AIRCRAFT AND SPACE VEHICLE SIMULATION RESEARCH, by Richard J. Crosbie. Rept. no. 3 on Proj. NM 11 02 12.6. 6 July 59, 34p. NADC-MA-5907.
Order from LC mi$3.00, ph$6.30 PB 143 723

Dynamic flight simulation is being conducted on the human centrifuge with gratifying success. The contributions are particularly important in the following areas: pilot tolerance, pilot restraint, cockpit instrumentation, control system design, controllability - with its implication of airframe and engine design, flight techniques including emergency procedures, and pilot training. Preliminary studies indicate that, by a number of modifications to the centrifuge, its capability can be increased.

Bell Helicopter Corp., Fort Worth, Tex.
COST ANALYSIS OF A LIGHT WEIGHT TWO-PLACE OBSERVATION HELICOPTER. Rept. on Contract DA 44-177-tc-420. 27 Oct 57, 33p. Rept. no. D233-099-003; AD-204 372L.
Order from LC mi$3.00, ph$6.30 PB 138 543

Chicago Midway Labs., U. of Chicago, Ill.
DETERMINATION OF FACTORS GOVERNING SELECTION AND APPLICATION OF MATERIALS FOR ABLATION COOLING OF HYPERVELOCITY VEHICLES, by John H. Bonin, Channon F. Price, and Donald E. Taylor. Rept. for 1 Dec 57-30 Nov 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5436. July 59, 142p. 6 refs. WADC Technical rept. 59-87, Pt. 1; AD-226 829.
Order from OTS $2.75 PB 161 090

The report includes the results of an investigation for which the prime objective was the determination of the behavior of materials exposed to thermal environments representative of re-entry conditions. The environment encountered by ballistic, glide, and skip vehicles is reviewed. Heat flow into single and composite slab materials for heat sink applications is discussed. The development and calibration of an air-stabilized arc facility of a nominal 1000-KW rating is described. In the experimental phase of the investigation, representative materials were exposed to the high-temperature plasma discharge produced in stabilized arcs. The results obtained are reported upon, along with a correlation of the observed behavior with theory.

Convair, Fort Worth, Tex.
ACTIVATION HANDBOOK FOR AIRCRAFT DESIGNERS, REVISED. Rept. on [Contract AF 33(600)32054]. 30 Sep 57, 407p. 19 refs. ANP Doc. no. NARF-57-50 T; FZK-9-124.
Order from LC mi$11.10, ph$62.10 PB 144 269

This revision is intended to furnish the aircraft design engineer with a readily accessible reference source for the underlying theory, the necessary nuclear data, and the analytical techniques required in the practical analysis of the neutron induced activation of aircraft materials functioning in a nuclear environment.

Courtney and Co., Philadelphia, Pa.
HUMAN FACTORS IN AIR TRAFFIC CONTROL SYSTEMS DESIGN, by Kenneth W. Colman, Douglas Courtney, and Wallace W. Wallace. Summary rept. on Contract Nonr-2346(00). 1 Dec 58, 53p. Rept. no. 24.
Order from LC mi$3.30, ph$7.80 PB 143 930

The organization of this report follows the natural phases into which the work was divided: Chapter Two Phase I describes the work performed in support of the Air Navigation Development Board and the CAA Technical Development Center, while Chapter Three Phase II describes the human factors effort carried out in support of the Airways Modernization Board.

David Taylor Model Basin, Washington, D. C.
COMPARISON OF EXPERIMENTAL AND THEORETICAL DESIGN PARAMETERS OF A 6-INCH-DIAMETER ANNULAR JET MODEL WITH A JET ANGLE OF -45° HOVERING IN PROXIMITY TO THE GROUND; AND EXPERIMENTAL RESULTS FOR FORWARD FLIGHT AT ZERO ANGLE OF ATTACK, by Anibal Alfredo Tinajero. May 59, 68p. 5 refs. Aero rept. 954.
Order from LC mi$3.90, ph$10.80 PB 143 574

The results of static and dynamic tests of a 6-inch-diameter "annular jet" model with a jet angle of -45° and at zero angle of attack are presented. Experimental values are compared with the theoretical results available for the static condition. The effects of ground proximity upon the aerodynamic characteristics were investigated. Lift, drag, and pitching-moment coefficients were determined. The "annular jet nozzle" was found to be highly effective as a lift producer. It was found that the lifting property that exists in the static configuration at low pressure ratios decays with increasing forward speed. At the higher pressure ratios the loss is still great at very low forward speeds, but there is some recovery as the speed is increased.

Diamond Ordnance Fuze Labs., Washington, D. C.
RADIO COLLISION AVOIDANCE SYSTEMS FOR AIRCRAFT, by R. T. Fitzgerald, H. C. Brown and M. D. Reed. 15 Sep 59, 52p. 10 refs. TR-744.
Order from OTS $1.50 PB 161 119

Several cooperative radio systems for avoiding aircraft collisions are considered from the standpoints of technical requirements, feasibility, and cost. The system with the broadest potential application is selected. In basic form, the selected system utilizes the upper UHF region to communicate altitude and heading information, and vertical maneuvers are defined by the altitude information. In expanded form this system determines relative bearing and heading, to predict collision hazard in both the vertical and horizontal planes. Potentially, a reduction in unintentional collisions of 100:1 can be achieved with the selected approach. The applicability of this system to collision avoidance problems of military, commercial, and private aircraft, and to related problems of navigation and air traffic control is outlined.

Gyrodyne Co. of America, Inc., St. James, N. Y.
PRELIMINARY DESIGN STUDY OF OPTIMUM ARMY TWO-PLACE OBSERVATION HELICOPTER, by Edward W. Strong. Final rept. on Contract DA 44-177-tc-419. Aug 57, 213p. 25 refs. Rept. no. RD46-310000-1; AD-207 276.
Order from LC mi$9.60, ph$33.30 PB 138 544

A study has been conducted to arrive at the design of the optimum Army two-place observation helicopter for use in the 1960-70 decade. Of the configurations considered, the coaxial type and the single rotor-tail rotor type have been found to be the most suitable. A detailed comparative evaluation of these two configurations indicates that the coaxial type offers a much greater degree of fulfillment of the characteristics desired by the Army than does the single rotor-tail rotor type. The design selected as optimum - namely a coaxial rotor type incorporating two two-bladed semi-rigid coaxial rotors, powered by a 250 horsepower turbine engine (final version) and/or a Lycoming VO-360 reciprocating engine (interim version) - is described. The design of the proposed two-place helicopter is based very closely upon that of the Model XRON-1 Rotorcycle (one-man helicopter).

Hiller Aircraft Corp., Palo Alto, Calif.
STATIC LIFT CHARACTERISTICS OF JET SLOTS: A CLARIFYING STUDY OF THE EXTERNAL EJECTOR, by M. F. Gates. Final rept. on Contract Nonr-2428(00). 15 Oct 58, 95p. 29 refs. Rept. no. ARD 213.
Order from LC mi$5.40; ph$15.30 PB 143 229

The external ejector utilizing a surface profile developed by Cornell Aeronautical Laboratory was evaluated in both two-dimensional and three-dimensional configurations for the purpose of defining the thrust augmentation potentialities of this phenomenon in an attempt to end a controversy that has existed for a number of years. The results of the program, the recent work of NACA and the almost unanimous conclusions of other reviewed work indicate that static thrust augmentation is not possible with the external ejector. It was found however, that ideal turning efficiencies as high as 88% are possible with this extremely simple hardware. In both two-dimensional and three-dimensional configurations, the turning efficiency increased with increasing nozzle slot height (σ) which was terminated by breakaway in the two-dimensional tests and by insufficient air supply in the three-dimensional tests. Performance data and surface pressure surveys are presented for both configurations. Flow visualization by means of smoke streams is discussed.

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by Glen N. Rardin. Interim engineering rept. no. 1 for 18 Oct 57-28 Feb 58 on Contract AF 33(600)35543. 28 Feb 58, 192p. 79 refs. LR-12970; AD-156 722.
Order from OTS $3.00 PB 161 271

This report covers the first phase of an investigation into the application of high rates of energy to the forming of materials difficult or impossible to form by conventional means. A thorough literature survey has been made of the theoretical differences between statically and dynamically applied loads. Twenty-seven organizations were contacted to determine the level of knowledge extant. Their methods of applying high velocity energy and high hydrostatic pressures have been examined and reported.

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by Glen N. Rardin and A. F. Watts. Interim engineering rept. no. 2, 1 July-30 Sep 58, on Contract AF 33(600)35543. [1958] 54p. 37 refs. LR-13350.
Order from OTS $1.50 PB 161 272

This report describes the facilities that have been constructed, the design and manufacture of the tooling, preparation of the materials, and the instrumentation required to conduct forming tests. (See also PB 161 271)

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by Glen N. Rardin and A. F. Watts. Interim engineering rept. no. 3, 1 Oct-31 Dec 58, on Contract AF 33(600)35543. [1958] 43p. LR-13435.
Order from OTS $1.25 PB 161 273

The program deals with open die forming in air and water, employing a steel die to produce a 2.5 inch diameter hemisphere with a draw radius of .25 inches. The material used throughout this phase was Vascojet-1000 in the annealed condition, 5.75 inches in diameter, 0.025 inches thick. (See also PB 161 272)

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by A. F. Watts and Glen N. Rardin. Interim technical engineering rept. no. 5 for 1 Apr-30 June 59 on Contract AF 33(600)35543. [1959] 268p. 54 refs. LR-13873; AD-225 601.
Order from OTS $4.00 PB 161 274

The result of forming tests on two steel and two titanium alloys using high explosives is presented. Measurements of strain rates, velocities and temperatures together with the metallurgical effects of materials subjected to high strain rates are given. Although forming sheet materials with high explosives offers decided advantages in certain areas, within the limits of the test procedure there was no evidence of increased elongations as a result of increased strain rates or pressures. (See also PB 151 849)

Martin Co., Baltimore, Md.
ANALYSIS OF WIND TUNNEL TEST RESULTS OBTAINED FOR A PROPELLER-POWERED MODEL WITH FLAP BLOWING, by Milton A. Schwartzberg and Theodore E. Challberg. Rept. on Contract NO a(s) 56-311C. 30 Aug 57, declassified 2 July 58, 176p. 25 refs. Engineering rept. no. 9429.
Order from LC mi$8.10, ph$27.30 PB 143 603

A wind tunnel test has been conducted of a propeller-powered model seaplane with high-speed air blown over the trailing-edge flaps. The configuration had a high-mounted, aspect ratio 10 straight wing, a high fineness ratio hull and a T-tail. The wing mounted a full-span, 25-percent chord plain flap with blowing momentum coefficients up to 1.2. Power was simulated for four inboard propeller engines at thrust coefficients up to 0.7 per engine. The test results are presented in David Taylor Model Basin wind tunnel report No, 919 (Ref. 7). These results have been analyzed in the present report. The analysis of the test results is concerned with the effects on lift, drag and pitching moment of propeller power, flap blowing and combined power and blowing. The effect of these parameters on the dynamic pressure ratio and downwash at the tail as well as the stabilizer incidence required to trim the configuration were also determined. Some effects of the presence of a ground are noted. In the course of the analysis, it has been possible to devise methods for predicting some of the effects of propeller power and flap blowing on a general airplane configuration. These methods are presented for consideration and future application.

Massachusetts Inst. of Tech., Cambridge.
AN EXPERIMENTAL STUDY OF THE FLOW FIELD ABOUT SWEPT AND DELTA WINGS WITH SHARP LEADING EDGES, by Ivan Jaszlics and Leon Trilling. Rept. on Contract AF 18(600)1306. Oct 57, 54p. 16 refs. Fluid Dynamics Research Group rept. no. 57-4; AFOSR Technical [rept.] no. 58-6; AD-157 948.
Order from LC mi$3.60, ph$9.30 PB 144 067

A series of experiments was performed to define the flow field on the upper surface of high aspect ratio swept wings and narrow delta wings at high angles of attack. It was found that near the root section of either type of wing, the flow is conical. The edge of the vortex sheet which originates at the leading edge is a straight line whose position relative to the leading edge depends only on incidence. On swept wings, the vortex edge turns downstream as soon as the vortex sheet covers the front half of the wing chord, and the flow under the vortex sheet outboard of that turning point is uniform and parallel to the leading edge of the wing. On narrow delta wings, the conical symmetry persists almost to the trailing edge.

National Research Labs., Ottawa (Canada).
PRESSURE DISTRIBUTION AND FORCE MEASUREMENTS ON A VTOL TILTING WING-PROPELLER MODEL. PART I. DESCRIPTION AND TABULATED RESULTS, by J. A. Dunsby, M. M. Currie and R. L. Wardlaw. June 59, 52p. 7 refs. Aeronautical rept. LR-252.
Order from LC mi$3.60, ph$9.30 PB 143 579

This report presents tabulated results of pressure and force measurements on a half wing model of a twin-engined tilt-wing VTOL configuration over a range of thrust coefficient for a limited range of incidence.

Ohio State U. Research Foundation, Columbus.
A SURVEY OF FLIGHT-LINE HAND SIGNALS, by Henry M. Moser, John J. O'Neill and others. Technical note no. 51 on Contract AF 19(604)1577. Sep 58, 26p. 20 refs. AFCRC TN-58-57; AD-160 705.
Order from LC mi$2.70, ph$4.80 PB 138 776

This report is essentially a collection and preliminary survey of hand signals used by flight line personnel. Two Air Force publications were used as pictorial and descriptive sources and visits were made to an Air Force Base, a Naval station, and an aircraft factory. Photographs were taken of hand signals previously represented in publications by drawings. Modifications of these signs, new signs, and variations on the signs by a deaf man are also shown in photographs. Recommendations are made for further surveys and a pocket manual of photographed signs.

Quick, A. W.
OSCILLATIONS IN AXIAL-FLOW COMPRESSORS, by H. Söhngen and A. W. Quick. Scientific rept. no. 2 on Contract DA 91-508-EUC-298. 25 Apr 59, 38p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 143 455

It will be shown that in the case of blade oscillations in axial-flow machines the compressibility of the fluid, however small the flow speeds may be, is of vital importance.

Rensselaer Polytechnic Inst., Troy, N. Y.
ON THE THRUST HYPOTHESIS FOR THE JET FLAP INCLUDING MIXING EFFECTS, by K. T. Yen. Rept. on Contract AF 49(638)23. June 59, 37p. 11 refs. TR AE-5902, AFOSR-TN-59-737.
Order from LC mi$3.00, ph$6.30 PB 143 159

This paper is concerned with the thrust generated by a jet flap. It is shown that a "linear" thrust hypothesis can be obtained, provided linearized potential flow is assumed. In fact, the linearized problem of a jet flap system is found to be the linear combination of a lift problem and a thrust problem. The lift problem gives all the lift generated, but it is of interest to note that the thrust problem would yield all the thrust developed by the jet flap within the limitation of the linearized theory. The mixing of the jet flap with the surrounding fluid is analyzed by the momentum integral method. The analysis substantiates Stratford's suggestion for obtaining an increase of thrust by causing the jet to mix with the main stream in a region of high suction. Finally, some approximate formulas, relating the thrust and the jet angle, are derived. The drag of the airfoil section and other viscous effects are, however, not considered.

Soundrive Engine Co., Los Angeles, Calif.
STUDY OF INTERNAL ACOUSTIC ABSORBERS AS A TECHNIQUE FOR TURBOJET ENGINE NOISE REDUCTION: DATA, by D. A. Bies, J. H. Caffrey, and O. B. Wilson, Jr. Final rept. on Contract NOas-55-541-c. Aug 57, 167p. Rept. no. 94.
Order from LC mi$7.80, ph$25.80 PB 138 868

Southern Calif. Labs., Stanford Research Inst., South Pasadena.
PRESENT STATUS OF THE FUTURE OUTLOOK FOR ALL-METAL SANDWICH CONSTRUCTION FOR AIR VEHICLES, by William A. Tweedie, Peter D. Tilton and Redford C. Rollins. Rept. on Contract NOas-59-4264-f. Aug 59, 148p. 69 refs. SRI Proj. no. IU-2932.
Order from OTS $2.75 PB 161 099

The information presented in this report has been drawn from a wide variety of sources and has been supplemented by extensive field investigations by the Institute's project team. Although every attempt has been made to obtain and present the most reliable data, it is possible that the rapid pace of technological development may have introduced certain changes since the conduct of the study and the preparation of the report. In making this study, the Institute's project team held discussions with manufacturers of both core and panels and with the major contractors in the aircraft industry under BuAer cognizance. In certain instances, other aircraft manufacturers were contacted when it was known that development work was under way on core panel construction or that specific design dictated the use of low-density core panel components. Section II of this report summarizes the findings of the research. Since a study of honeycomb requires some familiarity with airframe design requirements and applications, Section III provides a resumé of information on this subject. Section IV and V are concerned with the manufacture of welded honeycomb core and low-density core panels, respectively. Section VI provides a discussion of quality control, and Section VII is concerned with testing and inspection. Section VIII presents a projection of the estimated requirements for honeycomb core and core panels and an estimate of the industry's capability to produce these requirements.

Vertol Aircraft Corp., Morton, Pa.
FEASIBILITY STUDY OF HELICOPTER RANGE EXTENSION USING FLOATING WING FUEL TANKS, by C. B. Fay. Rept. on Proj. no. 9-38-01-000 ST801 Contract DA 44-177-tc-478. 28 Sep 58, 88p. 9 refs. Rept. R-156; AD-203 262.
Order from LC mi$4.80, ph$13.80 PB 142 950

This report presents the results of an engineering analysis of floating wing fuel tanks as a means of helicopter range extension. Both single and tandem rotor helicopters of current operational types are considered. The floating wing concept is one in which the wing supports the required fuel for the ferry mission while the helicopter provides the propulsive force to overcome the wing drag. The wing is attached to the helicopter through a skewed horizontal hinge. Calculations of wing parameters and characteristics were based on 1200 and 2400 nautical mile range missions for both the VERTOL H-21 and Sikorsky H-34 helicopters. The results of the study show that the concept is feasible and that the structural modification of the basic helicopter using the floating fuel-wing kit is minor.

Civil Engineering

Brown U. Div. of Engineering, Providence, R. I.
ENGINEERING RESEARCH IN SOIL MECHANICS WITH EMPHASIS ON STRESS-STRAIN RELATIONS AND SOLUTIONS BASED ON SIMPLE THEORY, by Daniel C. Drucker. Final technical rept. on Contract DA-19-020-ORD-3703. 31 Mar 58, 2p. 1 ref. AD-157 858.
Order from LC mi$1.80, ph$1.80 PB 138 587

Bureau of Yards and Docks, Washington, D. C.
DREDGING. 1 July 53, 50p. Technical Pub. NAVDOCKS TP-Pw-19.
Order from OTS $1.25 PB 161 254

This publication serves as an introduction to the subject of dredging and is provided for personnel concerned with dredging operations. These operations include: (a) providing and maintaining channels, anchorages, turning basins, and slips used primarily by Navy vessels, where suitability for use by commercial craft is only incidental; and (b) providing material for aggregate or for filling low areas. Part A presents the Bureau's policies and responsibilities for dredging operations and facilities, and defines terms relating to the subject of dredging. Part B describes the various kinds of dredges, submerged-rock-removal equipment, dump scows, pontoons, and

pipe lines. Part C outlines dredging operations and deals with the objects of dredging, preliminary engineering involved, the handling of dredging equipment, and subsurface rock removal.

Massachusetts Inst. of Tech., Cambridge.
FEASIBILITY STUDY CONCERNING THE UTILIZATION OF PLASTICS FOR UNDERGROUND PERSONNEL SHELTERS, by Denis A. Blackett and Saul Namyet. Rept. on Contract NBy-3150. Sep 59, 144p. 33 refs.
Order from LC mi$7.20, ph$22.80 PB 143 895

An investigation is made into the feasibility and practicability of using plastic materials for the structural components of underground personnel shelters. It is found that fiberglass reinforced plastic is the only suitable, presently available plastic material. The general nature of underground structural behavior is investigated and it is found that curvilinear surfaces having at least one radius of positive curvature are the best shelter shapes. Doubly-curved or warped surfaces are recommended for underground shelter purposes. Certain aspects of underground load-response phenomena are investigated. Design procedures are developed for various structural types and cost data obtained. Brief recommendations concerning future research and development are presented.

Electrical and Electronic Engineering

Air Force Cambridge Research Center, Bedford, Mass.
OFF-AXIS SIDELOBE REDUCTION IN ELLIPTIC TORUS REFLECTORS, by William G. Mavroides and Joseph H. Provencher. Dec 58, 15p. 5 refs. AFCRC-TR-58-199; AD-160 758.
Order from LC mi$2.40, ph$3.30 PB 142 802

A three-horn primary feed used with an elliptic torus effectively reduces undesirable sidelobes. Patterns and contour plots show a reduction of 8 to 14 db in sidelobe level while the beamwidth remains essentially unchanged.

Air Force Cambridge Research Center, Bedford, Mass.
TECHNIQUES FOR AIR CONTROL SYSTEM APPLICATIONS, by Thomas C. North, George Harpell and others. July 59, 38p. AFCRC-TR-59-165.
Order from LC mi$3.00, ph$6.30 PB 143 966

During the development of the Tactical Air Control System at AFCRC several techniques that were found feasible were not put into the production model, but it was felt that they were of sufficient value to warrant being made a matter of record. Four of these efforts are described in this report. The passive coincidence circuit was designed to aid the prediction of collisions when used with an iterative display computer, such as SAINT. The optical analog-to-digital converter (optical digitometer) was originated to read the outputs of a time-sharing analog intercept computer. The two-speed joystick was an attempt to simplify the manual assignment operation in the tracking console, CARTRAC. The electronic switch was built to switch dc analog tracking voltages to permit tracks to be labeled.

American Machine and Foundry Co., Boston, Mass.
RECEIVER INDICATOR FOR A LONG RANGE DISTANCE MEASURING SYSTEM. Final engineering rept. on Contract AF 30(602)668. 20 June 57, 93p. AMFED Ref. no. 262-9; RADC-TR-57-134; AD-131 214.
Order from LC mi$5.40, ph$15.30 PB 144 020

A receiving and range-measuring equipment which will furnish distance information in rho-rho form with respect to fixed ground stations was constructed to test the practicability of a system which operates on the principle of the phase shift of a received signal as a function of the distance between the receiver and the transmitter. The development of this equipment indicated the feasibility of an equipment designed to measure the phase of a received signal and compare it with the phase of a locally generated signal. The operation of the system in the laboratory proved satisfactory. The evaluation of field data was suggested to determine the value of the rho technique for use in a long-range navigation system.

Armed Services Electro-Standards Agency [Fort Monmouth, N. J.]
ARMED SERVICES INDEX OF R. F. TRANSMISSION LINES AND FITTINGS. 1 Apr 59, 292p. ASESA 49-2B; NAVSHIPS 900-102B.
Order from LC mi$11.10, ph$45.60 PB 143 816

[Army Signal] Radio Propagation Agency, Fort Monmouth, N. J.
ANALYSIS AND PREDICTION OF SKY-WAVE FIELD INTENSITIES IN THE HIGH FREQUENCY BAND, by Paul O. Laitinen and George W. Hayden. Aug 50, reprinted Mar 56. 132p. 16 refs. Technical rept. no. 9.
Order from LC mi$6.90, ph$21.30 PB 143 141

The purpose of this report is to present an engineering method of evaluating sky-wave field intensities in the high frequency band for any transmission distance up to about 15,000 kilometers. Field intensity recordings were statistically analyzed in order to study daytime absorption, day-to-day variations, and absolute magnitudes. Based upon the analysis, a proposed prediction method was obtained which should give relatively accurate sky-wave field intensities for the frequencies and distances considered. Succeeding sections show the method of analysis of absorption, the method of analysis of absolute magnitudes, the method of analysis of day-to-day variations, the proposed field intensity prediction method, and summarizing conclusions. All necessary equations used in the prediction method are represented in nomograms.

Army Signal Radio Propagation Agency, Fort Monmouth, N. J.
LONG-TERM PREDICTIONS OF GEOMAGNETIC DISTURBANCES AND THEIR EFFECTS ON RADIO COMMUNICATIONS, by Luther C. Kelley. Nov 58, 40p. 10 refs. Proj. no. 636A.
Order from LC mi$3.00, ph$6.30 PB 143 138

This report forewarns supervisory and operating personnel of increased radio circuit outage during the downward trend of the current sunspot cycle. Long-range predictions indicate that severe disruptions of radio service will result from geomagnetic or ionospheric storms during this period. Data of actual circuit performance illustrate the curtailment of radio communication with rising geomagnetic activity. Long-term forecasts are based on the correlation between geomagnetic activity and sunspot number observed for many years. Recommendations for the reduction of outage are made. A general discussion is included.

Army Signal Radio Propagation Agency, Fort Monmouth, N. J.
OTHER-THAN-CO-CHANNEL INTERFERENCE WITH RESPECT TO TROPOSPHERIC SCATTER COMMUNICATION. PART A: CONSTANT BARELY AUDIBLE SIGNALS, by Sol Perlman, William J. Russell, Jr. and William D. Stuart. May 58, 157p. 26 refs. Proj. no. 646.
Order from LC mi$7.50, ph$24.30 PB 143 140

Mutual interference between "Forward Propagation by Tropospheric Scatter" ("FPTS") circuits and other communication circuits is examined for other-than-co-channel intrusions. The first sections and the Appendix of the report define the various types of interference and briefly analyze their causes and remedies. In a later section certain interim assumptions are proposed concerning measures of the interference threshold signal strength at the inputs to the affected receivers. For the various antennas, frequencies, and azimuths examined, tabulated values are presented of the distances of separation between the receivers and the sources of interference required to satisfy these assumptions. Recommendations include possible means of reducing the interference and measurements that should be taken to enable the interference to be predicted more accurately. A supplement is included covering co-band interference at 2000 Mc and second harmonic interference from 1000 Mc "FPTS" equipment.

Army Signal Radio Propagation Agency, Fort Monmouth, N. J.
TENTATIVE EVALUATION OF TRANSMISSION FACTORS FOR SPACE VEHICLE COMMUNICATION, by Luther C. Kelley, Sol Perlman and others. Sep 58, 145p. 88 refs. Proj. no. 664.
Order from LC mi$7.20, ph$22.80 PB 143 142

With the increased use of space vehicles a study of the various propagational and equipment factors affecting space vehicle communication is needed. This report makes a preliminary evaluation based on theoretical considerations and the limited experimental evidence from the existing satellites, moon-radar experiments, and radio astronomy measurements. The optimum frequencies for the varied needs of space vehicle communication can best be determined from estimated system performance. A discussion is given of the noise limitations, equipment limitations, proper choice of earth station locations and the other factors that affect the signal-to-noise ratio at the receiver. Some of the newer technical developments that increase sensitivity to weak signals are evaluated for their potential increase in distance of communication. Some consideration is given to the effects of the ionosphere including absorption, angle errors, Faraday rotation of polarization, meteor trail interference, and auroral interference and to the effects of oxygen, water vapor, and other gases that cause absorption, angular deviation, and noise. Included is a selection of the better frequencies for line-of-sight and for over-the-horizon communication with space vehicles and the frequencies that would be less subject to mutual interference with earth stations for communication between vehicles. A discussion is given of the advantages of elevated locations for communication with space vehicles including "hovering" ones.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
DESIGN TECHNIQUES FOR STRIP LINE DIRECTIONAL COUPLERS AND RESONATORS, by Isaac Aheyta. 10 June 57, 36p. 9 refs. Technical memo. no. M-1893.
Order from LC mi$3.00, ph$6.30 PB 142 809

Because of their outstanding characteristics, two of the components treated under this program deserve special consideration from the standpoint of user and designer. The two items are coupled strip-line directional couplers and resonators. It is the purpose of this memorandum to point out some of the outstanding characteristics, suggest possible applications, and present the necessary design information. The design information is, of course, available in the various SRI progress reports, however, as presented in this memorandum the designer interested in final results will find it unnecessary to digest the SRI research work before he can design either of these components. This memorandum will also serve as a summary for those who do not have the time to follow the detailed analysis carried out by SRI but who are nonetheless interested in forming an idea of what can be achieved with these components.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
RECENT ADVANCES IN SOLID STATE RECEIVERS by Wesley G. Matthel. 15 Oct 58, 29p. 29 refs. USASRDL Technical rept. 1993.
Order from LC mi$2.70, ph$4.80 PB 143 352

With new variable reactance semiconductor diodes, ferrites, and maser materials and techniques, broadband and narrow-band receivers have been built up to X-band frequencies with effective noise temperatures less then 200°K. The relative importance of these various types of solid state receivers and their future possibilities are presented.

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth and D. L. Goldwater. Scientific rept. no. 5 on Contract AF 19(604)3904. 15 July 59, 47p. 5 refs. AFCRC-TN-59-577.
Order from LC mi$3.30, ph$7.80 PB 143 683

In a program of development of thorium impregnated tungsten matrix cathodes life studies have been extended to 6000 hours at 1 amp/cm^2, at approximately 1550°C_B, and 3500 hours at 2.4 amps/cm^2 at approximately 1620°C_B, both life figures subject to upward revision as tests continue. An experimental determination of preliminary character has been made of the surface density of thorium on tungsten corresponding to the emission maximum. Relevant to studies concerning the possibility of desorption of thorium by electron bombardment, work is in progress regarding thermal deactivation (evaporation) rates as a function of temperature and coverage. Experiments are described concerning "knife-edge" seal techniques for dry box closure of experimental tubes which must thereafter have extensive baking. (See also PB 142 293)

Battelle Memorial Inst., Columbus, Ohio.
EXPERIMENTAL ANALYSIS OF PERFORMANCE OF GALVANOMAGNETIC AMPLIFIERS, by R. K. Crooks, G. J. Falkenbach, and T. S. Shilliday. Final rept. on Contract AF 30(602)1839, 15 July 59, 79p. 24 refs. RADC TR-59-119, AD-220 116.
Order from LC mi$4.50, ph$12.30 PB 142 934

This investigation is concerned with the theoretical and experimental analysis of the performance of galvanomagnetic amplifiers, especially the magnetoresistance amplifier, with verification of the analysis by laboratory investigation. Particular emphasis is placed on consideration of amplifier gain, impedance level, noise, bandwidth, and power-handling capabilities. Expressions for amplifier gain are developed and are verified experimentally for the magnetoresistance amplifier. Gain is shown to be a function of the d-c power dissipated in the semiconductor element, the mobility of the majority carriers in the element material, the magnetic bias on the element, and the efficiency of the input circuit in establishing the necessary a-c magnetic-flux density in the element.

Bell Telephone Labs., Inc. [Whippany, N. J.]
AN ULTRA-PRECISE STANDARD OF FREQUENCY, by R. A. Sykes. Interim rept. no. 1 for 12 July-12 Oct 56 on Contract DA 36-039-sc-73078. 21 Nov 56, 39p. 4 refs. Rept. no. 27480.
Order from LC mi$3.00, ph$6.30 PB 143 348

A preliminary analysis has been made of the behavior of quartz crystal units over a wide range of frequencies at very low ambient temperatures, and some experimental results are given for the temperature coefficient and Q as a function of temperature. An analysis is made of the effects on frequency resulting from variations in circuit reactances and tube-gain characteristics for two kinds of oscillators, with a comparison of the theoretical stability limitations of both types.

Bliley Electric Co., Erie, Pa.
SERVICE, FACILITIES AND MATERIALS TO CONDUCT RESEARCH AND INVESTIGATION INTO THE ORIGIN OF ACTIVITY DIPS IN THE RESPONSE OF AT CUT LOW FREQUENCY RESONATORS, by J. M. Wolfskill and R. H. Tuznik. Progress rept. no. 6 for 15 Mar-15 June 56 on Contract DA 36-039-sc-63105. [1956] 69p.
Order from LC mi$3.90, ph$10.80 PB 143 347

Bliley Electric Co., Erie, Pa.
SERVICES, FACILITIES, AND MATERIALS TO DESIGN AND DEVELOP HIGH SHOCK AND VIBRATION RESISTANT CRYSTAL UNITS IN THE FREQUENCY RANGE 200kc TO 500kc, by J. M. Wolfskill and R. H. Tuznik. Quarterly progress rept. no. 1 for 1 Jan-30 Apr 57 on Contract DA 36-039-sc-73148. [1957] 78p, AD 154 [illegible]
Order from LC mi$4.50, ph$12.30 PB 143 351

Testing and evaluation of the performance of standard type CR-26/U crystal units under shock and vibration conditions. Techniques, methods, and materials used in the manufacture of these standard units. Failure of these standard units under the conditions of the vibration test makes necessary a new type support structure to remedy the defects. Design considerations involved in meeting these new requirements are included.

Bliley Electric Co., Erie, Pa.
SERVICES, FACILITIES AND MATERIALS TO DESIGN AND DEVELOP HIGH SHOCK AND VIBRATION RESISTANT CRYSTAL UNITS, by J. M. Wolfskill and R. H. Tuznik. Quarterly progress rept. no. 2 for 1 May-30 Sep 57 on Contract DA 36-039-sc-73148. [1957] 31p.
Order from LC mi$3.00, ph$6.30 PB 143 034

Selection of an optimum "cut" in these 455 kc/s units, and performance of both "CT" and "DT" blanks in the ceramic frame symmetrical "H" supporting structure. The support structure design in experimental models eliminates significant resonances during the vibration spectrum from 10 to 2,000 cps.

Bureau of Yards and Docks, Washington, D. C.
BASIC ELECTRICAL ENGINEERING. CHAPTER 1. WIRE COMMUNICATION AND SIGNAL SYSTEMS. 15 Sep 55, 116p. 21 refs. Technical Pub. NAVDOCKS TP-Te-5.
Order from OTS $2.50 PB 161 253

This Technical Publication, which consists of four chapters, provides guidance to Bureau and field personnel responsible for the design, installation, maintenance, and operation of wire communication and signal systems, interior lighting and power facilities, lighting and cathodic protection, and suppression of radio interference at naval shore activities. The general introduction presents the authority and general responsibilities of this Bureau for the above-named phases of public works and public utilities operations. Chapter 1 is concerned with wire communication and signal facilities, including detailed criteria on all aspects of telephone installations.

Bureau of Yards and Docks, Washington, D. C.
BASIC ELECTRICAL ENGINEERING. CHAPTER 2. LIGHTING AND POWER SYSTEMS. CHAPTER 3. LIGHTNING AND CATHODIC PROTECTION. CHAPTER 4. ELECTROMAGNETIC INTERFERENCE SUPPRESSION. Rev. 26 June 58, 106p. Technical Pub. NAVDOCKS TP-Te-5; BuDOCKSINST 11000.12A.
Order from OTS $2.50 PB 161 256

Chapter 2 presents engineering criteria on (a) lighting and power systems inside buildings and structures and (b) street-lighting systems. Chapter 3 deals with (a) lightning protection methods and systems and (b) cathodic protection for underground and aboveground installations. Chapter 4 deals with the methods and systems used for suppression of electromagnetic interference from electrical sources. (See also PB 161 253)

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER I. ELECTRIC POWER GENERATION. 15 Sep 54, 194p. 34 refs. Technical Pub. NAVDOCKS TP-Pu-3; BUDOCKSINST 11310.9.
Order from OTS $3.00 PB 161 252

This Technical Publication, which consists of nine chapters, provides guidance to Bureau and field personnel responsible for the design, installation, maintenance, and operation of power generating plants and distribution systems at naval shore activities. The general introduction for this series of publications presents the general authority of this Bureau for power facilities. Chapter 1 deals with the major phases of electric power generation. The first part of the chapter discusses the design of steam generating plants, fuels, boilers and accessories, boiler feed, methods of firing, combustion control systems, and the generation of electric power by steam turbine. The last part of the chapter is concerned mainly with operation and maintenance of steam generating plants but also includes the essential plant elements for the generation of electric power by internal combustion engine.

California U., Los Angeles.
TRANSFORMS FOR LINEAR TIME-VARYING SYSTEMS, by John A. Aseltine. Rept. on Contract N6onr-275(16). Feb 52, 112p. 36 refs. Dept. of Engineering rept. 52-1; ATI-196 326.
Order from LC mi$6.00, ph$18.30 PB 144 286

This paper presents a method for finding an integral transformation appropriate for a given linear time-varying system. The method makes possible analysis and synthesis of certain time-varying systems through the use of transform tables and associated theorems. Although the method is not restricted to a particular kind of time-varying physical system, examples center around electrical circuits.

Case Inst. of Tech., Cleveland, Ohio.
SOLID ANGLE SYNTHESIS, by Robert Plonsey. Scientific rept. no. 7 on Contract AF 19(604)3887. 17 Aug 59, 61p. 16 refs. AFCRC-TN-59-595.
Order from LC mi$3.90, ph$10.80 PB 143 661

This paper discusses synthesis of solid angle antenna patterns by means of planar aperture or array distributions. The available techniques for one dimensional pattern synthesis (in particular that based on Fourier analysis, and methods due to Woodward and to Ruze) are applied to the two dimensional case. A discussion of antenna Q and its evaluation is given for an aperture with uniform source polarization. An approximation to the Q for a class of arrays is also given. Several optimization criteria are discussed for this problem, and the various techniques compared.

Centro Radioelettrico Sperimentale "G. Maroni", Rome (Italy).
H. F. BACKSCATTER FROM LAND AND SEA, by 1. Ranzi and P. Dominici. Scientific note no 1 on Contract AF 61(052)139. 30 May 59, 7p. 6 refs. AFCRC-TN-59-574.
Order from LC mi$1.80, ph$1.80 PB 143 642

The recordings of the backscattered echoes, performed since August 1957 on the frequencies of 18.6 and 22.3 Mc/s, in the station of Torrechiaruccia (42.03° N, 11.84° E), show an azimuthal distribution in the backscatter intensity, with maxima on the sea and minima on the land. This result is examined in the light of the observations of echoes directly backscattered from the sea at a short distance. The importance of the knowledge, concerning the dependence of the backscatter coefficient on the nature of the ground and on other eventual conditions, is emphasized especially for the solution of the problems about the protection of the ionospheric scatter communications against the signals arriving by backscattering.

Control Systems Lab., U. of Illinois, Urbana.
THE TRANSIENT RESPONSE OF CASCADED BUTTERWORTH FILTERS, by Bruce L. Hicks and Rosemarie Stemmler. Rept. on Contract DA 36-039-sc-56695. Aug 57, 26p. 3 refs. Rept. no. R-97; AD-144 937.
Order from LC mi$2.70, ph$4.80 PB 138 558

The impulse and step responses for cascaded, three or five pole Butterworth filters have been calculated on Illiac with an accuracy of three or more decimals. In this paper the dependence of the calculated step response upon the number of cascaded filters λ_2 studied, both with no phase correction and with complete phase correction, with λ_2 in the range from 4 to 512.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
HANDBOOK OF METHODS OF COOLING AIR FORCE GROUND ELECTRONIC EQUIPMENT, by James P. Welsh and Thomas J. Walsh (Rome Air Development Center). Rept. on Contract NObsr-63043. June 59, 636p. 43 refs. RADC-TR-58-126; AD-148 907.
Order from OTS $8.00 PB 161 264

This Handbook was prepared to aid electronic engineers in the thermal design of reliable military electronic equipment. Enumerated herein are principles and techniques to be followed in the design of electronic parts, assemblies, and equipments, enabling

heat removal to be achieved to the greatest practical extent. It supplements previous CAL reports HF-710-D-16, NAVSHIPS 900, 187, AD-53 100; HF-845-D-8, NAVSHIPS 900, 192, AD-127 527; HF-845-D-9, NAVSHIPS 900, 185; HF-845-D-19, NAVSHIPS 900, 194; AD-202 440, and HF-1053-D-3, AD-141 400.

Cruft Lab., Harvard U., Cambridge, Mass.
CROSS RELAXATION IN SPIN SYSTEMS, by N. Bloembergen, S. Shapiro and others. Technical rept. on Contract Nonr-1866(28). 15 Oct 58, 54p. 38 refs. Technical rept. no. 285.
Order from LC mi$3.60, ph$9.30 PB 143 038

The energy transfer between adjacent resonances in nuclear and electron spin systems is analyzed in terms of the overlap of line-shape functions. The procedure is an enlargement on the original proposal of Kronig and Bouwkamp, and consists of taking partial account of off-diagonal elements in the spin-spin interaction, which are omitted in Van Vleck's truncated Hamiltonian.

Dalmo Victor Co., San Carlos, Calif.
OPTICAL AND ELECTROMAGNETIC TECHNIQUES FOR PREDICTION OF RADOME BORESIGHT ERRORS, by George M. Hahn. Rept. for 1 July 54-30 May 57 on Radome Techniques and Components, Contract AF 33(616)2524. Aug 59, 86p. 9 refs. WADC Technical note 59-257.
Order from OTS $2.25 PB 161 126

The rigorous electromagnetic solution to the radome problem will yield a method applicable to all radomes; however, the cumbersome computation requirements might make such an approach highly undesirable for many radomes whose characteristics are such as to permit the use of a much simpler optical technique. A thorough "state-of-the-art" survey indicates that considerable work has been completed elsewhere utilizing optical techniques. Reasonable results have been obtained whenever the radomes involved were governed by the following restrictions: 1. Antenna apertures greater than 10 wavelengths in diameter. 2. Clearance between antenna and radome housing of the order of wavelengths. 3. Radome wall curvature such as to permit the use of flat panel approximations. The prediction program was divided into two parts. The optical approach was to be simplified to such an extent that no large scale computing efforts would be required for boresight error predictions, and a new approach was to be devised utilizing electromagnetic methods for those radomes which do not have the three qualifications listed above. The optical approach promising the most rapid results is described in Section II of this report. A comparison of theoretical results with experimental data is included. The electromagnetic approach, which seems to be attractive at this time, is recorded in Section III of this report. A detailed account of directions for computer programming for one particular radome is included.

Diamond Ordnance Fuze Labs., Washington, D. C.
TRANSISTORIZED POWER SUPPLIES: A LITERATURE SURVEY, by Floyd Allen. 25 Aug 59, 24p. 17 refs. TR-725.
Order from OTS $0.75 PB 161 266

High voltages may be obtained from a low-voltage d-c supply when some form of converter is employed. A literature survey shows that transistorized converters, because of their high efficiency and lack of moving parts, are tending to displace rotary converters and vibrator-power units. Various transistor circuits of interest in ammunition electronics for converting dc-to-ac or dc-to-dc are reviewed here. The ringing choke converter offers a simple method of obtaining high voltage at power levels up to about two watts. For powers up to 200 watts the transformer-coupled push-pull circuit is recommended. Of particular interest is the driven type converter for high-power, single- and three-phase applications.

Dikewood Corp., Albuquerque, N. Mex.
REDUNDANCY FOR IMPROVING ACCURACY IN COMMUNICATIONS, by B. L. Basore. Final rept. on Contract AF 19(604)4078. 30 June 59, 46p. 11 refs. AFCRC-TR-59-170, AD-225 956.
Order from LC mi$3.30, ph$7.80 PB 143 507

This report summarizes a study of the role of redundancy in communication. The investigation was carried out principally in terms of an n-dimension model of message space to determine an intuitively clear method of comparing the significance of redundancy in reducing error rates in a communication link with the contribution realized through the use of long messages and delay. The study clearly indicates that the cost of communications including the cost of terminal coding and decoding equipment is not necessarily optimized when the channel capacity is used at highest efficiency, but a trade of channel capacity (in the use of redundancy) for improved reliability, i e., accuracy, may often be justified.

Douglas Aircraft Co., Inc., Long Beach, Calif.
DEVELOPMENT OF A VHF FAN ANTENNA FOR THE C-133A AIRCRAFT, by J. A. Kobe, E. C. Alsenz and H. J. Katzman. Rept. on Contract AF 33(600)22452. 15 Jan 55, 341p. 2 refs. Engineering rept. no. LB-21742.
Order from LC mi$11.10, ph$53.10 PB 143 334

The antenna discussed in this report is for use in the 100-156 mc frequency range on the C-133A aircraft. It is a fan-shaped vertical stub located on the top of the vertical stabilizer and has been designed from existing data. Necessary compensations were added to achieve a 2:1 VSWR. Radiation coverage is adequate for the purpose of the associated equipment.

Dunham Lab., Yale U., New Haven, Conn.
MAGNETIC AMPLIFIER CIRCUITS. PART I. THE SERIES CIRCUIT WITH A NONLINEAR INDUCTOR, by Amram Rasiel. Rept. on Improved Amplifiers for Flight Control Applications, Contract AF 33(616)3391. May 59, 101p. 56 refs. WADC Technical rept. 57-43, Pt. 1; AD-226 798.
Order from OTS $2.50 PB 161 142

The purpose of the present work is to investigate the oscillations of a circuit with non-linear restoring force, in particular under the influence of a driving force, and to explain the mechanism by which subharmonics of the driving force are generated in the circuit response. The general equation describing the oscillations of the circuit is first obtained. The free oscillations of the circuit are then examined in detail for circuits with non-linear restoring force given by a polynomial. In particular, when this polynomial is an odd cubic parabola, relationships between the period of the oscillations and the initial conditions are obtained in a closed form depending on the circuit parameters. The forced oscillations of the circuit are then investigated by obtaining an approximate first integral in the phase-plane. It is found that there are in general two different stable first integrals. One is associated with the forced oscillations of the linear equation and goes to zero with the driving force. The other is associated with the free oscillations of the circuit and remains finite as the driving force goes to zero. The role of the second solution in the mechanism of subharmonic generation is then discussed and the conditions under which subharmonic may exist are investigated. Four appendices, containing calculations and discussions, are included.

Dunham Lab., Yale U., New Haven, Conn.
MAGNETIC AMPLIFIER CIRCUITS, PART II. THE FULL-WAVE BRIDGE AMPLIFIER WITH TWO-TERMINAL LOADS, by Richard Clark Barker. Rept. on Improved Amplifiers for Flight Control Applications, Contract AF 33(616)3391. May 59, 100p. 4 refs. WADC Technical rept. 57-43, Pt. 2.
Order from OTS $2.25 PB 161 086

This report provides an analysis of a "universal" full-wave-bridge magnetic amplifier and several circuits and connection configurations are examined for two-terminal loads. Many of the aspects of the amplifier have been examined and explained and the mathematical relationships of the various components have been derived. An attempt has been made to describe the physics of the amplifier in an easy to understand manner. (See also PB 161 142)

Eastman Kodak Co., Rochester, N. Y.
BASIC RESEARCH INVESTIGATION FOR AMMONIA VAPOR ACTIVATED BATTERIES, by J. M. Freund, V. M. Bryant, Jr. and J. B. Schliff. Quarterly progress rept. no. 6, 15 Dec 58-14 Mar 59, on Contract DA 36-039-sc-74902. [1959] 35p.
Order from LC mi$3.00, ph$6.30 PB 143 896

This report presents data on the specific conductivity of NH_4SCN solutions in NH_3. Information is given for very concentrated solutions, ranging from 20 to 40 mol percent NH_4SCN at temperatures ranging from saturation to +40°C. and higher. It is evident that the specific conductivity increases with rising temperature at all concentrations in this range; whereas it decreases with increasing concentration. Values range from 0.050 $ohm^{-1}cm^{-1}$ to 0.500 $ohm^{-1}cm^{-1}$. Less concentrated solutions were also studied at temperatures below -40°C. It was observed that at -56°C.. the specific conductivity increases with increasing concentration to a peak of 0.135 $ohm^{-1}cm^{-1}$ at 6.5 mol percent, and then decreases as the concentration is further increased. Some data on NaSCN, KSCN, and $Mg(SCN)_2$ solution conductivities are also presented. (See also PB 140 618)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
SECONDARY ELECTRON MULTIPLICATION IN MICROWAVE FIELD, by Frank Fu Fang. Scientific rept. no. 6 on Contract AF 19(604)2152. 15 May 59, 127p. 31 refs. AFCRC-TN-59-362; AD-217 035.
Order from LC mi$6.30, ph$19.80 PB 144 002

The electron dynamics of a periodic secondary electron multiplication process at microwave frequencies known as "multipactor" is analyzed theoretically and experimentally.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
COST CONSIDERATIONS IN THE EVALUATION OF ELECTRONIC COUNTERMEASURE SYSTEMS, by Guy Black. Rept. on Contract DA 36-039-sc-73170. 24 Apr 57, 48p. 31 refs. Technical memo. no. EDL-M109, AD-141 067.
Order from LC mi$3.30, ph$7.80 PB 138 566

The means of developing the cost information for significant and accurate parameters of models are discussed and the appropriate models are developed. The combined cost of system development, fabrication, and employment is considered. For analytical purposes, this cost is divided into investment and operating phases. The problems of cost analysis are examined and the methodology of cost estimation is discussed both generally and applied to particular phases. The theory of costs and the synthesis of over-all costs of complex operations from estimates for simple operations are explained in an appendix. Special attention is given maintenance cost analysis, which can be treated theoretically by models relating equipment design to reliability: the reliability analysis undertaken in electronics can be used in part in this analysis.

Electronics Research Lab., Stanford U., Calif.
MAXIMALLY-FLAT PHASE-DIFFERENCE NETWORK DESIGN, by George L. Matthaei. Technical rept. no. 2 on Contract AF 28(099)83. 31 Oct 50, 42p. 10 refs. ATI-96073.
Order from LC mi$3.30, ph$7.80 PB 144 064

The theory of networks which realize a constant difference in the phases of two outputs, over a wide band of frequencies, in the equal-ripple or Chebyshev manner is here extended to the limiting case of zero error and zero bandwidth. This is the maximally-flat or Taylor type of approximation. The electrostatic potential analogy is used, with an appropriate conformal transformation, to develop the mathematical theory, and a design procedure is developed. For application to single-sideband systems, a comparison is made of the performances of these and of the equal-ripple type. The maximally-flat type offers no advantage, in fact is inferior, in this application. There may,

however, be other applications in which the inherently smooth approximation of this type will be useful.

Electronics Research Lab., U. of California, Berkeley.
QUARTERLY PROGRESS REPORT, by S. Silver. Rept. for 1 July-30 Sep 58 on Contracts N7onr-29529, Nonr-222(53, 54, 57). 31 Oct 58, 22p. Series no. 60, Issue no. 22.
Order from LC mi$2.70, ph$4.80 PB 143 555

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Diffraction of plane waves by a circular aperture in a thin infinite plane conductor
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Electronics Research Lab., Stanford U., Calif.
A STUDY OF THE APPROXIMATION PROBLEM FOR LINEAR-PHASE CONSTANT-PHASE-DIFFERENCE NETWORKS, by David D. Cherry. Technical rept. no. 4 on Contract AF 28(099)83. 29 June 51, 165p. 28 refs. ATI-139 916.
Order from LC mi$7.80, ph$25.80 PB 144 063

The need has arisen in single-sideband systems for networks that will give a constant phase difference of 90° over a frequency band of some width. Although this problem has been solved to some extent, the transient response and so-called delay characteristic for such networks are not all that could be desired. To improve these, attention is focussed herein on the problem of linear-phase, constant-phase-difference networks. The problem considers all-pass networks only. There are three different phase characteristics that are formulated and investigated. The first type is chosen as the linear transmission phase characteristic; the second type is chosen as one offset from the first type by ninety degrees. Then the difference between these two is to be the constant phase difference for which the solution is sought. The approximation is limited to a definite portion of the real frequency spectrum, usually normalized symmetrically about the origin from zero to one radian per second. As one by-product of this investigation, attempts are made to formulate a design procedure for an arbitrary-phase characteristic.

Electronics Research Labs., Columbia U., New York.
RESEARCH IN DESIGN TECHNIQUES FOR CONTROL SYSTEMS BY ELECTRONIC SIMULATION OF THE COMPLEX PLANE, by Stanley Fenster and John Wuorinen. Interim final rept. IF/110 for 1 Oct 53-31 May 56 on Contract AF 18(600)962. 30 June 56, 28p. 16 refs. CU-13-56-AF-962-EE; AFOSR-TR-56-[64]; AD-154 226.
Order from LC mi$2.70, ph$4.80 PB 144 066

This report covers research done on the complex Plane Scanner (CPS) of Contract AF 18(600)-962 with the Air Research and Development Command during the period 1 October 1953 through 31 May 1956. Research was devoted to study of methods of applying the scanning of the complex plane to the solution of various problems occurring in linear systems, to study of implementation of such scanning in electronic form, and to development of displays useful in engineering design problems. The theory of an electronic analog method of scanning the complex plane is outlined and applications of this theory are indicated. The Complex Plane Scanner (CPS), an analog computer, the operation of which is based on this method, is described. System block diagrams and waveforms are included.

General Electric Co. [Schenectady, N. Y.]
ULTRA HIGH TEMPERATURE (500°C) POWER TRANSFORMERS AND INDUCTORS, by Harold B. Harms and James C. Fraser. Rept. for 1 Mar 58-28 Feb 59 on Improved Electronic Components, Contract AF 33(616)5579. July 59, 576p. 15 refs. WADC Technical rept. 59-348.
Order from OTS $7.00 PB 161 046

Contract objectives called for the development of electronic power transformers capable of operation in a 500°C ambient temperature and in intense nuclear radiation. New projects were breakdown potential of air up to 500°C temperature and in a radiation environment, an impregnation material development, and a design optimization study. The breakdown potential of air was found to be significantly affected by nuclear radiation but only slightly by high temperature. A versatile material, aluminum phosphate solution, was found to be a useful coil impregnant by imparting strength to the insulations. Two constructions remain in the program, one a miniature hermetic whose encasement conforms to the contours of the core and coil, and a standard hermetic. Although it offers a substantial size and weight reduction, the former is more difficult to construct; both are capable of withstanding the mechanical, temperature and radiation requirements of the contract. A very significant advance in the high temperature magnet wire field was uncovered in a ceramic insulated nickel-clad copper wire. It offers a thin film insulation in very small wire diameters. The chief effect of radiation on the transformers tested was to create an extra internal source of heat and, thereby, to increase their temperature rise. An optimization procedure was developed and partially checked on a digital computer. The assembly of a design practice summarizes the favorable aspects of two contract periods.

Hazeltine Electronics Corp., Little Neck, N. Y.
FEASIBILITY OF TRANSISTORIZING BEACON, RADIO AN/DPN-31( ), by Robert Olsen, Ronald A. Orlando, and others. Final technical rept., phase 1, 15 June 56-14 Feb 57, on Contract DA 36-039-sc-72417. [1957] 61p. 18 refs. Rept. no. 9841; AD-146 686.
Order from LC mi$3.90, ph$10.80 PB 138 557

A study was carried out to determine whether it is feasible to transistorize Radio Beacon AN/DPN-31 (XE-1). It was concluded that transistorizing all stages of AN/DPN-31(XE-1) except the transmitter-oscillator, modulator, and modulator driver is now feasible. Breadboard models of the receiver, decoder, and command channels and the blocking-oscillator chain were constructed and successfully tested. It was not possible to reduce the modulation power required by grid pulsing the S-band cavity. Until power transistors with higher alpha-cutoff frequencies become available, a transistorized modulator and a transistorized modulator driver will not be feasible, except that restrictions on the former would be lessened considerably if technical requirements for the system could be altered to increase the delay between interrogation and reply to 12 μsec or so. The partially transistorized beacon now considered feasible would be no smaller and might be slightly heavier than AN/DPN-31(XE-1). However, if a transistorized modulator were feasible, large savings in size and weight as well as power would be possible.

Hughes Aircraft Co., Culver City, Calif.
BEAM POINTING ERRORS OF LONG LINE SOURCES, by M. Leichter. Rept. on Contract AF 30(602)1718. Apr 59, 38p. 11 refs. Technical memo. no. 588.
Order from LC mi$3.00, ph$6.30 PB 143 606

The relation between the statistics of the antenna beam pointing direction and the phase and amplitude errors at the source has been obtained to first order in the mean square errors, under certain restrictions, for long line sources. It is shown that when the desired phase at the source is a constant the results are, to first order, independent of the amplitude errors. When the desired amplitude is also constant there is a simple formula for computing the allowable rms phase error at the source when the pointing direction is required to lie in a given angular range with a given probability. When the amplitude distribution corresponds to the Taylor modified (sin x)/x pattern, the allowed rms phase error is obtained from the constant amplitude case by a multiplicative factor which depends only on the one parameter characterizing the Taylor distribution. This function is plotted for the range corresponding to sidelobe ratios of 13.2 to 40 db. At 40 db the allowed rms phase errors are about three fourths of the allowed rms phase errors at 13.2 db (constant amplitude) for the same uncertainty in the pointing direction. The results are applied to a hypothetical example and to an actual "Mills Cross" for illustrative purposes.

Institute for the Study of Metals, U. of Chicago, Ill.
IMPROVEMENTS ON A SIMPLE TEMPERATURE CONTROLLER, by C. T. Tomizuka and D. Zimmerman. Rept. on Contract AF 18(600)1489. 14 Nov 58, 6p. 2 refs. AFOSR-TN-58-942; AD-205 084.
Order from LC mi$1.80, ph$1.80 PB 138 420

A circuit was developed to be an improvement over a single temperature controller previously developed by Wilson and presently enjoying use in many laboratories. It uses a transistor preamplifier followed by a small thyratron activating a relay. The buzz frequency can attain 10 cycles/sec., a frequency which would destroy an ordinary relay.

International Telemetering Corp., Los Angeles, Calif.
THE TRACK-FOLLOWING SERVO SYSTEM. Technical rept. no. 11 on Computer Set, General Information Data AN/GSQ-16(XW-1) (Photoscopic Information Storage Unit) Contract AF 30(602)1566. 20 Mar 57, 32p. RADC TN-57-162; AD-114 437.
Order from LC mi$3.00, ph$6.30 PB 138 682

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE AMPLITUDE ANALYZER, by Arthur C. Erdman, A. B. Fontaine, and David G. McConnell. Rept. on Contract AF 41(657)70. July 59, 21p. 2 refs. WADC Technical rept. 59-45; AD-227 481.
Order from OTS $0.75 PB 161 110

This report described a device developed for extracting information for a trend analysis of low-frequency (0.66 cpm to 4.98 cpm) signals with respect to amplitude of occurrence during a time period. The system here described uses 30 mechanical counters to accumulate a score equivalent to the time that a signal dwells within a predetermined voltage band. A comprehensive discussion as to the electronic principles and techniques is provided.

Machlett Labs., Inc., Springdale, Conn.
EVALUATION OF UHF PLANAR TRIODE TUBE TYPE 2C39A IN THE POSITIVE GRID REGION, by W. Brunhart. Final technical rept. for 1 Feb-31 Oct 58 on Contract DA 36-039-sc-74816. [1958] 44p.
Order from LC mi$3.30, ph$7.80 PB 142 994

Tests were performed on 2C39A and 2C39WA type tubes in accordance with the tentative technical requirement. Based on the accumulated data, test limits are proposed for inclusion in procurement specifications. However, it is recommended for the sake of uniformity to use slightly different test conditions and corresponding limits and to eliminate the positive grid current division test, since it is felt that this test does not result in new information about the tube. It was found that the presently used JAN specifications do in no way cover the tube performance with respect to the 4.5 ms pulse test.

Magnetic Research Corp., El Segundo, Calif.
NEW METHODS OF MAGNETIC PULSE GENERATION, by B. M. Wolfframm. Rept. on Improved Electronic Components, Contract AF 33(616)2970. Dec 57, 55p. 10 refs. WADC Technical rept. 57-66.
Order from OTS $1.50 PB 131 651

The efficiency of magnetic pulse generators is analyzed by locating their core losses. Because of saturation of magnetic components the major portion of losses can be found in the cores. The wattmeter and calorimetric methods are used to determine the losses

of single components as well as those of the whole system. In addition, an evaluation of the voltage pulse into resistive load is made. The results obtained in different ways vary only a few per cent and indicate almost fifty per cent efficiency for a three-stage pulse generator. Tests are reported on a pulse generator that is capable of changing the repetition rate by a ratio of 1:2, and also on a pulse generator with continuous changing repetition rate. Methods of pulse width control mentioned in earlier reports have been tested on the magnetron power level and indicate a successful solution for a variable pulse width.

Maryland U., College Park.
AN ASYMPTOTIC CAUSALITY REQUIREMENT FOR SYSTEMS WITH CONSTRAINED INPUTS, by J. Sucher. Rept. on Contract AF 49(638)24. July 59, 14p. 6 refs. Physics Dept. Technical rept. no. 141. AFOSR-TN-59-773, AD-220 577.
Order from LC mi$2.40, ph$3.30 PB 143 156

The usual formulation of causality for simple linear systems: "no output before input", may fail to imply that the system kernel, $K(\tau)$, is a causal function of the time delay τ, because the class of physically admissable input functions may not contain a complete set of causal signals. An attempt is made to formulate a causality requirement, asymptotic in nature, which overcomes this difficulty. It is found, rather generally, that systems which satisfy this requirement cannot have a finitely acausal kernel. If it could be shown that the kernel cannot be infinitely acausal, the validity of the usual dispersion relations for such systems would be ensured.

[Material Lab.] New York Naval Shipyard, Brooklyn.
TITANIUM CATHODE COUNTER TUBES, UNIVERSITY OF MARYLAND, EVALUATION OF, by A. B. Jones, Jr. Final rept. 10 Apr 57, 7p. Lab. Project 5115-B-19.62; AD-140 792.
Order from LC mi$1.80, ph$1.80 PB 138 567

The tubes were halogen-quenched, glass-enclosed cylindrical counter tubes with cylindrical titanium cathodes 3 in. long and 1/2 in. in diameter surrounding a 5-mil tungsten anode wire. The filling was a mixture of chlorine and neon under pressures of 0.5 and 400 mm Hg, respectively. The operating ability of 3 tubes over 8899 hr of active life and of 2 tubes over 14,050 hr of active life indicated a degree of stability not shown by most tube types presently in the field. Likewise, a high degree of stability in plateau characteristics was shown by the subject tubes over 617 days of shelf life. Significant changes occurred in tube response and plateau characteristics over the temperature range of -55° to 75°C. The count rate and current increased with depressed temperature and decreased with elevated temperature. It is recommended that the titanium cathode counter tube be improved mechanically and be further investigated for possible use in the Navy Radiac equipments.

Microwave Electronics Lab., Rutgers State U., New Brunswick, N. J.
POWER CONVERSION WITH NONLINEAR REACTANCES, by Edward Della Torre and Murray D. Sirkis. Rept. on Contract AF 49(638)554. June 59, 14p. 10 refs. Research rept. 59-1; AFOSR-TN-59-596; AD-217 181.
Order from LC mi$2.40, ph$3.30 PB 143 958

The Manley-Rowe relationships for a nonlinear reactance are derived proceeding from the voltage-charge characteristic for a capacitance. The method used follows the work of Van der Ziel. The problem is generalized to an arbitrary number of generators. A criterion on the degree of nonlinearity required for power conversion to power at a particular frequency is also derived. A condition on the oscillator frequencies is found, but this condition proves to be less strict in any practical case than the Manley-Rowe requirement of incommensurability. Output filter considerations are also discussed.

Microwave Engineering Labs., Inc., Palo Alto, Calif.
INVESTIGATION OF MICROWAVE NON-LINEAR EFFECTS UTILIZING FERROMAGNETIC MATERIALS, by Wesley P. Ayres and Perry H. Vartanian. Quarterly progress rept. for 4 May- 2 Aug 58 on Contract DA 36-039-sc-73278. [1958] 27p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 832

The harmonic generation measurement system has been improved by the addition of a new more sensitive crystal detector, a calibrated variable attenuator, a directional coupler and a phase shifter. A ferromagnetic amplifier has been operated in both the degenerate and non-degenerate conditions of electromagnetic mode operation.

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HIGH POWER MAGNETIC FIELD CONTROLLED MICROWAVE GAS DISCHARGE SWITCH, by S. J. Tetenbaum and R. M. Hill. Rept. on Contracts DA 36-039-sc-(71053, 73188). 22 July 57, 69p. 19 refs. Technical rept. MPL-8; AD-142 943.
Order from LC mi$3.90, ph$10.80 PB 138 554

A broadband magnetic field controlled, microwave gas discharge switch is described which is capable of rapidly switching high peak and average power at S band. The switch consists of two gas-filled tubes located at the junction of a rectangular waveguide Y-configuration One or the other of the switch tubes is fired by the incident microwave power when a magnetic field is applied to it. The high electron density of the discharge acts like a short circuit in one input arm of the Y effectively connecting the other input arm to the output.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
BROADBAND, BEAD-SUPPORTED COAXIAL LINES AND FITTINGS, by Paul G. Mariotti. Final rept. on Contract DA 36-039-sc-64456. 16 Mar 56, 74p. Rept. no. R-474-56; PIB-404.
Order from LC mi$4.50, ph$12.30 PB 129 483

Type "N" Connectors were designed for use with 1/2" O. D. and 7/8" O. D. semiflexible Styroflex line of both waterproof and pressurized types. In addition, a 7/8" RETMA rigid line flange was modified to accept a 7/8" O. D. semiflexible Styroflex line. A rotary joint in 7/8" RETMA line has been designed and developed. This design was then scaled and constructed for the 1-5/8" O. D. RETMA line. Values of $\lambda/\lambda g$ as a function of frequency were calculated for the 1/2" Styroflex line for higher mode operation. Values of $\lambda/\lambda g$ as a function of frequency were also calculated for the 7/8" line up to the first critical frequency. The changes of $\lambda/\lambda g$ are indicative of characteristic impedance change. The values of $\lambda/\lambda g$ were checked experimentally for the 7/8" line by means of a cavity technique. A comparison of performance parameters for various Styroflex type line is presented.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
COUPLED LEAKY WAVEGUIDES. II. TWO PARALLEL SLITS IN A CYLINDER, by S. Nishida. Rept. on Contract AF 19(604)2031. 10 June 59, 22p. 4 refs. Research rept. R-746-59; PIB-674; AFCRC-TN-59-392.
Order from LC mi$2.70, ph$4.80 PB 143 400

Theoretical expressions are derived for the effects of mutual coupling between two parallel leaky wave antennas which consist of slitted rectangular waveguides located in a cylinder. The expressions derived are presented in terms of the infinite plane result with additional terms due to the curvature of the cylinder. The graphical presentation of the numerical attenuation constants for the cylindrical case are compared with those for the infinite plane. (See also PB 135 401)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
FREQUENCY TRANSFORMATION AND TRANSMISSION LINE FILTERS, by Yosef Shalev and Eugene N. Torgow. Rept. on Contract AF 30(602)1650. 29 Apr 59, 86p. 11 refs. Research rept. R-706-59; PIB-634; RADC-TN-59-181; AD-216 435.
Order from LC mi$4.80, ph$13.80 PB 143 769

A technique for the design of high-pass and band-pass transmission line filters, by transformation from low-pass prototype transmission line filter was investigated. Dealing with networks comprised of commensu rate sections of line, a change of variable $\lambda = j \tan \theta$ was introduced. The new variable λ may be regarded as a frequency variable, and it has been shown that theorems and synthesis procedures for lumped element networks, can be adopted and applied directly to the distributed case. A general proof as to the validity of the transformation technique for filter design in the lumped element case is worked out and the physical realizability of the transformed functions is demonstrated. In an analogous manner, the applicability of the transformation technique to distributed networks in the λ plane was examined.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
TUNABLE MICROWAVE FILTERS, by Danlyo Jacenko and Eugene N. Torgow. Rept. on Contract AF 30(602)1650. 6 May 59, 67p. 8 refs. Research rept. R-740-59; PIB-668; RADC-TN-59-180; AD-216 436.
Order from LC mi$3.90, ph$10.80 PB 143 768

Tunable bandpass microwave filters with independently adjustable upper and lower cutoff frequencies have been developed. These filters use the hybrid junction cutoff waveguide structure which is modified, in the waveguide case, by the introduction of variable height ridges in the cutoff waveguide sections. The center frequency of the pass band can be varied over a maximum band of 20% and the bandwidth can be varied from 1.5% to 20% with low pass band losses. The maximum insertion loss at midband is 1.0 db. for the narrowest bandwidth. It has been shown that this loss can be significantly rereduced by minimizing the reflections from the tapered line inputs to the cutoff waveguide sections.

National Bureau of Standards, Washington, D. C.
RESISTANCE DIODE BRIDGE CIRCUIT FOR TEMPERATURE CONTROL, by Lawrence H. Bennett and Van M. Johnson. Oct 59, 4p. 3 refs. Technical note 34.
Order from OTS $0.50 PB 151 393

The conventional ac bridge gives irregular performance including loss of temperature control when the temperature error exceeds a certain critical value. The present note describes a simple method of achieving stable temperature control over a large range of temperatures.

Naval Air Development Center, Johnsville, Pa.
A TRANSISTOR ZERO-CROSSING DETECTOR, by John S. Denelsbeck. 16 Oct 58, 13p. 1 ref. Rept. no. NADC-ED-5826; AD-208 277.
Order from LC mi$2.40, ph$3.30 PB 144 108

A transistor detector is described which generates a pulse whenever the input waveform passes through zero. This device utilizes a combination of two grounded-emitter amplifiers which are fed by input signals of opposite phase relationship. Although specifically designed for use in a synchro shaft position encoder, this zero-crossing detector also has application as a composite pulse generator and as a frequency doubler.

Naval Ordnance Lab., White Oak, Md.
A FERRORESONANT REGULATOR WITH CONTROLLABLE OUTPUT, by George Schohan. 2 Oct 57, 29p. 5 refs. NAVORD rept. 5741.
Order from LC mi$2.70, ph$4.80 PB 143 308

A solution to the problem of obtaining essentially instantaneous correction for A. C. line voltage changes is shown. The combination of a ferroresonant regulator having controllable output voltage with degenerative feedback to produce a regulator having constant output voltage for changes in line

voltage, frequency and load conditions is discussed. Design procedures and actual construction details of a 1000 VA ferroresonant circuit are given.

Naval Ordnance Lab., White Oak, Md.
THEORY OF NOISE IN A MULTIDIMENSIONAL SEMICONDUCTOR WITH A P-N JUNCTION, by Max Solow. Doctoral thesis. 26 June 57, 102p. 18 refs. NAVORD rept. 5762; AD-205 428.
Order from LC mi$5.70, ph$16.80 PB 144 046

In the p-n junction the noise is the result of fluctuations in the minority carrier density, holes in the n-type material and electrons in the p-type material. The noise problem is solved by using Langevin equations and interpreting the distributed sources as random forces.

Naval Research Lab., Washington, D. C.
AN AUTOMATIC RADAR RANGE MOON TRACKING SYSTEM, by John E. Abel and Charles F. White. Final rept. 11 Aug 58, 27p. Rept. 5170.
Order from LC mi$2.70, ph$4.80 PB 133 235

The design and construction of a high-performance automatic range tracking system for radar echoes from the moon is reported. The servo-system transfer function employed is based upon range variations of the signal due to the maximum earth-moon distance variation with time and upon "velocity memory" requirements arising from the nature of the input signal. The impracticality of conventional measurement methods in repeated experimental verification during system development of transfer functions extending from 100 rad/sec to below 0.0001 rad/sec led to employment of analog techniques in a feedback system testing method by which open-loop transfer functions are determined from closed-loop transient testing.

Naval Research Lab., Washington, D. C.
ELECTROMAGNETIC PROBES FOR NEAR-ZONE MEASUREMENTS, by D. C. Rohlfs, W. W. Balwanz, and F. E. Boyd. Interim rept. 5 Oct 59, 42p. 9 refs. NRL rept. 5378.
Order from LC mi$3.30, ph$7.80 PB 142 451

A set of detailed drawings of horns, lenses, and heat-protection covers and photographs of antenna structures illustrate the instrumentation utilized at NRL to provide the focused electromagnetic beams used in flame-conductivity studies. These drawings have been compiled for the convenience of workers in the field of rocket-exhaust studies.

Naval Research Lab., Washington, D. C.
INVESTIGATION OF OSCILLATOR CIRCUITS FOR USE WITH CR-9/U OVER-MODE CRYSTAL UNITS, by Bertram C. Hill, Jr. and Sylvaine L. Kenyon. 1 Nov 47, declassified 15 Dec 53. 35p. NRL rept. no. R-3158.
Order from LC mi$3.00, ph$6.30 PB 129 172

The overall performance of some early production CR-9/U over Mode Crystal Units was evaluated in the activity in terms of series resonant resistance, frequency stability and the type of holder used to mount the crystal plate. Crystal activity was, on the average, satisfactory. Frequency drift was generally excessive and further tests showed that both crystal frequency stability and crystal activity were functions of the voltage applied across the unit - the lower the voltage drive across the unit, the greater the crystal frequency stability, with activity varying with drive.

Naval Research Lab., Washington, D. C.
A THREE-LEVEL CHROMIUM ION MASER, by M. A. Garstens and W. W. McAllister. Progress rept. 13 Nov 59, 8p. 4 refs. NRL rept. 5400.
Order from OTS $0.50 PB 151 996

A brief discussion of three-level solid state maser theory is presented, as well as the experimental results for a chromium ion ruby maser operated both at temperatures of liquid helium and liquid nitrogen.

Naval Research Lab., Washington, D. C.
THE ZERO CROSSING PROBLEM, by D. F. Grady. Interim rept. 10 Nov 59, 22p. 4 refs. NRL rept. 5397
Order from LC mi$2.70, ph$4.80 PB 142 595

One of the basic problems encountered in the analysis of signals is that of determining the effect of noise, which is inevitably present along with the signal, on the frequency of the signal. One method of determining frequency is to measure the number of crossings of the zero axis by the signal. A pure sine wave of frequency f_0 would have $2f_0$ zero crossings per second. A sine wave has a fixed frequency, whereas random noise is composed of a mixture of frequencies; when noise is present with a sine wave, the frequency of the composite signal will be in doubt due to the random variations of the noise. One approach to predicting the frequency of a composite signal of a sine wave plus noise is to determine by measurement the number of zero crossings of the composite signal. This method of analysis includes the case of predicting the frequency of random noise as an introduction to the case of random noise plus a sine wave. For a sine wave plus random noise passed through a low-pass filter with a cutoff frequency of five times the frequency of the sine wave and an input signal-to-noise ratio of one, it was found that the frequency of the composite signal determined by measuring the number of zero crossings was over twice the frequency of the input sine wave. A set of curves was plotted for various low-pass and bandpass filters.

Navy Electronics Lab., San Diego, Calif.
TECHNIQUES FOR RECORDING SURFACE BIOELECTRIC DIRECT CURRENTS, by A. Ford and J. L. Leonard. 6 May 58, 23p. 16 refs. Research rept. no. 839.
Order from LC mi$2.70, ph$4.80 PB 143 733

Despite its potential value in human engineering, bioelectric DC recording has been neglected in comparison with AC recording. The neglect is a result of the experimental difficulties encountered in DC recording, particularly in avoiding electrical

drift effects. This report describes successful DC recording techniques, largely developed at NEL, with special emphasis on the fabrication and application of silver-silver chloride electrodes.

New York U. Coll. of Engineering, N. Y.
EXTENSION OF NULL-RECEPTION ANALYSIS TO BINARY COMMUNICATION SYSTEMS EMPLOYING ENVELOPE DETECTION, INCLUDING FSK, by J. J. Metzner and K. C. Morgan. Scientific rept. no. 8 on Contract AF 19(604)1964. 1 July 59, 120p. 24 refs. AFCRC-TN-59-562.
Order from LC mi$6.00, ph$18.30 PB 143 662

The effects of applying the null-zone decision mechanism to two types of envelope-detection systems have been investigated, and comparisons have been made with previous results for synchronous-detection systems, primarily within the framework of discarding and cumulative decision-feedback configurations. (See also PB 142 384)

Office of Scientific Research and Development. Div. 6.
A MANUAL OF CALIBRATION MEASUREMENTS OF SONAR EQUIPMENT. Summary technical rept. vol. 11, on Contract OEMsr-1130. 1946, declassified 17 July 58. 360p. 229 refs. AD-200 789
Order from LC mi$11.10, ep$57.60 PB 144 163

Contents:
Standards used by the underwater sound reference laboratories
U. S. Navy sonar equipments
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Ohio State U. Research Foundation, Columbus.
STUDY OF RADIOTELEPHONE VOICE PROCEDURES AND RELATED RESEARCH, by Henry M. Moser. Final rept. for 1 Dec 55-30 Sep 58 on Contract AF 19(604)1577. 30 Sep 58, 37p. 42 refs. AFCRC-TR-58-52; AD-160 711.
Order from LC mi$3.00, ph$6.30 PB 138 593

Experimental work along applied, theoretical, and exploratory lines with special attention given to recommended research along lines suggested by the International Civil Aviation Organization on an International Language for Aviation as well as additional work with hand signals in aviation.

Palmer Physical Lab., Princeton U., N. J.
SIGNAL TO BACKGROUND RATIO OF GATED AND UNGATED IMAGE TUBES, by Geo. T. Reynolds and D. Scarl. Technical rept. no. 20 on Contract Nonr-1858(06). 12 Nov 58, 16p.
Order from LC mi$2.40, ph$3.30 PB 143 429

Pittsburgh Consolidation Coal Co., Library, Pa.
CONVERSION OF CARBONACEOUS FUELS TO ELECTRICAL ENERGY, by Everett Gorin and Howard L. Recht. Final rept. for 15 Aug 57-14 Aug 58 on Contract DA 36-039-sc-74941. [1958] 76p.
Order from LC mi$3.90, ph$10.80 PB 138 803

This work was directed toward the development of a high temperature fuel cell whose electrochemical output is derived from the free energy change in the combustion of gaseous fuels with air. The ultimate aim is the development of a cell which may be used in an integrated fuel cell - gasification system. It summarizes the results of the present one-year contract. Procedures have been worked out for the preparation of double-porosity lithiated nickel oxide air electrodes, and ultra-strong magnesia electrolyte matrices. The experimental work has been carried to the point where operations can be conducted with pressurized double porosity electrodes. Stable short term outputs of over 4×10^{-2} watts/cm^2 at approximately 0.5 volts have been obtained with both silver gauze and lithiated nickel oxide electrodes.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL SOURCES. VOLUME II. BATTERIES, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 99p. E-2FR049-332, AFOSR-TN-59-430. AD-214 780.
Order from OTS $2.25 PB 161 262

The following section comprises a summary of performance characteristics, structure, power weight ratios, and power volume ratios, whenever available, of chemical batteries. Performance data include such items as watt hours per pound, watt hours per cubic inch, behavior at low temperatures, unactivated shelf life, activated shelf life, rechargeability, reliability, open circuit voltage, average operating voltage, and adaptability for particular service. Fuel cells, essentially of the same class of converters of chemical energy into electrical energy will be discussed. So-called nuclear batteries are presented last.

Radiation, Inc., Melbourne, Fla.
TELEMETRIC DATA TRANSMITTING SET AN/AKT-14 AND TELEMETRIC DATA RECEIVING SET AN/UKR-7(XA-2). Final engineering rept. on Contract AF 33(600)27465. 29 Dec 58, 207p. 14 refs.
Order from LC mi$9.30, ph$31.80 PB 143 093

Radio Corp. of America, Camden, N. J.
TRANSISTORIZED INTERPHONE MICROPHONE AMPLIFIER, by Willard F. Meeker and R. Michael Carrell. Final rept. on Contract DA 36-039-sc-64453. [1954] 195p. 14 refs. AD-151 762.
Order from LC mi$8.70, ph$30.30 PB 138 552

Articulation tests were conducted to determine how to make the best use of speech peak clipping, preemphasis, deemphasis, and AGC in the microphone amplifier of an interphone system for Army aircraft in which the noise can be as high as 120 db. The system considered uses

M-33/AIC microphones, H-70/AIC headsets, and listening amplifiers of the AN/AIC-12(XC-1) intercommunication set. Results indicated that no pre-emphasis or deemphasis should be used, 6 to 12 db of peak clipping should be provided (under control of the listener), and AGC should be provided in the microphone amplifier. Word articulation performance with such a system was 82% in the presence of 120-db noise at talker and listener stations, 95% with 120-db talker noise and 50-db listener noise, 93% with less than 80-db talker noise and 120 db of listener noise, and 98% in the presence of about 50 db of talker and listener noise.

Raytheon Co., Newton, Mass.
INVESTIGATION OF THE CORRELATION OF STANDARD DIODE EMISSION STUDY CONTRACT FINDINGS WITH PRODUCTION TYPE TUBES USING STANDARD PRODUCTION EQUIPMENT, by F. Hill, C. Bardsley and others. Scientific rept. no. 2 for 16 Mar-15 June 59 on Contract AF 19(604)4095. 26 June 59, 52p. AFCRC-TN-59-382.
Order from LC mi$3.60, ph$9.30 PB 143 399

An evaluation and explanation of a rapid method for the determination of dynamic cathode activity is described. The results of a laboratory study of the effect of high and low pilot voltages on the decomposition rate of the cathode coating are listed. The lower the pilot voltage, the faster the rate of decomposition. Also, a method for the determination of the proper coil orientation and the results of its application is included.

[Remington Rand Univac Div., Sperry Rand Corp.] St. Paul, Minn.
PREPARATION AND CHARACTERISTICS OF MAGNETIC RECORDING SURFACES, by Edward D. Korhone, Lawrence W. Reid, and Walter L. Anderson. Rept. on Contract NObsr-42001. 7 Jan 49, 23p.
Order from LC mi$2.70, ph$4.80 PB 144 148

The operation of magnetic recording drums at high peripheral speeds has indicated the need for coatings with greater adhering properties than have been obtainable with recording tape and cements. In other tasks, the magnetic material has been deposited directly on the drum surface by brushing, dipping, and other similar means. The coatings thus obtained were non-homogeneous, fragile, and magnetically noisy. Further trials brought about the use of various spray methods, probably the first of which employed a crude atomizer, and next, ordinary paint spraying equipment. While these yielded promising results, it was not until an artist's airbrush was used that magnetically satisfactory coatings were achieved. However, the adherance to well-polished metal surfaces was still inadequate. This problem was overcome by the addition of a zinc-chromate primer coat to the drum before application of the magnetic material. This report is limited to practical considerations involved in the preparation of magnetic recording surfaces in the subject Task; the purpose is to describe the application of magnetic surfaces, and to compare characteristics of several types of surfaces.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
QUARTERLY PROGRESS REPORT NO. 49 [DECEMBER 1, 1957]-FEBRUARY 28, 1958, by J. B. Wiesner, G. G. Harvey, and H. J. Zimmerman. Rept. on Contract DA 36-039-sc-64637. 15 Apr 58, 151p. 110 refs.
Order from LC mi$7.50, ph$24.30 PB 143 556

Contents:
I. Physical electronics
II. Microwave gaseous discharges
III. Solid state physics
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V. Nuclear magnetic resonance and hyperfine structure
VI. Microwave electronics
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IX. Statistical communication theory
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XII. Speech communication
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XVII. Shop notes

Rome Air Development Center, Griffiss AFB, N. Y.
ACCURACY IN THE ESTIMATION OF DEVIATIONS FROM THE GLIDEPATH AS A FUNCTION OF DISPLAY CONFIGURATION, by Edward F. LaForge and Edmund J. Kennedy. June 59, 11p. RADC-TN-59-140; AD-214 493.
Order from LC mi$2.40, ph$3.30 PB 144 081

This report describes the results of a comparative evaluation of two precision approach displays. The currently used azimuth-elevation CRT display was found to be less accurate in estimating quantified deviations from the glidepath than a display with visual references enabling rapid perception of deviations in azimuth and elevation. The detection of changes in these two dimensions is a critical requirement in monitoring guidance by both automatic and manual precision approach and landing systems.

Rome Air Development Center, Griffiss AFB, N. Y.
DESIGN AND DEVELOPMENT OF A HIGH-FREQUENCY RECEIVING-ANTENNA MULTICOUPLER, by Donald W. Sykes. Rept. on Contract AF 30(602)1492. Oct 59, 40p. RADC-TR-59-117.
Order from LC mi$3.00, ph$6.30 PB 143 954

This report lists the technical characteristics of the CU-483(XW-1)/GR antenna multicoupler developed by CGS Laboratories, Stamford, Connecticut, for Rome Air Development Center under Contract AF 30(602)1492. This equipment was developed to satisfy the current antenna coupler requirements of AACS and other Air Force organizations. The antenna multicoupler possesses exceptional performance characteristics and provides for the simultaneous operation of ten high-frequency receivers from one antenna.

Rome Air Development Center, Griffiss AFB, N. Y.
INTELLIGIBILITY TESTS ON THE R-361 (GRR-7) RECEIVER IN THE PRESENCE OF RF PULSE INTERFERENCE, by Joseph G. Molnar. June 59, 10p. 1 ref. RADC-TN-59-198; AD-216 700.
Order from LC mi$1.80, ph$1.80 PB 142 944

The results of the effects of RF pulse interference on a UHF voice receiver are discussed. Percentage word articulation is presented for desired signal levels of 3 - 100 microvolts in the presence of peak pulse interference 20 - 60 db greater. Test results on the R-361 receiver indicate that RF peak pulse interference 40 db greater than the desired signal level will enable a listener to obtain at least 50 percent word articulation and at least 83 percent sentence intelligibility.

Rome Air Development Center, Griffiss AFB, N. Y.
INTELLIGIBILITY TESTING OF VOICE COMMUNICATION SYSTEMS, by George E. Renaud. May 59, 10p. 4 refs. RADC-TN-59-156; AD-215 023.
Order from LC mi$1.80, ph$1.80 PB 143 750

This report describes methods of testing voice communication. Particular emphasis is placed on the use of PB-50 lists, developed by Harvard University, in testing actual speakers and listeners.

Rome Air Development Center, Griffiss AFB, N. Y.
UTILIZATION OF AIR STRUCTURES IN USAF GROUND ELECTRONIC SYSTEMS, by Albert A. Ondrejka. Aug 59, 45p. 5 refs. RADC-TR-59-137; AD-225 509.
Order from LC mi$3.30, ph$7.80 PB 143 580

This report is intended to acquaint the reader with so-called air structures which have been recently developed and show great promise for use in electronic aircraft control and warning systems. Their present status, as applicable to military operations, is reviewed in general, and prominent types are discussed more closely for the purpose of presenting their basic features and characteristics. Advantages and disadvantages associated with air structures operating under actual conditions are revealed, and recommendations regarding further development work are indicated. Properties inherent to air structures tend to suggest their wider future applications, including operations in outer space.

Sonotone Corp., Elmsford, N. Y.
INVESTIGATION LEADING TO THE DEVELOPMENT OF A NICKEL CADMIUM BATTERY HAVING A HERMETICALLY SEALED CONSTRUCTION, by Irwin M. Schulman and Paul F. Ritterman. Final rept. for 10 Aug 56-30 Nov 57 on Contract DA 36-039-sc-73009. [1957] 86p. 7 refs. AD 153 553.
Order from LC mi$4.80, ph$13.80 PB 143 664

Automatic cycling (60 minute charge - 40 minute discharge) was continued for the 3-1x1 (0.45 A.H.) batteries at discharge rates of 0.07 to 0.20 amperes. The effects of temperature, rate of charge, and electrolyte concentration on the reaction rate of the charged negative cadmium plate with oxygen in the presence of potassium hydroxide solution was investigated. Summaries of all reaction rate studies done under this contract are shown.

Sparton Radio-Television Div., Sparks-Withington Co., Jackson, Mich.
FREQUENCY METER FR-4/U, by Milton Kaufman. Final engineering rept. on Contract DA 36-039-sc-5642. 10 June 53, 86p.
Order from LC mi$4.80, ph$13.80 PB 143 752

It was determined by Sparton that the Government furnished models would not meet specifications with regard to stability, output, and spurious responses. In the proxy oscillator sub-chassis, the type of oscillator circuit has been changed to a tuned-grid type, the order of frequency multiplication is different and a substantial mechanical and electrical re-design has been accomplished. These changes have resulted in better stability and reduced spurious responses. A tuning meter has been added and the r-f output has been boosted on some bands. In addition, a separate mixer tube is now used and provides more stable operation. A CR-36/U (1250kc) crystal oscillator of a type recommended by the Signal Corps is now being used in the crystal oscillator-divider sub-chassis. A number of divider circuits were experimented with. The type now used is similar to the original design, but has been stabilized and is not free-running. In the harmonic selector sub-chassis, the blocking oscillator has been stabilized with respect to line voltage variations. Amplitude variations between harmonics have been minimized and spurious outputs from the sub-chassis considerably reduced. The function switch has been greatly simplified and the comparitor switch which was necessary in the model eliminated. The interpolation oscillator has been changed to a tuned-grid type. To improve oscillator performance coils of better Q have been wound and a large shield can be used. Mechanical design has been improved to provide better frequency stability. The indicator sub-chassis has undergone considerable change and simplification. Iron-core plate chokes have been eliminated in favor of d-c coupling to the oscilloscope deflection plates. The audio amplifier-expander has been greatly simplified and improved in performance. A negative high-voltage supply is now used for the oscilloscope and facilitates simplification of the circuits. In the power supply, a series-type regulator is used instead of the gas tubes used in the model. Better regulation under varying line voltage conditions is obtained.

Sprague Electric Co., North Adams, Mass.
FOLDED FOIL SINUSOIDAL POTENTIOMETER. Final Engineering rept. on Contract NObsr-52366. July 58, 78p.
Order from LC mi$4.50, ph$12.30 PB 143 559

Stanford Electronics Labs., Stanford U., Calif.
CIRCUIT CONSIDERATIONS IN TRAVELING-WAVE PARAMETRIC AMPLIFIERS, by C. V. Bell and G. Wade. Rept. on Contract AF 19(604)1847. 28 Aug 59, 31p. 7 refs. Technical rept. no. 316-1.
Order from LC mi$3.00, ph$6.30 PB 143 483

This paper presents the circuit considerations appropriate to wide-band operation in a traveling-wave parametric amplifier. The model which is analyzed is a transmission line periodically loaded with parametric diodes. The diodes constitute the variable elements. Across each diode is fed a large pumping voltage which produces a time-varying capacitance. A Brillouin diagram for the structure (i. e., a plot of ω vs β) can be computed from the analysis. The conditions for high gain, wide band, and other desirable characteristics are conveniently determined from this diagram.

Stanford Electronic Labs., Stanford U., Calif.
THE HELITRON OSCILLATOR, by G. Wada. Technical rept. no. 31 on Contract Nonr-225(24). 21 Apr 58, 102p. 12 refs.
Order from LC mi$5.70, ph$16.80 PB 138 586

Three different models of the helitron were constructed. The first tube showed that an operational helitron was feasible. The second tube contained modifications permitting operation at relatively large currents. These modifications also eliminated undesirable modes present in the first model. The third model had modifications leading to a better understanding of the behavior of the device. The experimental data on the three tubes are presented. A few of the pertinent experimental data are: continuous voltage tuning from 1. 2 to 2. 4 kMc with an accompanying change in tuning voltage of from 650 to 1700 volts; power output is in the vicinity of 1 to 10 milliwatts; and start-oscillation current is approximately 0. 4 ma for a structure 4 inches long.

Stanford Electronics Labs., Stanford U., Calif.
AN INVESTIGATION OF ADIABATIC RAPID PASSAGE IN IONIC PARAMAGNETS FOR USE IN SOLID-STATE MASERS, by W. W. Anderson. Rept. on Contract AF 19(604)1847. 20 Apr 59, 171p. 40 refs. Technical rept. no. 211-1; AD-220 584.
Order from LC mi$8.10, ph$27.30 PB 143 327

The theory of adiabatic rapid passage and the first applications were used in the study of nuclear magnetic moments. This study extends the results to electron spin resonance systems with emphasis on ionic paramagnets. The theory of adiabatic rapid passage is shown to apply to any two-level quantum system under the appropriate conditions. Interactions with other quantum levels and interactions not taken account of in the simple theory developed are then described by phenomenological relaxation times. It is shown that the only significant relaxation time in adiabatic rapid passage experiments is the spin-lattice relaxation time. Several types of masers are discussed.

Stanford Electronics Labs., Stanford U., Calif.
MICROWAVE INTERACTION OF ELECTRON BEAMS AND NON-PROPAGATING PERIODIC STRUCTURES, by J. A. Ruetz. Technical rept. no. 30 on Contract Nonr-225(24). 27 Mar 58, 157p. 21 refs; AD-156 783.
Order from LC mi$7.50, ph$24.30 PB 138 588

The possibility of obtaining gain in periodic non-propagating structures is investigated. The analysis makes use of an equivalent circuit representation of the microwave structure. The electron beam is assumed to flow through constant-field gaps followed by field-free drift regions. The gap voltage is associated with two different voltages of the equivalent circuit. One case assumes that the gap-voltage is the voltage appearing across a part of the shunt branch of the equivalent circuit while the other case assumes that the gap-voltage is the voltage across part of the series branch of the equivalent circuit. It is shown, by making traveling-wave tube approximations, that the first case reduces to a Bernier type analysis while the second is a Pierce type analysis.

Stanford Research Inst., Menlo Park, Calif.
FEASIBILITY STUDY OF AIRCRAFT ANTENNAS FOR FORWARD-SCATTER AND METEOR-BURST COMMUNICATION, by J. F. Cline. Rept. on Contract AF 19(604)3458. July 59, 63p. 38 refs. Technical rept. no. 66; AFCRC-TN-59-397.
Order from LC mi$3.90, ph$10.80 PB 143 398

The characteristics of the tropospheric forward-scatter and meteor-burst modes of propagation are discussed insofar as they affect the design of aircraft antennas. Considering the antenna design limitations, the existing frequency allocations, the propagation characteristics, and the cosmic and thermal noise spectra, it is concluded that the best frequency for air-ground or ground-air forward-scatter communication is about 225 Mc. It is also concluded that the best frequency for air-ground or ground-air meteor-burst communication is about 50 Mc, although frequencies up to somewhat above 100 Mc may be satisfactory for transmission in the ground-air detection. General types of aircraft antenna arrays are suggested for fore-and-aft or omnidirectional coverage, and estimates are given for the obtainable values of directive gain. Flush-mounted or slightly protruding antenna elements are recommended. Slot, patch, loop, and monopole elements are discussed in regard to size, location, and orientation. In particular, it is suggested that arrays of these elements be mounted on the fore part of the fuselage for forward transmission, and near the wing tips for fore-or-aft space-diversity reception.

Stanford Research Inst., Menlo Park, Calif.
A STUDY OF POSSIBILITIES FOR IMPROVING SPACE UTILIZATION AND PERFORMANCE OF RHOMBIC ANTENNAS, by Angel Martin-Caloto. Rept. on Contract AF 19(604)3458. July 59, 128p. 12 refs. Technical rept. 67; AFCRC-TN-59-572; AD-225 971.
Order from LC mi$6.30, ph$19.80 PB 143 404

A study of the mutual coupling of concentric rhombic antennas is made together with the analysis of the radiation properties of multiple concentric rhombics.

Stromberg-Carlson-San Diego, Calif.
DIGITAL COMPUTER INTERVENTION AND DISPLAY SYSTEM: MODEL 130, by John L. Moser. Final engineering rept. on Contract AF 08(616)81. May 58, 18p. ER-249; APGC-TR-58-82; AD-152 069.
Order from LC mi$2.40, ph$3.30 PB 138 560

The Digital Computer Intervention and Display System, Model 130, is designed to be used as an input-output device for the ERA 1103 computer. The equipment purpose is to allow fast, efficient communication between an operator and the computer, and to provide a means of high-speed photographic data-recording. A CHARACTRON Shaped Beam Tube and a series of Indicate Lights are used to display information to the operator. Activate buttons, intervention switches, and a Flexowriter (typewriter) are used to introduce information into the computer. A second CHARACTRON shaped Beam Tube is used to facilitate photographic recording.

Technical Research Group, New York.
NUCLEAR RESONANCE FILTERS FOR RADAR AND COMMUNICATIONS APPLICATIONS, by R. T. Daly and M. Newstein. Final rept. for 15 June 56-14 Sep 57 on Contract DA 36-039-sc-72408. 1957, 108p. 8 refs. AD-155 480.
Order from LC mi$5.70, ph$16.80 PB 138 551

A method of artificially "shimming" the inhomogeneous field of a small magnet by means of a series of radio frequency pulses applied to the nuclear induction sample has been investigated. The investigation was directed toward the development of a sharp, tunable, bandpass filter. Both analytical and experimental results show that two difficulties present themselves. First, the method is unstable with respect to small variations in the amplitude or width of the shimming pulses. Second, to realize a "quiet" sample under no-signal conditions, the shimming pulses must be of impractically short duration. For the case of an initial transverse relaxation time of 200 μsec, it is shown that 1000 shimming pulses must be applied during the transient signal build-up (20 millisec) in a glycerine sample if spurious output is to be kept below a reasonable level. Under these same conditions the shimming pulse length should be about 100 millimicrosec. Fractional variation in the amplitude x width value of the pulses must be held to 7×10^{-6}. A brief analysis of the steady state response of a filter is given under the assumption that the pulse qualities can be met; however, a conclusion is reached that it is impractical to meet these requirements.

Transitron Electronic Corp., Wakefield, Mass.
INDUSTRIAL PREPAREDNESS STUDY FOR DIFFUSED SEMICONDUCTOR DEVICES; DEVICE NO. 2, by B. B. Frusztajer, G. A. Ferris and H. C. Rudenberg. Feasibility rept. for 1 July 56-30 Nov 57 on Contract DA 36-039-sc-72714. [1957] 76p.
Order from LC mi$4.50, ph$12.30 PB 138 801

Feasibility of design and reproducibility of the fabrication procedures for device 2 has been demonstrated and 50 samples have been submitted for evaluation. Electrical and environmental performance tests meet the objectives. Data on 100°C storage indicates no significant deterioration over the 85°C storage temperature.

Union Thermoelectric Corp., Forest Park, Ill.
TWO DOUBLE CRYSTAL X-RAY DIFFRACTION SYSTEMS FOR SORTING QUARTZ OSCILLATOR BLANKS BY ANGLE, by James T. Lavan, Robert Mechanic and others. Special rept. on Contract DA 36-039-sc-71061. 15 July 58, 168p. 1 ref. AD-201 356.
Order from LC mi$7.80, ph$25.80 PB 144 068

Two double diffraction X-ray systems for the precision sorting of quartz resonator blanks according to angle are described together with full drawings and assembly and installation instructions. One system is designed specifically for the measurement of AT cuts. The other is more flexible, having provisions for the adjustment of the reference crystal. This second machine also employs a rotary, three-point, vacuum chuck, which could also be used with the fixed reference crystal, instead of the fixed, three-point, vacuum chuck. The use of one or the other of these chucks is important, especially for the accurate measurement of thin blanks. Both systems are designed for installation on a General Electric XRD-4 X-ray. Instructions for installing the fixed system on a General Electric XRD-2 are also given.

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICE, by John C. Helmer and Marcel W. Muller. Final rept. for 1 June 56-31 May 57 on Contract DA 36-039-sc-72398. [1957] 30p. 21 refs. Engineering rept. no. 189-1F; AD-143 382.
Order from LC mi$2.70, ph$4.80 PB 137 923

The properties of molecular and atomic resonance devices were investigated for use as submillimeter wave generators and/or amplifiers. Two ammonia-beam maser oscillators were constructed and tested. A maser amplifier was developed which has a gain of 20 db. The noise figure of the amplifier was measured with the aid of a novel microwave receiver which uses a maser oscillator as the second local oscillator in a double superheterodyne system. An analysis predicted the contribution of spontaneous emission to noise in maser amplifiers. The noise was considered to be a kind of thermal noise. The noise temperature of a polarized medium with n_a elements in the upper state and n_b elements in the lower states is given by $e^{h\nu/kT_e} - 1 = (n_a - n_b)/n_a$, where $h\nu$ is the energy difference between states and T_e is the temperature in question. A maser noise figure of 3.5 ± 0.5 db was measured which is constant within the experimental scatter for any gain between 18 and 32 db. A noise figure of 3.5 ± 0.1 db is predicted by the magnitude of the cavity coupling alone. The spontaneous emission noise in the beam was not observed. The possibility of developing a background gas pressure in the cavity which could contribute up to 0.7 db with an upper limit of about 0.2 db was indicated. A preliminary investigation of other molecules for use in beam-type masers indicated that the rotational energy states in linear molecules may be separated by an inhomogeneous electric field such as that used in a Townes maser.

Willow Run Labs., U. of Michigan, Ann Arbor.
RUBY AS A MASER MATERIAL, by Chihiro Kikuchi, John Lambe and others. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 22p. 29 refs. Rept. no. 2144-3-T.
Order from LC mi$2.70, ph$4.80 PB 143 626

The reasons for the initial choice of ruby as a maser material are outlined and some measurements of the parameters in the spin Hamiltonian and of spin relaxation times are reported. The relative merits of single and double pump modes of operation of a four-level are discussed and measurements of the oscillator power for the two cases are included.

Ordnance, Missiles, and Satellite Vehicles

Aberdeen Proving Ground, Md.
POWER REQUIREMENTS AND INTERNAL FRICTION OF GRAPHITE LUBRICATED MECHANISMS, FEED, 20mm, AN-M2 [AND] INVESTIGATION OF TORQUE AND FRICTION CHARACTERISTICS OF 20mm M2 FEED MECHANISMS, by J. R. Patchell and N. Karasik. Rept. no. 73, 23 Mar-4 Sep 53, on Ordnance proj. no. TS3-3014. 9 Oct 53, 29p. 8 refs. Includes BRL TN-801.
Order from LC mi$2.70, ph$4.80 PB 142 922

To determine the power input requirements, shaft speed, internal friction, and potential output of Mechanisms, Feed, 20mm, AN-M2, with dry graphite lubricant, and to compare power requirements and internal friction with values obtained with feeds lubricated by other methods, under conditions of both normal and extreme low temperature.

Air Force Missile Development Center, Holloman AFB, N. Mex.
CENTRAL INERTIAL GUIDANCE TEST FACILITY, I: ERROR ANALYSIS FOR THE VELOCITY MEASURING SYSTEM OF THE HOLLOMAN TRACK, by Hermann P. Greinel. June 59, 77p. 12 refs. AFMDC-TR-59-25; AD-216 525.
Order from LC mi$4.50, ph$12.30 PB 143 184

The influence of physical error sources on the accuracy of the Velocity Measuring System, correlating space and time, is investigated. As far as it is possible up to date, the errors involved in spacing and timing are calculated in the mean square sense, or estimated, at least. The predominant effect of the random yaw-motions of the sled is shown as the main result of the study. Additional effort is requested to reduce the influence of this vibrational error source. To obtain an estimate of the relative error in velocity, finally, a comparison of the formulae of Beutler and Rauch, of the Midwest Research Institute, and of Dr. Moore, STL, is carried through.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE PENETRATION OF STEEL SPHERES INTO TISSUE MODELS, by Arthur J. Dziemian. Aug 58, 43p. 14 refs. CWLR-2226.
Order from LC mi$3.30, ph$7.80 PB 143 694

The penetrations of 3/16-, 1/4-, 3/8-, and 7/16-inch steel spheres, at striking velocities up to 1000 m./sec., into 20 per cent gelatin tissue models at 10.8°C. were studied by the use of high-speed motion pictures. By integration of the equations, the velocity, time or distance of penetration at any point in the target could be calculated if the striking velocity and size and weight of the sphere were known.

Astronautics Inst., Westinghouse Electric Corp., Baltimore, Md.
PERFORMANCE OF CLOSED-LOOP FLIP-FLOP CONTROL SYSTEMS IN MISSILES AND ROCKETS, by Milton Rogers (Air Force Office of Scientific Research) and George Shapiro. 15 Apr 59, 71p. 5 refs. AFOSR-TN-59-349; AD-213 677.
Order from LC mi$4.50, ph$12.30 PB 143 593

The basic concepts underlying the synthesis and analysis of closed-loop, flip-flop control systems of the electro-mechanical type are developed. Generalized design and analysis charts are presented to aid the engineer in quickly gaining an understanding of the relative importance of various elements in the system to the system's performance and stability. The importance of considering not only control-system dynamics, but also the damping provided by the airframe in developing practical flip-flop control systems is forcefully demonstrated to the engineer and scientist. Analog computer data, obtained as part of the present study, are used to substantiate analytic approaches and to advance the understanding of such systems.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DESIGN OF AN OPTICAL INSTRUMENT (SMT) FOR SMALL, HIGH VELOCITY MISSILES. by W. J. Carrion. Aug 58, 27p. 7 refs. Rept. no. 1053.
Order from LC mi$2.70, ph$4.80 PB 138 615

The design and development of an instrument for acquiring trajectory data of small, high velocity missiles at great distances are discussed. A new optical technique for instrument alignment is described. Tests of the instrument are described and the capabilities of the instrument in a wide field of application are noted.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DOPLOC TRACKING FILTER, by Victor W. Richard. Oct 58, 23p. 7 refs. Memo rept. no. 1173.
Order from LC mi$2.70, ph$4.80 PB 143 260

The operation and application of a phase-locked, audio frequency, tracking filter is described. The filters' primary function is to provide large improvements of the signal-to-noise ratio of noisy doppler signals by extreme reduction of bandwidth. Bandwidths adjustable from 0.5 to 50 cps are presently available, capable of operating when the input signal is 36 db below the noise, i.e., noise power 4000 times the signal power. The center frequency of the electronic bandpass filter tracks the input frequency by means of a phase-locked servo loop. A unique feature of the filter is the employment of a third order servo control system which makes it possible to maintain lock-on to the signal under dynamic flight conditions, thus obtaining maximum signal-to-noise improvement by permitting use of narrowest possible bandwidths.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INSTRUMENTATION, FLIGHT SUMMARIES AND ASPECT DATA OF NIKE-CAJUN ROCKETS OB6.04, OB6.06 AND OB6.15, by Spence T. Marks and Joseph M. Conley. Upper Atmosphere Research rept. no. 8, June 59, 34p. 7 refs. Memo. rept. no. 1214.
Order from LC mi$3.00, ph$6.30 PB 143 146

A series of Nike-Cajun rocket firings for the purpose of conducting magnetometer experiments to an altitude of 140 km are described. Flight objectives are enumerated. The nose cone instrumentation is described in some detail. Flight summaries for the three rockets are given. Aspect magnetometer data are also presented. The precession magnetometer data are being reduced, and will be the subject of a separate report. The firings here reported were part of a series conducted by these Laboratories during the International Geophysical Year, and were supported in part by the National Science Foundation under NSF Grant Number Y/10.14/151.

Defense Research Lab., U. of Texas, Austin.
THE EQUATIONS OF MOTION OF AND EQUIVALENT CIRCUITS FOR A GEOPHONE, by C. W. Horton. Rept. on Contract DA 44-009-eng-2073. 18 Oct 54, 23p. 2 refs. DRL Acoustical rept. no. 84.
Order from LC mi$2.70, ph$4.80 PB 143 731

Defense Research Lab., U. of Texas, Austin.
A PRELIMINARY STUDY AND ANALYSIS OF THE MECHANICAL-ACOUSTICAL IMPEDANCE OF THE EARTH, by E. L. Hixson and J. F. Mifsud. Final rept. on Contract DA 44-009-eng-2073. 21 Aug 56, declassified 14 Mar 58. 70p. 21 refs. DRL-A-111.
Order from LC mi$3.90, ph$10.80 PB 143 726

A device has been built which measures the driving-point impedance of the ground from 50 cps to 350 cps. The experimental dependence of the driving-point impedance on soil parameters such as particle size, moisture content, and density has been measured. Discontinuities in the ground such as cracks or stratifications show up as circles or loops on the complex impedance plot and also change the magnitude of the impedance, particularly at the low frequency end. The impedance increases over a buried mine if the mine is less compliant than the soil in which it is buried and vice versa. Some experimental results also are given on the dependence of the driving-point impedance on the size of the driving piston and the magnitude of the static and dynamic force. Equivalent electric circuits of the driving-point impedance are discussed. In agreement with the recommendation of the Panel on Acoustic Detection of Buried Land Mines, it is suggested that an automatic impedance recording device be constructed. This new system could be used for both a more complete study of the driving-point impedance of soils and buried objects and the measurement of transfer admittance.

Defense Research Lab., U. of Texas, Austin.
A STUDY OF THE PROPAGATION OF SOUND WAVES NEAR THE SURFACE OF THE EARTH AND THE MEASUREMENT OF THE DRIVING-POINT IMPEDANCE OF THE EARTH, by W. R. Runyan and J. F. Mifsud. Interim technical rept. on Contract DA 44-009-eng-2073. 10 Mar 55, declassified 12 Mar 58, 57p. 33 refs. DRL Acoustical rept. no. 88.
Order from LC mi$3.60, ph$9.30 PB 143 730

The work already accomplished consists of (1) the design of a system which will measure the driving-point impedance of the ground in the frequency range of 50 to 350 cps, (2) the measurement of the driving-point impedance of a silty sand and a clay soil as a function of frequency, and (3) a few measurements of the velocity of the Rayleigh wave on the surface of a semi-infinite soil.

Defense Research Lab., U. of Texas, Austin.
THE STUDY OF SOME ACOUSTIC PROPERTIES OF SOILS, by S. J. Brient and E. L. Hixson. Final technical rept. on Contract DA 44-009-eng-2875. 30 30 Sep 57, declassified 14 Mar 58, 49p. 5 refs. DRL Acoustical rept. no. 128.
Order from LC mi$3.30, ph$7.80 PB 143 724

The performance of any acoustic buried mine detector depends on the acoustic properties of soils. A study of the surface characteristics has been made using the impedance concept. Several devices have been developed for measuring force and the resulting velocity and an automatic computer-recorder has been built to calculate and plot impedance as the measurement is made. Driving-point impedance measurements have been made over several buried objects and the surface characteristics noted. In a study of the problem in increasing detector range some transfer impedance and velocity transfer functions have been measured. Impedance information has been used to predict the transient response of a soil to an impulsive force and the results verified experimentally. The results and information collected have been applied to the detection problem and some acoustic mine detection principles are presented.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
OPTIMUM SEARCH PROCEDURES: DISCRETE CASE, by Frank Proschan and William Pruitt. Rept. on Contract DA 36-039-sc-73170. 1 Aug 57, 24p. Technical memo. no. EDL-M112; AD-153 346.
Order from LC mi$2.70, ph$4.80 PB 138 565

Optimum search procedure is derived mathematically. An enemy missile is assumed to arrive at some time and in some location with some corresponding probability which is uniform over time. Detection of the enemy plane occurs with some fixed probability w when the search equipment scans its location. The resultant gain is some specified function of time arrival and detection. Proof is given that the scans devoted to a given location should be regularly spaced over time. The ideal proportion of scans devoted to a given location is determined explicitly as a function of the probability of missile arrival in the given location. For a large class of payoff functions, the ideal proportion of scans allocated to the i^{th} location is proportional to a corresponding power of the probability p_i. The solution does not depend on the probability of detection. A numerical example for a 6-location case is given to compare the ideal procedure with alternative procedures. Actual search schedules are presented.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
CHARACTERISTICS OF VARIOUS METHODS OF COLLECTING DATA IN TESTS OF INCREASED SEVERITY, by Alonzo Bulfinch. Aug 59, 24p. 10 refs. Technical rept. 2627.
Order from LC mi$2.70, ph$4.80 PB 143 720

The need for a better understanding of the characteristics of methods for collecting data in tests of increased severity is described. A number of problem areas in Ordnance research are listed in which tests of this kind are required. Characteristics of various standard methods and some of their modifications have been studied by Monte Carlo techniques. The results of sampling known normal and skewed distributions are evaluated. The relation of tests of increased severity to reliability testing is pointed out.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF UNIVERSAL HIGH-ALTITUDE, HIGH-TEMPERATURE-RESISTANT SQUIBS WITH AND WITHOUT RF AND MF PROTECTION, by Charles Knapp. Oct 59, 30p. 11 refs. Technical rept. 2653; AD-226 825.
Order from LC mi$2.70, ph$4.80 PB 142 488

Prototypes of universal high-altitude, high-temperature-resistant squibs both with and without RF and microwave frequency (MF) protection, have been developed. They are designed to endure such outer space conditions as temperatures of 200°C; vacuums of 10^{-8} mm mercury; and the vibration, acceleration, and shock of rocket launching and flight. Outstanding features of the new squibs are the hermetic sealing of the charge compartment and the use of materials of very low vapor pressures--stainless steel, Kovar, and glass or ceramics.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J
EXPERIMENTAL VERIFICATION OF EXPRESSION FOR RATE OF FALL OF PARACHUTE-SUSPENDED FLARE, by Matthew Nowak and Jesse F. Tyroler. July 59, 18p. Technical rept. 2623; AD-214 769.
Order from LC mi$2.40, ph$3.30 PB 143 320

An expression for the distance traveled as a function of time for a flare assembly suspended from a parachute was derived on the basis of the assumption that the frictional drag is expressible as a function of the velocity ($M=KV^2$), This expression was verified by comparing values obtained from it with experimental values. The derived values agreed with the experimental data to within less than 5%. The work done makes possible the use of the expression with a known degree of confidence.

Feltman [Research and Engineering] Labs., Picatinny Arsenal, Dover, N. J.
THE MECHANISM OF IGNITION AND PROPAGATION OF OXIDANT-METAL FLASHES, by Joseph Hershkowitz. Apr 58, 46p. 6 refs. Technical rept. 2526; AD-156 424.
Order from LC mi$3.30, ph$7.80 PB 138 639

The physics of a system consisting of a small quantity of explosive, centrally located in a case containing an oxidant/metal flash composition has been qualitatively described on the basis of an experimental study.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
QUANTITATIVE STUDY OF PARAMETERS AFFECTING BULLET SENSITIVITY OF EXPLOSIVES, by Samuel D. Stein. Sep 59, 63p. 7 refs. Technical rept. 2636; AD-226 111.
Order from LC mi$3.90, ph$10.80 PB 143 822

Rifle-bullet sensitivity tests (Caliber .30) were conducted to determine the extent to which explosive-column length, thickness of confining wall, and kind of wall material affect the bullet sensitivity of commonly used explosives. Also studied was the feasibility of evaluating the test results quantitatively by measuring the magnitude of the shock wave generated when an explosive detonates.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
STATIC TEST DEVICE WHICH SIMULATES GUN-FIRING PRESSURE ON BASE OF SHELL, by Samuel D. Stein, Stanley J. Lowell, and Richard W. Snook. Aug 59, 38p. 3 refs. Technical rept. 2640.
Order from OTS $1.00 PB 151 801

The device consists principally of a test chamber in which a propellant charge is fired, a locking mechanism to hold the test specimen in position, ventings, and auxiliary component parts and instrumentation. The device generates pressures up to 50,000 psi over a period of approximately 1 to 2 milliseconds. In addition to simulating the conditions to which the bases of shell are subjected during gun firing, the device can be used to study the strength and permeability of materials and joints under high pressures at ultra high rates of loading and to study the strength of materials under rapid compression. Its use should eliminate costly gun firing tests.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
THERMOANALYSIS OF BINARY SYSTEMS: $KClO_4$/ALKALI AND ALKALINE EARTH METAL NITRATES, by Virginia D. Hogan and Saul Gordon. Sep 59, 29p. 6 refs. Technical rept. 2608.
Order from LC mi$2.70, ph$4.80 PB 143 903

To investigate the high temperature physicochemical behavior of binary oxidant mixtures containing potassium perchlorate and the nitrates of the alkali and alkaline earth metals (lithium, sodium, potassium, rubidium, cesium, calcium, and strontium).

Institute for System Research, U. of Chicago, Ill.
DETERMINING AIR REACTIONS ON MOVING VEHICLES. PART III. METHODS OF HYDRODYNAMICS, by M. Z. Krzywoblocki. Rept. on Contract AF 33(616)5689. July 59, 217p. 820 refs. WADC Technical rept. 56-51, Pt. 3.
Order from OTS $3.50 PB 161 141

The present report describes briefly the most important methods of hydrodynamics to calculate the forces and moments acting on a body moving in a fluid which is at rest or on a body at rest in a moving fluid. Only the most distinguished features of each method under discussion are presented. The report is divided into two parts: incompressible and compressible fluids. Each part contains a separate list of references and separate numeration of equations. Along with the discussion of the most advanced methods in each part there are briefly mentioned some more advanced papers on the subject in question. Under the definition of "hydrodynamic methods" we understand the mathematical methods which have a full rigor of analysis. This implies that all the methods discussed in this report have mathematical justification and no approximative assumptions of an intuitive nature are introduced.

Institute of Molecular Physics, U. of Maryland, College Park.
ELECTRONIC TRANSIENT RECORDER FOR TRACKING OF HIGH SPEED PROJECTILES, by D. Ritke and E. White (Naval Ordnance Lab.). Rept. on Contract Nonr-595(02). 19 Nov 58, 33p. 12 refs. IMP-ONR-1.
Order from LC mi$3.00, ph$6.30 PB 143 457

A microwave interferometer system which is used to follow the motion of a high speed projectile is described. A block diagram is given for the complete apparatus as well as diagrams for the component units. The system described here differs in some respects from other microwave systems reported in the literature.

Integrated Range Mission, White Sands Missile Range, N. Mex.
A HIGH FREQUENCY DIRECT-WRITING RECORDER, by Robert C. Barto. 15 July 58, 43p. 5 refs.
Order from LC mi$3.20, ph$7.80 PB 143 357

A direct-writing analog recorder has been developed to provide "quick-look" recordings of telemetry data. The instrument produces high-resolution oscillogram records on electrophotographic paper. A xerographic process is used that allows a continuous and automatic processing of the record in the instrument. The result is a permanent record made without the use of wet chemical processing. The permanent, high-contrast record can be reproduced by Ozalid or Bruning processes, as well as photographically. Sensitizing, exposing, developing, and fixing are accomplished at paper speeds of one-half inch per second to sixteen inches per second. After exposure, the developed record can be viewed in the time required for four inches of chart movement. This corresponds to eight seconds for the slowest paper speed and one-quarter second for the highest paper speed.

Naval Ordnance Lab., Corona, Calif.
DESIGN CONSIDERATIONS IN THE USE OF SOLENOIDS IN SAFETY-ARMING DEVICES, by W. B. Lunt and R. E. Tafel. 3 Sep 59, 50p. NAVORD rept. 5952; NOLC rept. 451.
Order from LC mi$3.30, ph$7.80 PB 144 111

In a certain guided missile safety-arming device (S-A), reopening of the once-activated solenoid circuit caused the coupling of large transient voltages into the otherwise independent detonator circuit, and resulted in premature initiation. These electrical difficulties stemmed solely from the use of a solenoid as the S-A launch-latch actuator. This report details the investigation of the S-A in question and discusses the results obtained. Various corrective measures are considered, and recommendations are made for incorporating such improvements in future S-A's.

Naval Ordnance Lab., White Oak, Md.
UNDERWATER SHOCKWAVE PARAMETERS FOR TNT, by John P. Slifko and Thomas E. Farley. 1 June 59, 27p. 16 refs. NAVORD rept. 6634.
Order from LC mi$2.70, ph$4.80 PB 143 823

Free water shockwave parameters obtained from 80-pound spherical TNT charges, covering the scaled reciprocal range of $W^{1/3}/R$ from 0.08 to 0.6 $lbs^{1/3}/ft$, and similitude lines for peak pressure, time constant, impulse and energy are presented.

Naval Ordnance Test Station, China Lake, Calif.
SEA ANIMALS AND TORPEDOES, by William C. Shaw. 10 Aug 59, 49p. 103 refs. NOTS TP-2299; NAVORD-6573; AD-226 362.
Order from LC mi$3.30, ph$7.80 PB 143 824

Various aspects of sea-animal locomotion are surveyed in the light of the tactical propulsive requirements placed upon torpedoes. Intensive investigation looking toward the eventual application of the fundamental principles of locomotion that are utilized by the sea animals (without necessarily imitating their structure) is believed to offer a new

avenue of approach toward achieving the silent and efficient operation that is so essential for effective homing and stealth.

Naval Proving Ground, Dahlgren, Va.
SATELLITE TRAJECTORY AND ORBIT CALCULATIONS FROM MINITRACK TRIANGULATION, by W. A. Kemper. 8 Dec 58, 62p. 6 refs. NPG rept. no. 1633.
Order from LC mi$3.90, ph$10.80 PB 138 538

This work was undertaken to provide information on the performance of the Vanguard satellite launching vehicles during the third stage burning and also to provide a back-up prediction of the orbit or trajectory from simultaneous Minitrack data taken at Grand Turk and Antigua. The report describes the calculation procedures used and the results obtained through May 1958. The calculations are made in three steps. First, position coordinates are obtained by a least squares triangulation using simultaneous data from the two stations. Then a "best" fit is made to the position coordinates using orthonormal polynomials, and smooth position, velocity and acceleration are obtained. With these data as initial conditions, trajectories are integrated around an oblate spheroidal earth with a gravity field corresponding to the figure of the earth. Results are given for 1958 α and β and on the orbit attempts of Explorer II and SLV I.

[Naval Weapons Plant] Washington, D. C.
THE DESIGN OF AN ELECTROMECHANICAL SERVOMECHANISM WITH PHOTO ELECTRIC ERROR DETECTION, by Ralph C. Liebowitz and Seymor Kant. 30 June 49, issued 5 Jan 58. 89p. 6 refs. Technical rept. no. NGF-T-42-57; NAVORD rept. no. 5526; AD-152 772.
Order from LC mi$4.80, ph$13.80 PB 138 596

A servomechanism has been designed using two independent servo loops with a photoelectric cell as the error detecting device. Mathematical analysis shows that if the angle of rotation of the mirror which reflects light to the photocell along two orthogonal paths does not exceed 20 minutes then the two servo loops are mutually independent and the photocell voltage output will be a linear function of the error angle for each servo. The servomechanism has been designed by means of the "decibel-log-frequency" type of synthesis and a detailed mathematical analysis shows that the design specifications are satisfied.

Picatinny Arsenal, Dover, N. J.
DICTIONARY OF EXPLOSIVES, AMMUNITION AND WEAPONS (GERMAN SECTION) by Basil T. Fedoroff, Henry A. Aaronson and others. 1958 [declassified 20 July 59]. 352p. Technical rept. no. 2510.
Order from OTS $4.00 PB 161 270

This compilation has been made with the object of providing a ready reference to the subject matter covered by means of an alphabetical arrangement. In general, only sufficient information is furnished for understanding of the principles, meaning of terms, process, mechanical layout etc. Numerous references to original sources are provided for those seeking more detailed information. Classified information has been carefully excluded. However, a few classified references have been given to permit further study by those with authorized access to such sources. No attempt has been made to include all data and information available to the Ordnance Corps.

Rock Island Arsenal Lab., Ill.
GAMMA RADIATION OF PACKAGING MATERIALS, by W. F. Garland. 31 July 59, 19p. 19 refs. Rept. no. 59-2056.
Order from OTS $0.50 PB 161 097

This report summarizes the results obtained from exposing ten barrier materials or component parts over a dose range of 1.4×10^6 to 30.1×10^6 Rad. Spent reactor fuel elements were used as the source of gamma (ionizing) radiation. The study was of an exploratory nature. Although all materials were degraded somewhat by the highest dose of radiation, the plastic films seemed to be the least affected. Among the materials evaluated, cotton scrim was the poorest of the materials, losing approximately 60% tensile strength at 30.1×10^6 Rad.

Springfield Armory, Mass.
UTILIZATION OF INVESTMENT CASTINGS FOR SMALL ARMS WEAPON COMPONENTS, by J. F. Panda. 26 June 59, 42p. Rept. SA-TR19-1004.
Order from OTS $1.25 PB 161 268

An investigation was conducted to determine the feasibility of using investment castings for components of various small arms weapons. Description of the procedure used in fabricating components by the investment casting method is discussed.

Systems Labs. Corp., Sherman Oaks, Calif.
THE GEODETIC USE OF ARTIFICIAL EARTH SATELLITES. Final rept., Pt. 1, on Contract AF 19(604)5517. 15 Aug 59, 127p. 53 refs. CMCC 24.9; AFCRC-TR-59-276, Pt. 1.
Order from OTS $2.75 PB 161 147

This report discusses various ways in which an artificial earth satellite may be used to provide the geodesist with more accurate information about the relation between different geodetic datums. The various available methods are discussed both from a general point of view and in terms of a number of specific methods which have been proposed for this purpose. These include both optical and electronic techniques and in each case the predicted accuracy of the principal datum ties is discussed. Connection methods based both on orbit prediction and on simultaneous visibility of the satellite from the datums are investigated. The report is divided into two parts; Part I presents a general, non-mathematical discussion of the problems and methods and summarizes our principal conclusions; Part II presents a more detailed technical analysis of the accuracy of various methods, of equipment design and performance and of the effects of physical phenomena, such as ionospheric and atmospheric fluctuations, on the measurements.

Systems Labs. Corp., Sherman Oaks, Calif.
THE GEODETIC USE OF ARTIFICIAL EARTH SATELLITES. Final rept., Pt. 2, on Contract AF 19(604)5517. 15 Aug 59, 87p. 51 refs. CMCC 24.10; AFCRC-TR-59-276, Pt. 2.
Order from OTS $2.25 PB 161 148

This part of the report constitutes a technical appendix to Part I, and a number of mathematical and technical questions are analyzed in some greater detail here. There has not been any attempt made to ensure continuity between the sections here, and apart from the first three each may be read largely without reference to the others. As far as possible the notation has been kept consistent, and with some exceptions conforms to conventional usage. (See also PB 161 147)

Sanitation and Safety Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
DEVELOPMENT OF THE CLOSURE, PROTECTIVE SHELTER, ANTIBLAST, 600 CFM, E19R1, PART I, by Frank G. Ort and Merton D. Mears. Jan 59, 72p. 5 refs. CWLR-2269.
Order from LC mi$4.50, ph$12.30 PB 143 718

This report covers the development of the Closure, Protective Shelter, Antiblast, 600 cfm, E19R1. The unit was designed for use in the inlet and exhaust ducts of CBR protective shelters to provide protection against blast effects for personnel, filter units, ducts, and installed equipment. The closure unit is applicable to flows other than the design flow capacity of 600 cfm. The E19 antiblast closure, and its improved version the E19R1, satisfactorily met the special and protective requirements established by the Bureau of Yards and Docks, Department of the Navy. Shock-tube tests on the units were conducted at APG and its successful performance in the field under conditions of an atomic exposure at the Nevada Proving Ground is described. A plan for further work to provide additional engineering design and performance data for this type of antiblast closure is given.

Naval Research Lab., Washington, D. C.
ALGAE AND SUBMARINE HABITABILITY: AN APPRAISAL, by John M. Leonard. 26 Aug 58, 9p. 17 refs. Rept. 5182.
Order from LC mi$1.80, ph$1.80 PB 134 259

The feasibility of using algae in submarine air purification has been explored through an examination of the scientific literature. Without minimizing the serious biological and engineering problems, the writer believes that the prospects warrant serious experimental investigations. An estimate of 300 to 440 kilowatts is offered as the power requirement of the system. Various possible sources of illumination are examined. The writer recommends the seeking out of algae of optimum properties, the search to include chemical- and radiation-induced mutants. Chemical growth-stimulators should be closely studied. Construction of a pilot-plant exchanger would furnish valuable engineering experience.

Naval Research Lab., Washington, D. C.
A SOLID-PROPELLANT PRESSURIZER FOR FIRE-EXTINGUISHING SYSTEMS IN POLAR REGIONS, by J. K. Musick and J. A. Grand. Final rept. 3 Aug 59, 29p. 8 refs. NRL rept. 5332.
Order from OTS $0.75 PB 151 737

A solid-propellant pressurizer with an automatic firing device for a 300-gallon sprinkler system has been developed. The unit is designed to operate from -65°F to room temperature. One 300-gallon sprinkler system can provide fire protection for two 20 x 48 ft buildings. The pressurizer employs the combustion gases of a double-base propellant to expel the extinguishant. The propellant is shaped into a hollow cylinder, 3-1/4 inches in diameter and 4-1/2 inches long. These cylinders, or grains, can be burned either singly or coaxially in groups of two or three. This feature, with the selection of suitable nozzles and other hardware, permits the use of different sizes of cartridges while retaining the advantages inherent in the use of a single propellant-grain design. The use of different sizes of cartridges is advantageous, since the volume of space to be pressurized varies widely as the operation of the sprinkler system proceeds. The cartridges are fired at the proper time and in the proper sequence by a battery-powered firing system which employs two pressure switches and a stepping relay, and which is triggered by pressure changes in the sprinkler tank and loop. To initiate operation, a supervisory pressure of 10 to 15 psi is maintained in the sprinkler loop. When this pressure is reduced to 5 psi by the opening of one or more sprinkler heads, the first cartridge is fired. The high pressure (about 100 psi) resulting from the combustion of the first cartridge arms the firing system preparatory to firing the second cartridge. When enough fluid has been expelled through the open heads to reduce the pressure in the system to a predetermined level (about 35 psi), the second cartridge is fired. The process is then repeated automatically until all the cartridges are fired or until the line switch is opened manually. It appears that four cartridges will be sufficient for a 300-gallon system, although the use of a greater number would not require any basic changes in design.

Ship Building

Bureau of Yards and Docks, Washington, D. C.
TOWING NONSELF-PROPELLED FLOATING STRUCTURES. 1 Oct 53, 74p. Technical Pub. NAVDOCKS TP-Pw-26.
Order from OTS $2.00 PB 161 255

This publication has been prepared as a technical guide for naval and civilian personnel concerned with the preparation for towing of all floating craft within the Bureau's area of technical responsibility. Presented herein are the technical criteria used in the design, planning, and installation of towing equipment.

Experimental Towing Tank, Stevens Inst. of Tech., Hoboken, N. J.
METHODS FOR ESTIMATING THE LONGITUDINAL AND LATERAL DYNAMIC STABILITY OF HYDROFOIL CRAFT, by Paul Kaplan, Pung N. Hu, and Stavros Tsakonas. Rept. on Contract Nonr-263(14). May 58, 86p. 23 refs. Rept. no. 691.
Order from LC mi$4.80, ph$13.80 PB 143 133

The equations of motion of tandem hydrofoil craft in both longitudinal and lateral modes, each mode having three degrees of freedom, are derived on the basis of the linear theory of small disturbances. Various stability derivatives appearing in the equations are determined in terms of the lift and drag forces acting at the foils, together with their derivatives with respect to angle of attack and depth. Various theoretical and experimental methods for determining these hydrodynamic quantities are discussed in the report. Stability criteria for both the longitudinal and lateral dynamic stability of hydrofoil craft also are presented. The results may be used for estimating the dynamic stability of hydrofoil craft while in the preliminary design stage, and it is expected that the equations are sufficiently accurate to indicate the trends in the degree of dynamic stability as changes are made in the design configuration.

Experimental Towing Tank., Stevens Inst. of Tech., Hoboken, N. J.
SHIP BEHAVIOR AT SEA, LECTURE NOTES ON; SECOND SUMMER SEMINAR HELD AT STEVENS INST. OF TECH., JUNE 16-20, 1958. Rept. on Contracts Nonr-263(10, 19). Nov 58, 188p. 62 refs. Rept. no. 708.
Order from LC mi$8.40, ph$28.80 PB 143 481

Institute of Engineering Research, U. of California, Berkeley.
MARITIME CARGO TRANSPORTATION, L. M. Tichvinsky. Final rept. on Contract Nonr-222(36). Oct 58, 7p. 4 refs. Series no. 105, issue no. 3.
Order from LC mi$1.80, ph$1.80 PB 143 793

Iowa Inst. of Hydraulic Research, Iowa City.
ROLL DAMPING DUE TO BILGE KEELS, by Milton Martin. Rept. on Contract Nonr-1611(01). Nov 58, 63p. 24 refs.
Order from LC mi$3.90, ph$10.80 PB 143 734

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Forest Products Lab., Madison, Wis.
DEVELOPMENT OF A CASE LINER FOR LONG-TERM OUTDOOR STORAGE (FOURTH-YEAR INSPECTION), by Louetta Dieruf and Donald J. Fahey. June 59, 32p. Rept. no. 55-2-4.
Order from LC mi$3.00, ph$6.30 PB 143 280

This is the fourth in a series of reports made after annual examinations of 10 boxes and their contents returned from each of 4 outdoor exposure sites. Results of this fourth-year examination indicate that, of the three species of pretreated wood considered for use as boxes, Douglas-fir best protected the liner and its contents, and red oak was the least effective. The liner of polyethylene film, foil, and scrim was still superior to the liners consisting of polyethylene film and kraft paper combinations. Of the four sites, Panama's high temperature and moisture had the most detrimental effect on boxes, liners, and contents.

Food

Alabama U., University.
FACTORS CONTRIBUTING TO FOOD MONOTONY, by Paul S. Siegel. Rept. no. 5 (Final) for 7 Feb 55-6 July 56 on Contract DA 19-129-qm-264. [1956] 19p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 143 782

The present study was specifically designed to generalize to other and different menus the finding that acceptance declines with repetition, to re-examine the relationship between acceptance decline and initial palatability, to evaluate two different psychological tests as possible predictors of susceptibility to monotony, and to assess certain selected dehydrated and frozen items with respect to monotony production. Additionally, opportunity was found to pursue several fresh leads or hypotheses.

California U., Berkeley.
CAROTENOID STABILITY OF CARROTS, by G. MacKinney. Rept. no. 1 (Final) for 3 June 55-31 Dec 56 on Contract DA 19-129-qm-420. [1956] 12p. QFCIAF File no. V-327.
Order from LC mi$2.40, ph$3.30 PB 143 777

Three main lines of research were followed: (1) Impregnation of the diced carrot with a suitable antioxidant prior to dehydration. (2) Use of an oxygen scavenger added to the container in which the dehydrated product was to be stored. (3) Use of high vacuum, 28.5-29 inches, as encountered in the coffee industry packs. Of the three procedures, the last mentioned was successful. Samples stored at 104, 122, 140° F (40, 50, 60° C, respectively) showed no change in carotene content after three months in the absence of oxygen. By contrast, results with the antioxidant, propyl gallate, showed only partial protection of the pigment. Tests with the oxygen scavenger made at the request of the Quartermaster Food and Container Institute were inconclusive for various technical reasons not subject to our control. In principle it would appear also to be a workable procedure for eliminating the oxygen from the container.

Cremer, H. D.
STUDIES AND INVESTIGATIONS ON THE REQUIREMENTS OF VITAMIN B_1 IN DIFFERENT DIETS, by H. D. Cremer. Final technical rept. for 1 Sep 58-31 Aug 59 on Contract DA 91-508-EUC-374. [1959] 19p. 13 refs.
Order from LC mi$2.40, ph$3.30 PB 143 449

The method as developed for thiamine determination in urine was proved on its accuracy and specifity as well as tested on its appropriatness of vitamin B_1-determination in food-stuffs. It was the purpose of these investigations to study if sorbitol administration improves the maintenance of thiamine in the human in a similar way as found in the rat. It is concluded from these studies that sorbitol administration in the human and in the rat effects a stimulation of the thiamine synthesis of the intestinal microorganisms. Since absorption in the lower digestive tract is decreased, the main part of the intestinal vitamin production can not be utilized in the human, while an utilization takes place in the rat by coprophagia.

Food and Drug Research Labs., Inc., Maspeth, N. Y.
THE DEVELOPMENT OF METHODS FOR THE MEASUREMENT OF VITAMIN A IN PACKAGED RATIONS, by Kenneth Morgareidge. Rept. nos. 10, 11, and 12 (Final) for 1 June 55-31 May 57 on Contract DA 19-129-qm-392. [1957] 26p. File no. N-1127.
Order from LC mi$2.70, ph$4.80 PB 143 780

Two satisfactory methods for the determination of Vitamin A in packaged rations have been developed. One employs a single magnesia-celite column for partial isolation of the vitamin from a hexane extract of the unsaponifiable fraction of the food. Vitamin A is estimated on the basis of its blue color reaction with antimony trichloride. The second method is a refinement of the first in that the eluate from the magnesia column is further purified by re-chromatographing on weakened alumina after which the vitamin A content is determined by ultraviolet spectrophotometry.

Illinois U., Urbana.
ISOLATION AND IDENTIFICATION OF THE STALE-FLAVOR COMPONENTS WHICH DEVELOP IN DRY WHOLE MILK (AS A RESULT OF RADIATION), by R. McL. Whitney. Rept. no. 5 (Final), 26 June 55-25 June 57, on Contract DA 19-129-qm-483. [1957] 35p. 21 refs. File no. D-319.
Order from LC mi$3.00, ph$6.30 PB 143 776

New or modified fractionation techniques were developed for concentrating the stale-flavor components, and the following information was secured concerning the chemical and physical properties of the stale flavor: (1) The stale-flavor components are soluble in butteroil, petroleum ether, alcohol, CCl_4, and CS_2 but are relatively insoluble in water or 50% aqueous alcohol. (2) They distribute themselves between the various fractions of stale reconstituted milk according to the amount of butteroil in the fractions. (3) They are apparently not acid or γ- and δ- decalactones. (4) They are volatile with steam or CCl_4-vapor at both atmospheric and reduced pressures, but their volatility varies with the particular material being investigated. (5) Seven p. p. m. of the pertoleum-ether-soluble fraction of the steam distillate is sufficient to produce a detectable stale flavor in fresh milk. (6) The infrared adsorption spectra of the CS_2 and CCl_4 extracts of the steam distillate of stale fats indicate that the stale-flavor components may contain the following groups: $-CH_3$; $-CH_2-$; ester or lactone C = O; aldehyde or ketone C = O; aliphatic ether $-\dot{C}-O-$; unsaturated ether -C-O-; and cis $-\dot{C}=\dot{C}-$ or $>C=CH_2$.

The storage study of the irradiated dried whole milk indicated that the irradiated products were always described by the judges as gluey, burnt, or scorched while the control samples were considered typically stale. Thus the two flavors were not the same or similar. The flavor of the irradiated samples did not change in character on storage but continued to increase in intensity throughout the storage period. Neither temperature of storage nor irradiation dosage appears to have a consistent effect upon the flavor of the irradiated samples.

Oregon State Coll. Agricultural Experiment Station, Corvallis.
RESISTANCE OF MICROORGANISMS TO IONIZING RADIATION APPLIED TO FOOD, by P. R. Elliker. Rept. no. 6 (Final) for 15 Aug 56-14 Aug 57 on Contract DA 19-129-qm-730. [1957] 33p. 1 ref. QFCIAF File no. S-547; AD-154 835.
Order from LC mi$3.00, ph$6.30 PB 138 804

Microbial examination of meat and poultry products revealed microorganisms that can survive radiation intensities considered to be in the sterilization range. Samples examined at 20 weeks' storage showed varying degrees of decomposition, either enzymatic or bacterial in nature. Combinations of irradiation and antibiotics may have some value if the irradiation level is less than 10^6 rep (930,000 rad) and the level of the antibiotic high enough to leave an effective residual quantity. Recent investigation has revealed that the antibiotics are destroyed at the proposed sterilization dosages and in some instances may actually offer some protection to the microorganisms. With the exception of salt none of the commonly used preservatives have shown promise in inhibiting growth of radiation-resistant bacteria because of the high levels required for the radioresistant cocci. It may be possible to inhibit the organisms with low levels of salt (sodium chloride). The combination of heat and radiation has not proven effective in sterilizing food material, unless both high temperature and high levels of radiation are used. Our results to date indicate that heat which will inactivate most enzymes does not destroy the sporeforming species.

Southern Research Inst., Birmingham, Ala.
STUDY OF FLAVOR AND CHEMICAL CHANGES IN FOODS DURING STERILIZATION BY IRRADIATION, by Robert E. Burks, Jr. Rept. no. 8 (Final), 1 Sep 56-31 Oct 57, on Contract DA 19-129-qm-740. 7 May 58, 44p. 16 refs. File no. S-530.
Order from LC mi$3.30, ph$7.80 PB 143 775

This is a summary report on work done to elucidate the chemistry of the characteristic flavor of irradiated beef. Gas-chromatography confirmed the conclusion that methylamine, ethylamine, ammonia, and other amines are produced by the irradiation of beef. Radiation lowers the respiration rate of beef. The total volatile-base content of irradiated beef definitely increased during storage. The changes in water-extractable carbonyls, hydrogen sulfide, and methyl mercaptan conformed less closely to a definite pattern. The deactivation of enzymes by heating had some benefit in improving the flavor of stored irradiated beef. Exhaustive lyophilization failed to deodorize beef, so much of the odor must be caused by large molecules or compounds which are constantly being released.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Rodman Lab., Watertown Arsenal, Mass.
EVALUATION OF ALLOY BINDER SYSTEMS IN CEMENTED CARBIDES, by James E. Mahaffy and William O. Woods. Feb 59, 28p. 5 refs. Rept. no. RPL-43/1.
Order from OTS $0.75 PB 161 122

Tungsten carbide prepared with alloy binders in the ranges investigated exhibits strength properties which are generally inferior to straight cobalt bonded tungsten carbide. Binder alloys of cobalt-iron and cobalt-iron-nickel would be suitable for applications where high hardness is a necessary critical requirement and high transverse rupture strength is of secondary importance.

Engines and Propulsion Systems

Army Transportation Research and Engineering Command, Fort Eustis, Va.
MULTIFUEL-DIESEL-ENGINE TRUCK, by Joseph T. Gurganious and Rodney L. Berriker. Final rept. on Project 9-47-16-000, Test MT-12. July 59, 31p. AD-214 496.
Order from OTS $1.00 PB 161 114

This report compares the capabilities of a multifuel diesel engine and a standard gasoline engine. Two Trucks, Tractor, 2-1/2-Ton, 6x6, M48, were tested: one was equipped with the multifuel diesel engine; the other retained the standard gasoline engine. Three test routes were selected. Each was traversed six times (five times with the multifuel-diesel-engine truck, each time using a different type of fuel, and one time with the standard M48 truck using Army gasoline). Results of the tests prove that the multifuel diesel engine has a remarkably lower fuel consumption, as well as a much higher performance rating, than the standard gasoline engine of comparable power.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF AXIAL COMPRESSORS WITH ASYMMETRIC INLET FLOWS, by Robert Katz. Final rept. on Contract AF 18(600)178. June 58, 158p. 16 refs. AFOSR-TR-58-89; AD-162 112.
Order from LC mi$7.50, lh$24.30 PB 144 039

Overall performance measurements and circumferential surveys of total pressures, velocities and flow angle were obtained in an axial compressor with inlet disturbances covering approximately 25 % of the inlet annulus area. Three configurations were tested to find the principal effects in a single rotor, a complete stage and a multi-stage machine. A two-dimensional linearized theory was developed which includes the effect of losses and leaving angle deviations in the blade rows.

James Forrestal Research Center, Princeton, N. J.
PROJECT SQUID. Semi-annual progress rept. for 1 Oct 57-31 Mar 58 on Contract Nonr-1858(25). 1 Apr 58, 128p. 82 refs. AD-147 921.
Order from LC mi$6.30, ph$19.80 PB 138 556

This study is concerned with the extension of theoretical and experimental methods for the analysis of nonsteady-flow problems. Theoretical investigations of such problems are frequently carried out by means of wave diagrams based on the method of characteristics, and experimental work is based on shock tube techniques. Various cases of boundary conditions in nonsteady flow have been studied. The effect of pressure waves on small regions where the density differs from that in the surrounding gas is also being investigated.

James Forrestal Research Center, Princeton, N. J.
PROJECT SQUID. Semi-annual progress rept. on Contract Nonr-1858(25). 1 Oct 58, 111p. 64 refs.
Order from LC mi$6.00, ph$18.30 PB 143 226

Contents:
Fluid Mechanics: Fundamental investigation of nonsteady flow; Investigation of turbulence; Structure of a detonation wave; Exhaust nozzle impedance to high-frequency longitudinal gas flow oscillations
Transport and Transfer Processes: Thermal conductivity and the viscosity of ammonia and hydrazine; Thermal conductivity of gases and liquids over a range of temperatures and pressures; Atomization, vaporization, and combustion of multicomponent fuel droplets; Dynamic conditions in a spray zone; Statistical properties of two-phase flow; Studies of heat transfer to gases and the mechanism of two phase flow
Chemical Kinetics: Reactions of oxygen atoms; High temperature reactions; Surface-catalyzed atom and free radical reactions;
Combustion Phenomena: Structure and burning mechanism of laminar flat flames; Research on high pressure combustion; Investigation of flame propagation and stability with particular reference to the interaction between flame and flow; Investigation of the basic problems associated with gaseous combustion; Burning velocity, flammability limits, and

ionization in flames; High output combustion; Ionization in detonation waves; Physical properties of various types of flames; Theory of detonations and flame propagation in Gases

Naval Civil Engineering Lab., Port Hueneme, Calif.
WINTERIZATION OF POLAR EQUIPMENT: INTAKE AIR PREHEATING FOR TWO-STROKE-CYCLE ENGINE, by E. J. Beck, Jr. Final rept. 15 Oct 59, 29p. 6 refs. Technical rept. 039.
Order from LC mi$2.70, ph$4.80 PB 143 904

This report deals with the results of the Laboratory's first experiments with supplying heat to the intake air of a two-stroke-cycle diesel engine in order to determine the heat requirement necessary to achieve adequate combustion at low ambient temperatures. Cold chamber tests, in which intake air was electrically heated to simulate engine waste heat input, were conducted at temperatures varying from Port Hueneme normal ambients to -32 F in steps of approximately 32 degrees Fahrenheit. Air preheating was found to markedly improve the operation of a two-stroke-cycle diesel engine. First, heat loss at moderate and low loads must be scrupulously avoided by use of suitable enclosures and intermittent fan operation. Second, relatively large amounts of heat to the intake air would be required to obtain optimum operation, at idle and low loads, but small to moderate amounts, considered to be available in a properly shrouded engine, will allow satisfactory operation. Relatively small amounts of heat to the intake air will be required when the engine is heavily loaded. Specific design approaches are proposed.

New York U. Coll. of Engineering, N. Y.
THERMAL STRESSES IN LONG CYLINDRICAL CASE-BONDED PROPELLANT GRAINS, by Eric E. Ungar and Bernard W. Shaffer. Rept. on Contract NOrd-16640. Sep 58, 31p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 143 604

Equations are presented by means of which one may compute the thermally induced stresses in a bond between a long cylindrical propellant grain and a case surrounding it. The general equations are simplified for assemblies with cases that are elastically stiff and thermally thin compared to the grain. An optimization study shows how the bond stress is affected by the assembly geometry and properties of the materials.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME I. MORPHOLOGY, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 31p. E-1FR049-332; AFOSR-TN-59-103.
Order from LC mi$3.00, ph$6.30 PB 144 009

A survey and classification is made of various types of power sources which might possibly be used in conjunction with propulsion systems for space vehicles. Codification of these types has been systematically developed with the objective in mind of providing a convenient classification by means of which a rapid evaluation of any "new" proposals can be made. A number of possible new power systems and propulsion systems have been brought out. The primary goal in evaluation of all systems is to obtain an unambiguous upper limit to performance, equivalent to that derived for heat engines on the basis of the Carnot cycle. It can be readily observed from the examples given that the basic conservation laws of physics are usually sufficient to settle the question of "feasibility" in regard to any proposal.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME III. DIRECT ELECTRICAL CONVERTERS, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 72p. 15 refs. E-3FR049-332; AFOSR-TN-59-429; AD-214 779.
Order from LC mi$4.50, ph$12.30 PB 143 998

A review of findings.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME IV. NUCLEAR FISSION REACTORS, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 127p. 17 refs. E4FR049-332; AFOSR-TN-59-428; AD-214 778.
Order from LC mi$6.30, ph$19.80 PB 143 999

A review of findings. (See also PB 143 998)

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES, VOLUME VI. FUSION POWER, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 70p. 3 refs. E-6FR049-332, AFOSR-TN-59-427; AD-214 777.
Order from LC mi$3.90, ph$10.80 PB 144 000

A brief review.
(See also PB 143 999)

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME VII. BIBLIOGRAPHIES, by Helen Fife. Rept. on Contract AF 49(638)332. 24 Apr 59, 45p. 379 refs. E-7FR049-332; AFOSR-TR-59-104.
Order from OTS $1.25 PB 161 117

The references listed here are arranged in accordance with the morphology described in our report E-TN088-332 also published under this contract. Briefly, this morphology arranges possible power sources according to whether they are (a) internal (wholly contained within the space vehicle) or external (utilize energy available outside the vehicle), (b) waste (utilize waste products from other functions) or direct storage, and (c) certain detailed categories. The array is presented graphically. The figures contained in brackets are used to form a code which classifies any particular power source. Since there are three levels of classification, each code number consists of these digits: n_1, n_2, n_3.

Machine Parts and Mechanisms

Alloyd Research Corp., Watertown, Mass.
BALL MOTION AND SLIDING FRICTION IN BALL BEARINGS, by A. B. Jones (Fafnir Bearing Co.) Rept. on Contract NObs-72203. [1957] 46p. AD-143 887.
Order from LC mi$3.30, ph$7.80 PB 138 494

A method is derived for determining the motion of the ball and the sliding friction in a high-speed, angular contact ball bearing under thrust load in terms of the inertia effects on the ball and frictional resistances resulting from interfacial slip at the contact area. The solution of eight, simultaneous equations involving double integrals for which closed form solutions cannot be found is required.

George Washington U., Washington, D. C.
A METHOD FOR DETERMINING THE MILITARY WORTH OF SPARE PARTS, by Henry Solomon, Joseph P. Fennell, and Marvin Denicoff. Rept. on Logistics Research Proj., Contract Nonr-761(05). Apr 58, 62p. 1 ref. Serial T-82/58.
Order from LC mi$3.90, ph$10.80 PB 139 364

Manufacturing Equipment and Processes

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.
ENDURANCE TESTS OF MAGNESIUM CASTING ALLOY DOW H CONTAINING VARIOUS GRADES OF TRANSVERSE AND LONGITUDINAL MICRO-SHRINKAGE, by Walter F. Worden. Final rept. on Proj. TED NAM AE 4132, pt. 3. 11 Sep 58, 29p. 6 refs. Rept. no. NAMC-AML-AE-1065.
Order from LC mi$2.70, ph$4.80 PB 138 705

It was established that the fatigue strength of Dow H magnesium casting alloy decreased as the quantity of radiographic defect indications increased, and that longitudinal microshrinkage was less detrimental to fatigue strength than transverse microshrinkage.

Armour Research Foundation, Chicago, Ill.
TIME-TEMPERATURE-TRANSFORMATION DIAGRAMS OF THE TITANIUM SHEET-ROLLING-PROGRAM ALLOYS, by L. E. Tanner. Rept. for 9 June 58-15 June 59 on Department of Defense Titanium Sheet-Rolling Program, Contract AF 18(600)1375. 19 Oct 59, 81p. 19 refs. DMIC rept. no. 46G.
Order from OTS $2.25 PB 151 075

The titanium alloys Ti-2.5Al-16V, Ti-4Al-3Mo-1V, Ti-6Al-4V, and Ti-13V-11Cr-3Al are being evaluated in the Department of Defense Titanium Sheet-Rolling Program. To assist in the determination of optimum heat treatments for these alloys, the kinetics of their transformations were studied for two heat-treatment cycles, and T T T diagrams were constructed. The T T T diagrams resulting from each heat-treatment cycle are shown on the following pages accompanied by a description of the important mechanistic features of the transformations of each alloy.

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsbrugh, Pa.
BUDGET CONTROL AND COST BEHAVIOR, by Andrew C. Stedry. ONR Research memo. no. 60 on Planning and Control of Industrial Operations, Contract Nonr-76001. 28 Feb 58, 44p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 143 569

This paper represents an investigation into some of the possible reactions which occur in response to a system of budget control. The research described here is a first step in a project whose aim is to establish decision rules which can be utilized in setting up and maintaining an integrated budget control system in an industrial firm. The preliminary work was carried on (1) to define the nature and scope of the problem, (2) to evaluate some of the techniques available for its solution and (3) to point out avenues for future research.

Detroit Arsenal, Center Line, Mich.
ARC WELDING OF ALUMINIZED MILD STEEL, by Donald E. Phelps. 8 Aug 58, 23p. Rept. no. 4225 (Final); AD-202 211.
Order from LC mi$2.70, ph$4.80 PB 143 828

Four different brand electrodes were employed to weld aluminized mild steel sheet 1/16-inch thick. Tests were conducted to determine the suitability of the electrodes, the effect of heat and the corrosion resistance on the welded joint.

Metcut Research Associates, Cincinnati, Ohio.
MANUAL ON THROW-AWAY TOOLING, by D. C. Kaufman, A. Dupuis, and M. Grider. Final technical engineering rept. for 19 June 58-30 June 59 on Contract AF 33(600)37479. 14 July 59, 96p. Wright Aeronautical Serial rept. no. MP. 00-193; AD-226 022.
Order from OTS $2.25 PB 161 276

This Manual describes the benefits that can be derived from a program which replaces brazed carbide cutting tools with throw-away type tooling. The approach used in instituting the throw-away tool conversion program and the steps taken in accomplishing a successful program are described. Graphs, charts, forms and photographs are incorporated to assist in the understandability of the program. Also described in the Manual are cost reduction programs that are directly associated with a throw-away tool conversion program or a natural outgrowth of such a program.

Rock Island Arsenal Lab., Ill.
EVALUATION OF ELECTRICAL-DISCHARGE MACHINING, by F. J. Daasch. Technical rept. 4 June 59, 36p. 5 refs. Rept. no. 59-1516; AD-217 044.
Order from OTS $1.00 PB 161 267

The electrical-discharge method was evaluated for suitability to perform Ordnance manufacturing and production work on the difficult-to-machine metals, machining hardened tool steels, high-speed steel and carbide tool materials. Tests were performed to evaluate the variables such as machining time, surface finish of the workpiece, loss of electrode material and other performance characteristics. Results are included for operations comparable to drilling, tapping and surface removal.

Rodman Lab., Watertown Arsenal, Mass.
MECHANICAL PROPERTIES AND PROCESSING TECHNIQUES FOR HIGH STRENGTH STEEL CASTINGS, by K. D. Holmes, J. Zotos and P. J. Ahearn. Apr 59, 23p. 11 refs. Rept. no. RPL 10/19; AD-220 591
Order from LC mi$2.70, ph$4.80 PB 143 625

Arc furnace and induction melted low-alloy steels were cast into test coupons and shaped castings, heat treated to high strength levels, and physically tested. The arc furnace cast steels exhibited mechanical properties superior to those of induction melted steels, at a strength level of 225,000 psi.

Rodman Lab., Watertown Arsenal, Mass.
PARTICLE COATING IN INVESTMENT CASTING MOLD MANUFACTURE UTILIZING SOLID FLUIDIZATION, by Francis Quigley and Eugene Deluca. Feb 59, 11p. 5 refs. Memo. rept. no. RPL-13/7.
Order from OTS $0.50 PB 161 098

The process of gas-solid fluidization was applied in the development of an improved technique for the application of particle coatings in the manufacture of investment casting molds. A unit was designed and built to accomplish fluidization of solid particle beds. Particle coating was effected by immersion of prewetted forms into the bed in its fluidized state.

Selskapet for Industriell og Teknisk Forskning ved Norges Tekniske Høgskole (Norway).
DISTRIBUTION OF HEAT AROUND FINITE MOVING SOURCES. Final technical rept. for 1 July 58-30 July 59 on Contract DA 91-508-EUC-378. 10 Sep 59, 59p. 28 refs.
Order from LC mi$3.60, ph$9.30 PB 143 836

Calorimetric measurements have been made of the net heat transferred to the work-piece in welding with the argon-arc, metal-arc, and SIGMA processes. A method is suggested for presenting the distribution of temperature around a point source in one diagram valid for all materials and operating condition. Measured temperatures outside the weld pool are in fair agreement with theory at a sufficient distance from the weld, but deviations are observed in regions closer to the weld. A procedure is outlined for the assessment of average bath temperatures from the measured temperature distribution in the parent-plate material. Exploratory measurements of liquid weld metal temperatures indicate temperatures in the order of 2000°C and 1500°C in the welding of steel and of aluminum, respectively.

Springfield Armory, Mass.
RECLAMATION OF DIAMONDS FROM MACHINE WIPING CLOTHS, by K. A. Jorczak. 23 Mar 59, 11p. SA-TR20-7003.
Order from OTS $0.50 PB 161 121

The most suitable method developed is based on washing the diamond-bearing cloths with a synthetic detergent in a washing machine which is fitted with a wire mesh screen over a false bottom. The recovered residue is treated by the flotation method similar to that used for diamond reclamation from grinding wheels and segregated swarf or sludge.

Transport, Traction and Hoist Facilities

California U., Los Angeles.
TECHNICAL STUDIES IN CARGO HANDLING. V. EFFECT OF COMMUNICATION ON A N-STAGE SHUTTLE PROCESS, by Maurice Pollack. Rept. on Contract Nonr-233(07). May 58, 28p. 5 refs. Dept. of Engineering rept. 58-43; AD-218 980.
Order from LC mi$2.70, ph$4.80 PB 138 840

By means of a simple model, it is shown that the effect of communication on a shuttle process is small. The link-node model of cargo handling developed by R. R. O'Neill is found to be a good representation of actual systems. The "effectiveness" of a shuttle process as predicted by this link-node model is well correlated with actual field data values of "balance allowance" given by R. Herbert. It is also possible to obtain the values of coefficient of variation which correspond to the balance allowances given by R. Herbert.

Goodrich, B. F., Aviation Products, Troy, N. Y.
EVALUATION OF B. F. GOODRICH 450°F AMBIENT TEMPERATURE BRAKE, by Carlos F. Afanador Rept. for May 57-Dec 58 on Contract AF 33(600)35046. June 59, 36p. WADC Technical rept. 59-198.
Order from OTS $1.00 PB 161 143

The purpose of this contract was to evaluate a B. F. Goodrich capsule-actuated disk brake operating from an ambient temperature of 450°F, and to determine the effects of forced air cooling. The assembly used in the test was designed, manufactured, and laboratory tested at the B. F. Goodrich Wheel and Brake Plant, Troy, Ohio. The brake successfully passed the required laboratory testing. Operation at the required ambient temperature was confirmed by the data presented herein. Further testing will be conducted at the WADC laboratory.

Southwest Research Inst., San Antonio, Tex.
INDUCTION SYSTEM ICING IN ORDNANCE AUTOMOTIVE VEHICLES: A LITERATURE SURVEY AND ANALYSIS. Final rept. on Contract DA 23-072-ORD-836, T.O. 4. Feb. 56, 78p. 122 refs.
Order from OTS $2.00 PB 131 844

Analysis of the icing problem in the induction system of Ordnance engines may be divided into three separate discussions of the water sources from which the ice is formed. The format of this report consists of three main headings covering the formation of ice caused by condensation and freezing of atmospheric water vapor, water in the fuel, and induction of entrained atmospheric solids, such as snow, in the charge air. Following these analyses, consideration is given to methods of indicating the presence of ice as well as anti-icer and deicer systems. A summary with conclusions also is presented regarding the overall induction system icing problem in Ordnance vehicles.

MATERIALS

Clapp, William F., Labs., Inc., Duxbury, Mass.
INVESTIGATION OF GLASS CLOTH OVERLAYS ON PLYWOOD AS PROTECTION AGAINST MARINE BORER ACTIVITY. Final rept. on Contract NObs-72139. 10 Jan 57, 8p. Rept. no. 10261; ITL no. 2007-J; AD-139 699.
Order from OTS $0.50 PB 151 998

The exposure of plywood panels covered with overlays of duck, duck with silica added, fiberglas cloth, as well as duck with less than normal resin content in the overlay to marine borer activity at Kure Beach, North Carolina for 39 months and at Daytona Beach, Florida, for 51 months revealed that no borers were able to penetrate the overlays with the exception of those overlays with reduced resin content. Marine fungi were found to be active in those overlays containing natural fibers. Paint adherence and effectiveness was relatively poor on all panels in the series. Adherence of the duck overlays to the wood, with and without silica added, was better than those with fiberglas cloth after the first 24 months exposure.

Danielson Mfg. Co., Conn.
DEVELOPMENT OF MOLDED NYLON SAMPLES, by William McKinlay. Final rept. for 1953-1958 on Contract DA 18-064-404-cml-22. 15 June 58, 108p.
Order from LC mi$5.70, ph$16.80 PB 143 333

The contract was successfully completed after considerable experimentation and a number of changes to the designs originally envisaged. The final approved samplers were molded of two types of nylon, "Zytel 101" supplied by E. I. duPont de Nemours & Company, and "Spencer 401" supplied by Spencer Chemical Company. Figures 3 and 4 show the designs finally adopted, figures 5, 6, 7 and 8 show photographs of the samples, and brochures 1 and 2 of Appendix B give the physical properties of the two nylons used.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
EVALUATION OF SOME METHODS OF NICKEL FERRITE FORMATION; EFFECT OF IRON OXIDE PARTICLE SIZE ON NICKEL FERRITE FORMATION; CURRENT PROBLEMS IN THE PRODUCTION OF MAGNETIC CERAMICS, by George Economos. Rept. on Contract Nonr-1841(10). Nov 58, 49p. 24 refs. Technical rept. nos. 129, 130, 131.
Order from LC mi$3.30, ph$7.80 PB 143 601

The extent of nickel ferrite formation, as affected by four preparatory techniques, was investigated by determining the magnetic moment of the reacted powder with a vibrating-coil magnetometer. The oxide, carbonate, hydroxide and oxalate methods were used. At low temperatures the hydroxide and oxalate techniques were found to give the greatest yield of ferrospinel. The hydroxide method yields a magnetic material by precipitation. Weight-loss measurements are correlated to the magnetic data. Five iron oxides of increasing particle-size distribution, mixed with nickel oxide of a constant-size range, were heated at various temperatures and time intervals. The extent of nickel ferrite formation, as influenced by particle size distribution of the iron oxide constituent, was measured with a compensating-coil magnetometer. Using the Jander relationship for this type of reaction, activation energies ranging from 54 to 70 kcal were computed for increasing particle size. These results are examined and compared with current procedures for the production of ferrite powders. Reproducibility of the electrical and magnetic properties while adhering to mechanical tolerances is still the main difficulty in quantity production of magnetic ceramics. This problem is discussed from a developmental viewpoint with suggestions for improving present methods.

Vitro Labs., West Orange, N. J.
INVESTIGATION OF THE HIGH INTENSITY ARC TECHNIQUE FOR MATERIALS TESTING, by Charles Sheer, C. Dudley Fitz and others. Rept. for Apr 57 to Mar 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3669. Nov 58, 109p. 20 refs. WADC Technical rept. 58-142; AD-205 364.
Order from OTS $2.50 PB 161 265

Basic studies performed during the second year of a two-year program to evaluate the adaptability of the high intensity arc flame as a testing medium are described. A more stable and controllable configuration of arc operation, featuring a triple cathode, was developed. The pulse method of measuring tail flame velocity was improved, and the range of measurements extended by using a more powerful electronic pulsing device. Several flow visualization techniques were utilized to determine flow patterns of the arc plasma in the vicinity of solid objects. Direct and schlieren photography showed an abnormally thick boundry layer for the flow of plasma near the models; a possible explanation is offered. Finally, attempts were made to measure thermal diffusivities of copper, graphite, molybdenum, and tungsten by inserting appropriate specimens in the flame. Results indicate that the technique of measurement requires further development to obtain reliable measurements using a plasma flame.

Ceramics and Refractories

Minerals Research Lab., U. of California, Berkeley.
INTERNAL STRESSES IN MODEL CERAMIC SYSTEMS, by Richard M. Fulrath. Technical progress rept. no. 1 on Contract AF 49(638)4. 20 Mar 58, 31p. 1 ref. Series no. 119, issue no. 1.
Order from LC mi$3.00, ph$6.30 PB 138 927

Model ceramic systems of crystals and glass fabricated by vacuum hot compaction have been used to study methods of detection of internal stress on the crystalline phase. Effects of the volume fraction of the glass, compaction temperature and time, and crystal particle size in modifying induced internal stress are presented. These effects together with x-ray diffraction and wetting studies indicate that internal stress development is closely connected to wetting of the crystal by the glass and formation of a second crystalline phase.

National Bureau of Standards, Washington, D. C.
FACTORS CONTROLLING RESISTANCE TO DEFORMATION AND MECHANICAL FAILURE IN POLYCRYSTALLINE (GLASS-FREE) CERAMICS, by John B. Wachtman, Jr., Wayne E. Tefft and others. Rept. for 1 July 57-15 Dec 58 on Solid State Research and Properties of Matter, Contract AF 33(616)56-4. May 59, 83p. 35 refs. WADC Technical rept. 59-278.
Order from OTS $2.25 PB 161 112

The elastic moduli and internal friction of several refractory oxide materials were studied. The six elastic constants of sapphire were measured with particular care and the results were found to differ from previously accepted values for four of these constants. Young's modulus for single crystal sapphire was found to decrease linearly with increasing temperature above 100°C. As the temperature was decreased below 100°C, Young's modulus first rose above the extrapolated high temperature straight line and then tended to become constant. The internal friction of single crystal sapphire was found to vary from 5×10^{-5} to 3×10^{-6} at room temperature. Annealing below 500°C decreased the value in a specimen with initially high damping. An internal friction peak was found in polycrystalline alumina with 15% lanthanum oxide additive. Young's modulus of uranium dioxide was measured as a function of temperature. Two internal friction peaks were found in polycrystalline zirconium oxide stabilized with 5% calcium oxide. These results are discussed.

Rodman Lab., Watertown Arsenal, Mass.
PROPOSED BASIS FOR TESTS OF CEMENTED CARBIDES, by William O. Woods. May 59, 16p. 11 refs. Rept. no. RPL-43/2.
Order from OTS $0.50 PB 161 269

Based on data compiled from information obtained from industrial producers and other carbide investigators, an examination was made of the hypothesis that a linear relation exists between hardness and strength of cemented carbide materials. The study incorporates mathematical and graphic representations of the precepts involved in the investigation. Data reported by Kieffer and Hotop were chosen as representative for the extended examination.

Utah U. Coll. of Engineering, Salt Lake City.
THE IRREVERSIBLE COMPRESSIBILITY OF SILICA GLASS, by William B. Gogarty. Technical rept. no. 4 on Contract Nonr-1288(02). May 58, 32p. 7 refs, AD-161 491.
Order from LC mi$3.00, ph$6.30 PB 138 817

The compressibility of silica glass wafers was measured by means of density changes in small specimens.

Fuels, Lubricants, and Hydraulic Fluids

Atlantic Research Corp., Alexandria, Va.
INVESTIGATION TO DETERMINE BUILDUP OF A STATIC ELECTRIC FIELD CHARGE IN A ROLLING FLUID TRANSPORTER. Final rept., Phase 2 on Contract DA 44-177-tc-461. 15 June 59, 38p.
Order from LC mi$3.00, ph$6.30 PB 143 323

This is the final report of the Phase II work on an "Investigation to Determine Buildup of Static Electric Field Charge in a Rolling Fluid Transporter," and is a summary of the entire work of Phase II. The purpose of this program was to improve understanding of the phenomena involved in the generation and discharge of static electricity in the transporter. Results of tests made with JP-4 in the transporter simulating normal cold weather operating conditions gave positive evidence of static discharges. In the range tested the rate and intensity of discharges appeared to increase with increasing transporter speed and with decreasing transporter temperature, especially below 35°F. Rough roads and sharp turns also appeared to increase the rate and intensity of discharges. These results generally confirm those of Phase I of this work and, in addition, establish the importance of fuel temperature. In order to assess the relative hazards of the transporter and a standard fuel truck, an Air Force F-6 tank truck was tested for static discharges during cold weather. Static discharges were detected in a truck filled 40 per cent with JP-4 at 37°F and were especially intense when operation was over rough terrain. A conclusion that the relative hazards of the two devices are the same under similar operating conditions cannot be considered firm on the basis of this work. However, continued explosion-free operation of transporters with an explosive mixture in the vapor space would help support such a conclusion.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
DEVELOPMENT OF AN OPERATIONAL PRESERVATIVE HYDRAULIC BRAKE FLUID, by Charles B. Jordan. 26 Aug 59, 21p. 19 refs. Rept. no. CCL-81.
Order from OTS $0.75 PB 161 096

The object of this study was to develop a combination preservative and operational fluid for use in automotive hydraulic brake systems and components. Brake fluid components were selected which were known to have good preservative properties. Combinations of these components were subjected to tests outlined in Specification VV-H-910. The more promising fluids were stored with brake parts in warehouse and simulated vehicle storage. From the preliminary results received in the storage tests, a fluid combination was chosen. Different inhibitor combinations were tried until maximum corrosion protection and stability could be obtained. The fluid outlined in this report meets all requirements of Specification VV-H-910 except the sub-zero requirements. It is satisfactory with natur and SBR synthetic rubber cups. It tolerates up to 5% moisture. It performs satisfactorily in the stroking machine at 158°F. It has satisfactorily passed storage tests up to 30 months. A proposed specification has been written for the fluid.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
QUANTITATIVE DETERMINATION OF ETHYLENE GLYCOL IN COOLANT MEDIA BY INFRARED ANALYSIS, by Jules B. Counts. 5 Aug 59, 13p. 3 refs. CCL #79, AD-225 394.
Order from LC mi$2.40, ph$3.30 PB 143 328

This report describes the application of infrared analysis to the quantitative determination of ethylene glycol in a mixture of glycols. The method utilizes the base line technique in conjunction with a working curve. Two unique analytical features of the method are the saturation of the glycol mixtures with sodium chloride to prevent attack of the rock salt cell window by the small amounts of water normally present in glycol mixtures, and the use of dimethylformamide as a transparent solvent for the glycols. The dissolved ethylene glycol is treated as a minor constituent of the mixture and the absorp tion recorded differentially. A correction is made for the presence of diethylene glycol. It is recommended that this method be used for the analysis of ethylene glycol in glycol mixtures, and that the method be studied further for possible application to other constituents of coolant media.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF T34 PROPELLANT: AN IMPROVED NITROGUANIDINE COMPOSITION, by Russell L. Trask and David J. Zauder. July 59, 40p. 7 refs. Technical rept. 2629.
Order from LC mi$3.00, ph$6.30 PB 143 285

A new nitroguanidine propellant which is ballistically and physically superior to standard M15 propellant and requires 50% less final mixing time has been developed. The new propellant has been found to have better ballistic uniformity than M15 over a wide range of test conditions; its temperature and pressure dependence are significantly less; and it produces less flash and is at least as smokeless as M15 propellant.

Frankford Arsenal, Philadelphia, Pa.
SOLID PROPELLANT CHEMICAL STABILITY: A SURVEY, by J. Quinlan. Sep 58, 22p. 55 refs. Technical rept. no. R-1465.
Order from LC mi$2.70, ph$4.80 PB 143 827

A survey has been made of the presently available literature in order to determine the relationship between the chemical stability of solid propellants and the variation in nitroglycerine content and the degree of nitration of the nitrocellulose. The decomposition mechanism of nitrocellulose and the effect of temperature and various additives upon propellant stability are presented. It is noted that the stability varies inversely as the nitroglycerine content and that, as the nitrocellulose nitrogen is increased, there is a tendency toward exponential chemical decomposition. When exudation of nitroglycerine occurs, it is promoted by the presence of diphenylamine, but no conclusion is reached upon the effect of nitrocellulose nitrogen on this phenomenon. The reliability of safe life tests made above 65.5° C is questionable.

Inland Testing Labs., Morton Grove, Ill.
THE BEHAVIOR OF FUELS AND LUBRICANTS IN DYNAMIC TEST EQUIPMENT OPERATING IN THE PRESENCE OF GAMMA RADIATION, by M. E. Krasnow, O. P. Reynolds and O. C. Wolford. Rept. for 31 Mar 58-31 Mar 59 on Chemical Propulsion Subsystems, Contract AF 33(616)3865. 31 Mar 59, 182p. 12 refs. WADC Technical rept. 58-264, Pt. 2, Preprint Copy.
Order from OTS $3.00 PB 161 127

This report summarizes work conducted on a program designed to evaluate fuels, lubricants, and hydraulic fluids for use in a nuclear-powered aircraft. During the performance period, April 1958 to March 1959, 52 fuels, 44 lubricating oils, 4 greases, 4 dry film lubricants, and 1 hydraulic fluid were investigated. The most promising fuels and lubricants are listed in the accompanying tables. These materials were selected on the basis of performance in dynamic test machinery operated in a radiation environment and predict useful performance characteristics of lubricants up to doses of 10^{10} ergs/gmC and of fuels up to 10^{9} ergs/gmC. (See also PB 151 701)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE THERMAL DECOMPOSITION OF AMMONIUM NITRATE, by Russell N. Doescher. Rept. on Basic Research on Rocket Propellants, Contract W04-200-ORD-1482. 15 Mar 50, 12p. 28 refs. Progress rept. no. 9-43.
Order from LC mi$2.40, ph$3.30 PB 144 095

Interest has recently been stimulated in the use of ammonium nitrate in solid propellants for rockets, one of the principal factors being the recognition that it is possible to prepare smokeless mixtures with this compound. The burning of solid propellant charges containing ammonium nitrate is understood only incompletely, but it is believed that the thermal decomposition of the ammonium nitrate is an important step in the process. Accordingly a literature and experimental study of this decomposition was undertaken. The initial phase of the study has been completed, and the results are given in the present report. The contribution represented here consists of the development of a simple, rapid, and easily applied method of measuring the catalytic activity of a given solid substance in the thermal decomposition of ammonium nitrate and the partial coordination of pertinent knowledge presently available.

Ordnance Fuels and Lubricants Research Lab., Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF A THERMAL-OXIDATION STABILITY TEST FOR GEAR LUBRICANTS, by Nelson T. Meckel. Rept. on Contract DA 23-072-ORD-1144. June 58, 128p. 1 ref.
Order from LC mi$6.30, ph$19.80 PB 138 780

An apparatus and procedure to determine thermal-oxidation stability of gear lubricants were developed. The objective of this work was to devise a thermal-oxidation test technique which would correlate with military field test results. A refined laboratory version was designed and a final test procedure was developed. The apparatus, procedure and test results are presented in this report.

Princeton U., N. J.
FURTHER STUDIES ON THE LIGHT SCATTERING TECHNIQUE FOR DETERMINATION OF SIZE DISTRIBUTIONS IN BURNING SPRAYS, I, by R. A. Dobbins. Technical rept. on Contract AF 18(600)1527. 10 Apr 59, 37p. 15 refs. Aeronautical Engineering Lab. rept. no. 463; AFOSR TN-59-700; AD-220 496.
Order from LC mi$3.00, ph$6.30 PB 143 022

Rocketdyne, Canoga Park, Calif.
EFFECTS OF GAS MOTION ON HETEROGENEOUS COMBUSTION; NATURAL CONVECTION, STEADY FORCED CONVECTION, STANDING ACOUSTIC WAVES, AND SHOCK WAVES, by William T. Webber. Final summary rept. on Contract AF 33(616)3556. Apr 59, 92p. 26 refs. WADC Technical rept. 59-50.
Order from OTS $2.25 PB 161 128

Two experimental techniques have been used to determine the effects of gas motion upon the combustion of liquid fuels under extremes of conditions resembling those found in liquid rocket combustion chambers. In the first technique methanol was burned as it flowed down a vertical quartz fibre mounted in a pressure vessel containing pure oxygen at pressures from 1.0 to 10.2 atmospheres. The combustion rate was determined under conditions of natural convection, with steady forced flow transverse to the fibre; and with the fibre held at the velocity loop of a very strong standing acoustic field. The application of conventional heat and mass transfer correlations for cylinders give theoretical values for combustion rate which are in fairly close agreement with the experimentally observed data. Reynolds number (based on fuel element diameter) was varied from 340.0 to 5300.0. Grashof number was varied from 1.3 million to 340.0 million. In the acoustic field the Reynolds number was derived from the mean gas particle velocity. The second technique was to burn sprays of liquid fuel in an oxygen atmosphere in the channel of a shock tube through which a pressure pulse was passed. Here the pressure, velocity, and temperature perturbations of the wave affect the combustion rate at the location of, and in the wake of the wave, and thus can act to sustain or augment the wave to the point where it resembles a detonation. Some experiments were conducted to determine which combinations of droplet size, initiating pulse amplitude, pulse duration, extent of combustion completed before introduction of the pulse, etc., cause the wave to grow to detonation strength, and which allow it to decay. Other experiments were conducted to quantitatively infer combustion rates as functions of wave strength, by measuring pressure histories at several positions along the tube. In these experiments, Reynolds numbers per centimeter ranged from about 150,000 to 1,500,000. Combustion rates increase with Reynolds number at about the proper slope to agree with classical correlations for heat and mass transfer up to Reynolds numbers per centimeter of about 450,000. Beyond this point there appears to be a sudden increase in rate.

Leather and Textiles

Fabric Research Labs., Inc., Dedham, Mass.
METHODS OF WITHIN-SECTION BLEND ANALYSIS, by Myron J. Coplan and William G. Klein. Technical rept. no. 6 on Contract Nonr-1422(00). 1 Dec 58, 31p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 143 610

Statistical implications of the Index of Blend Irregularity have been elaborated, with consequent improved utility of this measure. A more complete characterization of within-section blend distribution is now possible by two new techniques developed. Some new light is shed on the characteristics of fiber clustering and blend irregularity within the sections of woolen wool-nylon yarn.

Naval Supply Research and Development Facility, Bayonne, N. J.
DEVELOPMENT OF SOLUTION DYED RAYON FABRICS FOR FLIGHT DECK IDENTIFICATION CLOTHING, by Jack Naimer. 15 June 59, 13p. 3 refs. Research and Development rept. no. 31.
Order fromLC mi$2.40, ph$3.30 PB 143 504

Solution dyed rayon fabrics in six colors were developed for use in winter identification garments worn by flight deck personnel on aircraft carriers. The materials were evaluated in the laboratory for breaking strength (wet and dry), tear strength, cumulative shrinkage, fabrication properties and colorfastness. A cotton-back rayon satin was found to be more suitable for the intended end use than a similar all-rayon construction. Original report contains dyed specimens in color which will not reproduce.

Quartermaster Research and Engineering Center, Natick, Mass.
AN EVALUATION OF NEW FIBER BLENDS IN ARMY SUMMER UNIFORM FABRICS, by C. J. Monego and S. J. Kennedy. May 59, 72p. 16 refs. Textile Series rept. no. 108.
Order from LC mi$4.50, ph$12.30 PB 143 737

This report presents the results of a detailed laboratory and field study on nine tropical-type blended fabrics which were developed for this test through close cooperation between fiber producers and fabric manufacturers. The development of each fabric was based on the fabric manufacturer's previous experience with that particular blend on the civilian market, and only those blends which had achieved a marked consumer preference were considered. The results of this study show that the 60/40 polyester/wool blend performed well in laboratory tests and ranked higher than the other fabrics in field tests.

Textile Research Inst., Princeton, N. J.
EFFECTS OF CRIMP AND CROSS-SECTIONAL AREA ON THE MECHANICAL PROPERTIES OF WOOL FIBERS, by Joseph H. Dusenbury and James H. Wakelin. Technical rept. no. 17 on Contracts Nonr-090(00) and Nonr-090(01). 29 Apr 58, 45p. 22 refs.
Order from LC mi$3.30, ph$7.80 PB 138 584

Force-extension data for a large number of wool fibers of various types have been analyzed in detail by statistical methods in order to determine the effects of fiber crimp and cross-sectional area on mechanical behavior. The methods of crimp evaluation used indicate that (1) within a group of fibers taken from the same Rambouillet sheep the crimp level increases with increasing fiber diameter, and (2) among fibers taken from sheep of different breeds the crimp level decreases with increasing fiber diameter. It is also observed that the rupture properties, breaking stress and breaking extension, generally increase with increasing fiber diameter.

Paints and Finishes

Material Lab., New York Naval Shipyard, Brooklyn.
THE MATERIAL LABORATORY ICE SHEAR ADHESION APPARATUS AND TEST METHOD, by H. Lacks and M. Quatinetz. Final rept. 9 Aug 55, 17p 3 refs. Lab. Proj. 5284-3; AD-76 789.
Order from LC mi$2.40, ph$3.30 PB 144 325

The Material Laboratory is engaged in the development of ice-phobic paints for shipboard use, that is, paints to which ice will have little or no adhesion. This report describes the ice shear adhesion apparatus and test method employed in the project to measure the adhesion of ice to a surface and reviews the variables involved in such measurements. It also lists the other items of equipment used in the work.

Naval Civil Engineering Lab., Port Hueneme, Calif.
CATALOG OF INFRARED SPECTRA OF PAINTS AND DRYING OILS, by J. B. Crilly and R. J. McGowan. Interim rept. 7 Aug 59, 36p. 9 refs. Technical Compilation C-001; AD-214 883.
Order from LC mi$3.00, ph$6.30 PB 143 287

This report presents a catalog of infrared spectra of paint vehicles conforming to selected specifications and of drying oils used in paint formulations. It is intended to be used as a reference for inspection and identification of nonvolatile vehicles of paints. The spectra of 32 drying oils commercially treated in a variety of ways are presented. The spectra of 18 specification paint vehicles are also presented. Two samples of paint were found not to conform to the expected pattern. One of these has been identified.

Rubber and Elastomers

Frick Chemical Lab., Princeton U., N. J.
THE OXIDATIVE CROSS-LINKING REACTION IN POLYDIENE VULCANIZATES, by A. V. Tobolsky and A. Mercurio (Doctoral thesis). Rept. on Contract Nonr-1858(07). 15 Dec 58, 7p. 5 refs. ONR Technical rept. RLT-26.
Order from LC mi$1.80, ph$1.80 PB 143 854

Intermittent and continuous stress relaxation methods have been utilized to follow the oxidative degradation of vulcanizates of natural rubber and of synthetically prepared polybutadienes. Vulcanizates were prepared by exposing samples to high energy electrons. For natural rubber only oxidative scission reactions were detected, while emulsion polymerized polybutadiene and all cis 1, 4 polybutadiene exhibited both oxidative scission and oxidative cross-linking. With sulfur vulcanizates of the above there is superposed on the oxidation reactions a continued vulcanization caused by remaining curing agent.

Frick Chemical Lab., Princeton U., N. J.
OXIDATIVE STRESS RELAXATION OF RADIATION CROSSLINKED NATURAL RUBBER, by A. V. Tobolsky and A. Mercurio (Doctor thesis). Rept. on Contract Nonr-1858(07). 1 Dec 58, 14p. 16 refs. Technical rept. RLT-25; AD-207 292.
Order from LC mi$2.40, ph$3.30 PB 143 855

Evidence is presented which shows that oxidative scission at elevated temperatures is independent of the degree of cross-linking in radiation cross-linked natural rubber as studied by stress relaxation. The rate of scission in these vulcanizates is the same within 50 per cent as the rate of scission determined for unvulcanized rubber. These results demonstrate that scission in the vulcanizates occurs randomly along polyisoprene chains, not specifically at the cross-linked sites.

Massachusetts U., Amherst.
ON THE CONFIGURATION OF FLUOROCARBON-AMIDENE ELASTOMERS. II. THE GEL STRUCTURE, by Richard S. Stein. Rept. on Contract Nonr-2151(00). 2 Oct 58, 11p. 1 ref; AD-217 767.
Order from LC mi$2.40, ph$3.30 PB 143 227

(See also PB 143 228)

Rock Island Arsenal Lab., Ill.
AGING OF UNSTRESSED ELASTOMERIC VULCANIZATES DURING OUTDOOR AND CONTROLLED HUMIDITY EXPOSURES, by E. W. Bergstrom. 9 July 58, 21p. 8 refs. Rept. no. 58-1808.
Order from LC mi$2.70, ph$4.80 PB 138 762

This report covers (1) the results of a seven year humidity aging program using vulcanizates based on copolymers of butadiene/styrene, isobutylene/isoprene, butadiene/acrylonitrile, and the homopolymer of chloroprene as well as inhibited (antioxidant) and uninhibited natural rubber vulcanizates and (2) the results of a six year outdoor aging program on all vulcanizates mentioned above except the uninhibited natural rubber. The effect of humidity on the physical properties of the vulcanizates was determined after they had been exposed indoors, unstressed, to relative humidity concentrations of 0, 50, 100 and a cycle of 0 and 100% for periods of one, three, five and seven years. The effect of outdoor weathering was determined after the vulcanizates had been aged outdoors, unstressed, for periods of one, two, three, four, five and six years. A statistical analysis of the data obtained from the humidity aging phase of this investigation showed that relative humidity was not a significant factor in the aging of the characteristics of the various vulcanizate types studied, which was to be expected. A comparison of the physical properties of the vulcanizates aged indoors with those aged outdoors showed that all the vulcanizates resisted aging less outdoors than indoors; the hevea and butadiene/styrene based vulcanizates showed the greatest differences in amount of deterioration (outdoor vs indoor) while the isobutylene/isoprene based vulcanizate showed the least difference.

MATHEMATICS

Air Force Cambridge Research Center, Bedford, Mass.
TABLES AND SCHEMES FOR EVALUATING FOURIER COEFFICIENTS OF PERIODIC FUNCTIONS, by Kurt H. Haase. June 59, 93p. AFCRC-TR-59-154; AD-216 367.
Order from LC mi$5.40, ph$15.30 PB 143 968

This volume contains the tables and schemes required to solve practical problems by a new procedure for analyzing periodic functions, described in A Method for Numerical Evaluation of the Coefficients of Fourier Series, by Kurt H. Haase, AFCRC-TR-59-153. Tabulations are of the function

$$\sin\frac{\pi}{N/r}\cdot\frac{k}{r},$$

where k, r, and N are integers, and of the function

$$C_n(m)=\left[\frac{\sin \pi n/2n}{m/2n}\right]^2$$

where m is the sequence of positive integers and n is a parameter integer. The schemes are closely related to the particular method but the tables may also have use in other applications.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
TRANSLATION INVARIANT FUNCTION ALGEBRAS ON ABELIAN GROUPS, by Karel Deleeuw and Hazelton Mirkil. Technical note no. 5 on Contract AF 49(638)294. 26 Aug 59, 47p. 10 refs. AFOSR-TN-59-659; AD-225 363.
Order from LC mi$3.30, ph$7.80 PB 143 524

Results are established concerning translation invariant uniformly closed subalgebras of the algebra $C_0(X)$ of continuous functions, zero at infinity, on a locally compact abelian group X.

California U., Berkeley.
FREE BOUNDARY PROBLEMS FOR PARABOLIC EQUATIONS, by Avner Friedman. Technical rept. no. 28 on Contract Nonr-222(37). Oct 58, 72p. 29 refs.
Order from LC mi$4.50, ph$12.30 PB 142 861

In this paper the method of Rubinstein is refined and applied to solve Stefan problems for all future times and the problems of evaporation and condensation of drops for small intervals of time.

California U., Berkeley.
A STRONG MAXIMUM PRINCIPLE FOR WEAKLY L-SUBHARMONIC FUNCTIONS, by Walter Littman. Technical rept. no. 1 on Contract Nonr-222(62). Aug 58, 19p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 142 818

Carnegie Inst. of Tech., Pittsburgh, Pa.
NOTES ON THE ANALYSIS OF VARIANCE OF LOGARITHMS OF VARIANCES, by Robert E. Odeh and Edwin G. Olds. Rept. on Research on Transformations in the Analysis of Variance, Contract AF 33(616)3878. Mar 59, 53p. 15 refs. WADC Technical note 59-82; AD-211 917.
Order from OTS $1.50 PB 161 108

One of the assumptions needed in the Analysis of Variance is equality of within-cell variances. Often the validity of this assumption is investigated by the use of Bartlett's modification of the Neyman-Pearson L_1 test. The present report is concerned with the investigation of an alternative test which seems to have some more desirable properties. An example of the use of the proposed test is given. Some analytical results are derived. Tables of the approximate probability for the Type I error are given for the case when the sampled distribution is normal.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ON POSITIVE REAL FUNCTIONS, by Jack Leonard Goldberg, Doctoral thesis. Interim technical rept. no. 14 on Contract DA 11-022-ORD-1983. 27 Mar 59, 59p. 10 refs.
Order from LC mi$3.60, ph$9.30 PB 143 114

Functions which map the right half-plane into itself and take reals into reals - the so-called Positive Real functions - are studied by considering iterations of a transformation of P. Richards (A special class of functions with positive real part in a half-plane, Duke Mathematical Journal, Vol. 14, (1947), p. 779) which takes Positive Real functions into Positive Real functions.

Laboratory of Statistical Research, U. of Washington, Seattle.
UNBIASED ESTIMATION: FUNCTIONS OF LOCATION AND SCALE PARAMETERS, by Robert F. Tate. Technical rept. no. 31 on Contract Nonr-477(11). 16 Oct 58, 44p. 16 refs.
Order from LC mi$3.30, ph$7.80 PB 143 794

Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAHN DECOMPOSITIONS AND HYPOTHESIS TESTS, by I. S. Reed, E. J. Kelly and D. H. Lyons. Rept. on Contract AF 19(122)458. 4 Mar 57, 7p. 2 refs. Technical rept. no. 152. AD-137 718.
Order from LC mi$1.80, ph$1.80 PB 144 045

The relation between hypothesis tests and Hahn decompositions of measure spaces is briefly discussed. Several theorems concerning Hahn sets are presented, making possible the direct application of this relation to denumerably infinite dimensional spaces.

Midwest Research Inst. [Kansas City, Mo.]
EXPANSION OF THE GAUSSIAN HYPERGEOMETRIC FUNCTION IN SERIES OF FUNCTIONS OF THE SAME KIND, by Richard L. Coleman and Yudell L. Luke. Rept. on Contract AF 49(638)66. 15 Aug 59, 16p. 7 refs. AFOSR Technical note 59-734; AD-225 713.
Order from LC mi$2.40, ph$3.30 PB 143 772

An expansion of the hypergeometric function ${}_2F_1(a,b;c;z)$ in series of hypergeometric functions with changed argument is derived. For special values of the parameters the expansion simplifies considerably and is especially advantageous due to the change in argument which yields more rapidly converging series. Known Chebyshev type expansions for the logarithm and arc tangent functions are derived. The Gauss transformation for the complete elliptic integral of the first kind is the special case $a = b = \frac{1}{2}$, $c = 1$. Finally, a rapidly converging expansion of the complete elliptic integral of the first kind is derived for modulus near 1.

Stanford Electronics Lab., Stanford U., Calif.
A DISCUSSION OF SAMPLING THEOREMS, by D. A. Linden. Rept. on Contract Nonr-225(24). 14 Nov 58, 30p. 8 refs. Technical rept. no. 1551-1.
Order from LC mi$2.70, ph$4.80 PB 143 487

The convolution theorem of Fourier analysis is a convenient tool for the derivation of a number of sampling theorems. This approach has been used by several authors to discuss first-order sampling of functions whose spectrum is limited to a region including the origin ("low-pass" functions). The present paper extends this technique to several other cases: second-order sampling of low-pass and band-pass functions, quadrature and Hilbert-transform sampling, sampling of periodic functions, and simultaneous sampling of a function and of one or more of its derivatives.

Stanford U., Calif.
AN EXAMPLE OF FIDUCIAL INFERENCE, by Charles Stein. Technical rept. no. 21 on Contract Nonr-225(21). 17 Oct 58, 7p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 143 337

Virginia Agricultural Experiment Station, Blacksburg.
ON THE ANALYSIS OF PAIRED RANKED OBSERVATIONS, by Leo Lynch and John E. Freund. Technical rept. no. 32 on Contract DA 36-034-ORD-1527. Aug 57, 80p. 18 refs. AD-140 412
Order from LC mi$4.50, ph$12.30 PB 138 179

An extension is considered of the problem of deciding in the case of 2 k-variate populations whether several samples should be regarded as coming from the same population. The first approach is made by means of discriminant analysis. The ranked sample points are projected onto a vector giving maximum discrimination between the 2 samples, and the sample points are then reranked along this vector. The problem is reduced to a one-dimensional situation, but the standard one-dimensional nonparametric tests cannot be used so that this approach is unsatisfactory. The other approach is based on the Euclidean (or more general) distance between the centroids of the ranked samples. Several methods are suggested for constructing approximate tests of significance on the basis of such a distance.

Virginia Agricultural Experiment Station, Blacksburg.
TWO-WAY RANK SUM TESTS FOR VARIANCES, by John E. Freund and Abdur R. Ansari. Technical rept. no. 34 on Contract DA 36-034-ORD-1527. Aug 57, 13p. 1 ref. AD-140 410.
Order from LC mi$2.40, ph$3.30 PB 138 178

Two rank-sum procedures are developed for testing the null hypothesis that 2 samples come from populations with identical continuous distribution functions against the specific alternative that there is a difference in the population variances. The disadvantage of one procedure is that it can lose its sensitivity to detect differences between variances in the presence of differences between means. The other procedure, based on deviations from medians, poses the problem that the sampling distribution of the proposed statistic is not distribution-free under the usual randomization methods.

Virginia U. [Charlottesville].
THE ABSOLUTE CONTINUITY OF TOEPLITZ'S MATRICES, by Marvin Rosenblum. Technical note no. 14 on Contract AF 49(638)72. July 59, 15p. 14 refs. AFOSR-TN-59-735; AD-220 355.
Order from LC mi$2.40, ph$3.30 PB 143 160

Virginia U. [Charlottesville.]
MAPPING NORMS, by G. T. Whyburn. Technical note no. 13 on Topology and Mathematical Analysis, Contract AF 49(638)72. July 59, 13p. 2 refs. AFOSR TN-59-725; [AD-220 353].
Order from LC mi$2.40, ph$3.30 PB 143 506

Virginia U., [Charlottesville].
TRANSFORMATION GROUPS ON A $K(\pi, 1)$ by P. E. Conner and D. Montgomery. Technical note no. 11 on Contract AF 49(638)72. June 59, 16p. 8 refs. AFOSR-TN-59-733.
Order from LC mi$2.40, ph$3.30 PB 143 161

Washington U., Seattle.
A NOTE ON HYPERCONVEXITY IN RIEMANNIAN MANIFOLDS, by Alfred Nijenhuis. Technical rept. no. 5 on Contract Nonr-277(15). 1 July 58, 12p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 142 909

Washington U., Seattle.
THEORY OF VECTOR-VALUED DIFFERENTIAL FORMS. PART II. ALMOST-COMPLEX STRUCTURES, by Alfred Frölicher and Albert Nijenhuis, Technical rept. no. 3 on Contract Nonr-477(15). [1958] 28p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 143 135

Computing Devices

David Sarnoff Research Center, Princeton, N. J.
SHIFT REGISTER TRANSISTOR, by J. T. Wallmark. Final rept. for 15 Feb 57-15 Apr 59 on Integrated Semiconductor Device Studies, Contract AF 19(604)1957. 31 May 59, 17p. 7 refs. AFCRC-TR-59-177; AD-220 315.
Order from LC mi$2.40, ph$3.30 PB 143 634

During the course of the contract work the ideas behind the shift register were broadened into a new contract - integrated electronics, the general idea being a "molding" or integration of several component functions, active as well as passive, into one piece of material, e.g. a solid. In the case of semiconductors one might talk of integrated semiconductor circuits or devices of which the shift register is an example. By applying the integrated electronics approach to other semiconductor structures a whole new class of integrated semiconductor devices using unipolar transistors was developed. The unipolar transistor, although inferior to the conventional bipolar transistor in high-frequency response and power capabilities, may offer advantages in noise and radiation tolerance under certain conditions. It has been shown possible to extend the integrated device approach also to tuned circuit functions, such as radio and communication circuits.

Digital Computer Lab., Mass. Inst. of Tech., Cambridge.
FERROELECTRICS FOR DIGITAL INFORMATION STORAGE AND SWITCHING, by Dudley Allen Buck. Master's thesis. Rept. on Contract [N5ori-60]. 5 June 52, 72p. 13 refs. Rept. R-212; ATI-174 582.
Order from LC mi$4.50, ph$12.30 PB 144 326

Materials have recently been discovered within which exist domains of permanent electric dipoles. These materials, named ferroelectrics, can be used to advantage in many electronic applications where ferromagnetic materials are currently used, often in circuits which are the duals of those of their ferromagnetic counterparts. Ferroelectrics can be made in the form of single crystals or rugged ceramics. Digital information can be stored in a matrix of ferroelectric condensers, and an efficient method of storage-element selection is available in the form of a two-coordinate, coincident-voltage scheme. The matrix can be made on a thin ferroelectric sheet by painting the coordinate rows on one side and the coordinate columns on the other. The information can be taken from the matrix via a simple mixing transformer.

Digital Computer Lab., Mass. Inst. of Tech., Cambridge.
A MAGNETIC MATRIX SWITCH AND ITS INCORPORATION INTO A COINCIDENT CURRENT MEMORY, by Kenneth H. Olsen. Rept. on Contract N5ori-60. 6 June 52, 104p. 7 refs. Rept. R-211; ATI-173898.
Order from LC mi$5.70, ph$16.80 PB 144 069

A multi-position switch, capable of handling pulses shorter than one microsecond, can be made from magnetic cores. Windings on the magnetic cores, when matrix-connected, control selection of the switch output. These windings can be excited with either direct current or pulses. This switch is capable of transmitting power efficiently, and the magnetic cores from which it is made are inexpensive and rugged, and promise reliability and long life. Two such switches pulse the 16 coordinate rows and the 16 coordinate columns of a coincident-current magnetic-core memory. The complete cycle-time of the memory, including the switch set-up time, reading of information, and re-writing of information, is less than 4 microseconds. Design of the magnetic-matrix switch is facilitated by an equivalent-circuit technique.

Eastman Kodak Co., Rochester, N. Y.
THE MINICARD INTERIM DEVELOPMENT PROGRAM, Technical rept. on Contract AF 30(602)1683. 28 May 59, 271p. 48 refs. RADC-TR-59-49; AD-213 582.
Order from LC mi$11.10, ph$42.60 PB 142 936

A serial scan code reader scheme has been proposed and compared with the present parallel scan code reader. Serial scan offers the following potential advantages: increased card code capacity, increased readout rate, broader film density tolerances, broader card positioning tolerances. It is proposed that the serial code reader use a flying spot scanner with edge following and binary pulse position modulation code. Block diagrams show how such a serial code reader might be developed. The questions of film wear and of x-radiation are examined in detail. An estimate is made of the size and complexity of a serial scan code reader.

Marine Physical Lab., Scripps Institution of Oceanography San Diego, Calif.
A SAMPLED DATA PROCESSOR, by R. A. Rasmussen. Rept. on Contracts NObsr-72512 and Nonr-2216(05). 12 Dec 58, 37p. SIO Reference 58-16.
Order from LC mi$3.00, ph$6.30 PB 143 613

This report describes a semi-automatic data sampler and computer accommodating two channels of information representing optically stored, magnetically stored, or direct electrical data in the form of time varying potentials. All data are converted to time modulated pulses and directed to a computer where a combination of analog and digital computer circuits can be adjusted to perform a variety of mathematical operations on the data with accuracies on the order of ±0.1 percent. Results of the computations are displayed numerically on decimal totalizers, the registered numbers being proportional to the computed functions.

Mellon Inst. of Industrial Research, U. of Pittsburgh, Pa.
COMPUTER COMPONENTS FELLOWSHIP NO. 347, by W. J. Kirkpatrick and C. H. T. Wilkins. Final rept. for 1 Oct 53-30 Sep 56 on Contract AF 19(604)943. 20 Sep 57, 99p. 5 refs. AFCRC-TR-56-165; AD-98 803.
Order from LC mi$5.40, ph$15.30 PB 137 656

Small, light, low-cost, mass producible computer components were sought for performing one or more of the functions of switching, storage, selection, amplification, comparison and arithmetic or other operation on information pulses. Nonlinear resistors, saturable transformers, electroluminescence, and the effect of RF fields on gas diodes were investigated for application to electronic digital computer components. Work on nonlinear resistors resulted in adder circuits formed by printing conducting circles on opposite sides of bonded sheets of Si carbide grain. The circles were connected by printed conducting lines into matrices. Saturable transformers were used in the construction of gating circuits. A hard vacuum tube was made with a photocathode and a phosphor anode which was bistable and was triggered by light pulses. Ways were sought to make passive electronic components capable of continuous service from 200° to -60°C. It was almost impossible to print solid areas of uniform density by xerography. Conductors, capacitors, inductors, and resistors were successfully made by vacuum evaporation deposition and screen printing. The vacuum evaporation excelled for uniform thin films of metal, but SiO-SiO_2 was the only dielectric successfully deposited by this method. Chemically formed films of semiconductors appear promising because of the very low temperature coefficient of resistance in their extrinsic range.

Naval Radiological Defense Lab., San Francisco, Calif.
X Y PLOTTING WITH THE IBM MODEL 026 PRINTING CARD PUNCH, by R. Ehat and R. A. Taylor. 15 July 58, 45p. 1 ref. Research and Development technical rept. USNRDL-TR-258.
Order from LC mi$3.30, ph$7.80 PB 143 092

An IBM Model 026 Printing Card Punch has been adapted to operate into a Mosely Model 30A card Translator and a Mosely Model 2 Recorder. The design permits the plotting of IBM card information on an XY Plotter (Mosely Model 2) without disabling the normal card punching and card duplicating functions of the IBM Model 026 Printing Card Punch.

Naval Research Lab., Washington, D. C.
DIGITALIZED PICKOFF DISPLAY CONVERTER, by F. R. Fluhr. Interim rept. 11 Mar 59, 5p. Rept. 5281.
Order from LC mi$1.80, ph$1.80 PB 138 311

As Naval Data Handling Systems become larger and more complex, data processing becomes more efficient when accomplished by digital methods. Most such systems require manual monitoring and override capabilities in data insertion, detection, tracking, and computing functions. One means by which an operator can insert and correct target track data as displayed on a radar plan-position indicator is through the use of the Pickoff Display Converter. A digitalized PDC can convert an operator's positioning of an inserted marker displayed on the PPI with the radar video into the digit values representing the marker coordinates. The positioning of the marker is accomplished by positioning a probe on the surface of a conducting-glass PPI overlay. When the operator lifts the probe, the marker coordinate values are transferred to the main computer. The proposed digitalized PDC can be made to operate so that the probe will move the PPI marker in a direct 1:1 relationship or in a vernier-differential relationship.

Naval Research Lab., Washington, D. C.
SOLUTION OF SYSTEMS OF SIMULTANEOUS LINEAR EQUATIONS ON THE NAREC, by Benjamin Lepson and Janet P. Mason. Interim rept. 23 Oct 59, 16p. 1 ref. NRL Rept. 5372; NAREC ref. no. 20.
Order from LC mi$2.40, ph$3.30 PB 140 974

The solution of large systems of simultaneous linear equations is a necessary part of many research, development, and design projects. Although several methods are known for obtaining such solutions, the amount of computation necessary may be quite large. One of the standard methods, usually referred to as Gaussian elimination, has been adopted for high-speed computation and programmed for the NAREC. This can be used to solve, in a few minutes, systems of equations with as many as fifty-four unknowns. Several versions of this program are described in detail with instructions for their use.

Naval Research Lab., Washington, D. C.
SYMBOLIC ADDRESS-SYMBOLIC OPTIMUM PROGRAMS FOR A DRUM-MEMORY COMPUTER, by J. K. Russell. Interim rept. 23 Oct 59, 42p. Rept. no. 5377.
Order from OTS $1.25 PB 151 999

Because of the man-hours involved, lengthy computer programs are rarely time-optimized. It is found that the optimizing process for a computer with magnetic drum memory is itself a computable process. A program for the Royal McBee LGP-30 has been developed which performs the optimizing process on a data program written in a simple symbolic language (memory locations symbolized rather than specified). Although the data program is lengthened 2 to 5 times, it is 1/4 to 1/3 faster. Because of the length and lack of sequence in the resultant program, it is felt that an additional program is necessary to translate the symbolic language directly to unoptimized computer language (memory locations specified), for ease in troubleshooting. Such a program has also been developed. Examples of the symbolic language are given as well as the results of processing by the two programs.

MECHANICS

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF A METHOD TO DETERMINE PLASTIC STRAINS AND STRESSES USING BRITTLE COATINGS, by Kenneth E. Hofer, Jr. and A. J. Durelli. Final rept. on Contract DA 11-022-ORD-2346. June 59, 90p. 39 refs.
Order from LC mi$4.80, ph$13.80 PB 143 624

The experimental stress analysis method, of brittle coatings is used to determine the directions of the principal stresses in a plastically yielded specimen. A device for measuring the strain sensitivities of low sensitivity brittle coatings was constructed. This device was used to determine the strain sensitivity of several grades of "Stresscoat". Various resinous and ceramic coatings are used to detect Lueders' lines and their qualities are compared with each other.

Brown U. Div. of Applied Mathematics, Providence, R. I.
NUMERICAL CALCULATION OF SLIP-LINE FIELDS, by Thomas M. Downie. Technical rept. no. 45 on Contract Nonr-562(10). Nov 58, 65p. 15 refs. C11-45.
Order from LC mi$3.90, ph$10.80 PB 143 411

This paper is concerned with the quantitative values of slip-line fields in plane plastic flow. In particular, the coordinates of slip-line fields determined by two circular arcs are calculated. There are many problems in plasticity where the field is determined by two circular arcs of equal radii. An example is the extrusion of metal through a square die.

Brown U. Div. of Applied Mathematics, Providence, R. I.
NUMERICAL SOLUTIONS FOR ELASTIC-PLASTIC BEAMS BY METHOD OF CHARACTERISTICS, by R. C. Alverson. Technical rept. no. 46 on Contract Nonr-562(10). Dec 58, 106p. 32 refs. C11-46.
Order from LC mi$5.70, ph$16.80 PB 143 612

This report is concerned with the solution of problems of impact or dynamic loading of a beam such that extensive plastic deformation takes place. The main purpose of the present work is to explore the usefulness in such problems of a numerical treatment based on the Timoshenko beam equations in the elastic sections, and using integration techniques of the method of characteristics. The beam is assumed to obey laws of ideal plasticity; effects of strain-hardening, of rate of strain, and of shear force on the plasticity condition are neglected. A particular type of impact problem was solved numerically for several combinations of the load and beam parameters, and the computed results are contrasted with experimental results and with those of simple plastic-rigid analyses.

Brown U. Div of Applied Mathematics, Providence, R. I.
ON THE PROPAGATION OF STRESS IN A HALF-SPACE, by J. W. Craggs. Technical rept. no. 44 on Contract Nonr-562(10). Oct 58, 31p. 9 refs. C11-44.
Order from LC mi$3.00, ph$6.30 PB 143 785

The purpose of the present exposition was to develop a method of solution for elastic problems which is, in principle, capable of extension to the plastic-elastic case. However the solution for the elastic half-space proves to supplement previous solutions in certain respects, emphasising the importance of Rayleigh waves, and giving the stress and velocity components without complicated contour integration. The solution is therefore presented by itself for its own intrinsic interest.

Brown U. Div. of Engineering, Providence, R. I.
THE FRACTURE OF BRITTLE AND QUASI-BRITTLE MATERIALS: A SURVEY, by J. Gurland. Rept. on Contract DA 19-020-ORD-4888. Aug 59, 58p. 63 refs. DA-4888/1.
Order from LC mi$3.60, ph$9.30 PB 143 627

This survey summarizes some of the prevalent views on the theory, behavior, testing and design of brittle materials, with the absence of plastic deformation and the origin of fracture, and the problems of testing and the characteristic features of brittle behavior.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
PLASTICS STRESS CONCENTRATION AT A CIRCULAR HOLE IN AN INFINITE SHEET SUBJECTED TO EQUAL BIAXIAL TENSION, by Bernard Budiansky and O. L. Mangasarian. Technical rept. no. 3 on Contract Nonr-1866(02). Dec 58, 26p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 143 609

With the use of J_2 deformation theory, the stress-concentration factor at a circular hole in an infinite sheet of strain-hardening material subjected to equal biaxial tension at infinity is found for a variety of representative materials. The analysis exploits a transformation which permits the calculation of the stress-concentration factor without determining the stress distribution in the sheet. Subsequent calculations reveal, that for a monotonically increasing applied stress, the stress-history at all points in the sheet is nearly radial.

Institute of Flight Structures, Columbia U., New York.
ON A DYNAMICAL SAINT-VENANT PRINCIPLE, by Bruno A. Boley. Technical rept. no. 12 on Contract Nonr-266(20). Dec 58, 20p. 7 refs. CU-12-58-ONR266(20)-CE.
Order from LC mi$2.40, ph$3.30 PB 143 618

The dynamic behavior of a simple mechanical model composed of two Timoshenko beams connected by springs is studied. The accuracy of a quasi-static solution and of Saint-Venant's principle is studied for various rates of load application.

Massachusetts Inst. of Tech., Cambridge, Mass.
ELASTIC-PLASTIC TORSION OF A CIRCUMFERENTIALLY NOTCHED BAR, by J. B. Walsh and A. C. Mackenzie. Rept. on Contract AF 18(600)957. [1958] 26p. 10 refs. AFOSR-TN-59-710.
Order from LC mi$2.70, ph$4.80 PB 143 677

The elastic-plastic torsion of a cylindrical bar with a circumferential notch is investigated. Theoretical predictions of angle of twist and notch root strain are compared with experimental values.

Massachusetts Inst. of Tech., Cambridge.
ON NOTCH SENSITIVITY, by Frank A. McClintock. Rept. on Contract AF 18(600)957. 9 May 59, 33p. 23 refs. AFOSR-TN-59-712; AD-225 364
Order from LC mi$3.00, ph$6.30 PB 143 676

Experiments on pure aluminum are in agreement with the fully plastic theory. Experiments on 7075 aluminum alloy and 4140 steel show a notch sensitivity, with a crack behavior and size effect similar to that predicted from elastic-plastic analysis.

Massachusetts Inst. of Tech., Cambridge.
THE SINGLY-GROOVED, PLANE STRAIN TENSILE TEST, by Frank A. McClintock. Rept. on Contract AF 18(600)957. [1959] 27p. 14 refs. AFOSR-TN-59-713.
Order from LC mi$2.70, ph$4.80 PB 143 675

The distributions of stress and strain around a single groove in a plane strain specimen subject to fully plastic tension are found theoretically. The distinguishing features of this configuration are the lack of triaxiality and the constant strain pattern as the specimen separates. The transition temperature is lower than in the Charpy test, and a shear lip is absent.

Minnesota U., Minneapolis.
STEADY STATE UNDAMPED VIBRATIONS OF A CLASS OF NONLINEAR DISCRETE SYSTEMS, by P. R. Sethna, B. E. Fristedt, and V. G. Harvester. Rept. for Jan 58-Jan 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)2803. Aug 59, 37p. 10 refs. WADC Technical rept. 59-141.
Order from OTS $1.00 PB 161 129

Steady state vibrations of a class of nonlinear discrete systems with an arbitrary number of degrees of freedom are studied. The coordinates of the system are first transformed to the principal coordinates corresponding to the linear part of the system. A perturbation scheme is used to obtain the solutions. Some special effects of the ratios of the linear natural frequencies on the qualitative nature of the solutions are demonstrated. Solutions are obtained for some specific problems and the results are checked against those obtained from an analog type computer.

Naval Research Lab., Washington, D. C.
NOTES ON DYNAMICS OF LINEAR ELASTIC STRUCTURES, by G. J. O'Hara. Interim rept. 23 Oct 59, 19p. 10 refs. NRL rept. 5387.
Order from OTS $0.50 PB 151 933

Normal-mode theory is a recognized method of calculating the dynamic response of linear elastic structures. This report gathers together many of the important theorems, some of which have not been previously published in NRL reports, and explains and discusses them. Included is a section on Duhamel integrals for a linear simple oscillator exhibiting many of the important forms which are rarely seen. Characteristic shape or normal load theorems are also discussed, and a more exact method of stress-checking a structure is proposed.

Pennsylvania State U., University Park.
CORRELATIONS BETWEEN TRANSVERSE AND TORSIONAL SHEAR CREEP DEFORMATIONS, by Joseph Marin. Rept. for Mar-Dec 57 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)2729. June 59, 35p. 5 refs. WADC Technical rept. 57-755; AD-226 375.
Order from OTS $1.00 PB 161 258

The creep deformation of a rivet subjected to transverse shear depends, among other factors, upon the rivet diameter and rivet length. This influence of size means that each particular rivet configuration must be tested to obtain the transverse shear-creep deformation. A more basic approach would be to predict the transverse shear-creep of a rivet in terms of the more fundamental case of pure shear as represented by torsion. A theory is developed for predicting the transverse shear-creep deformation of a rivet in terms of pure torsional shear-creep. The correlation of transverse shear and pure torsion shear is made, based on both the torsion of a solid circular bar and the torsion of a thin-walled circular tube. From the theory developed, it is also possible to obtain the creep deflection of a rivet from the creep constants in pure shear or simple tension.

Space Research Labs., Litton Industries, Beverly Hills, Calif.
RESEARCH PROGRAM ON HIGH VACUUM FRICTION. Final rept. on Contract AF 49(638)343. 30 Mar 59, 159p. 71 refs. Pub. no. 1023; AFOSR-TR-59-97.
Order from OTS $3.00 PB 161 116

The principal test condition studied was that of the linear motion between two dry, clean, unlubricated, flat surfaces. Microscopic examination of sliding contact between two clean, machined surfaces led to the conclusion that each individual contact area was largely point-to-plane. Models could be loaded to yield pressures, and under certain conditions could be made to slide with abnormally low friction forces and without microscopic evidence of wear or surface distortion. A theory of friction has been postulated, based principally on the analysis of these tests.

Utah U., Salt Lake City.
A SPECIAL CASE OF CONTACT ELASTICITY, by W. Komkov. Technical rept. no. 5 on Contract Nonr-1288(02). Nov 58, 42p. 27 refs.
Order from LC mi$3.30, ph$7.80 PB 143 472

The purpose of this study was to determine the distribution of stresses in the piston and in the body of the material subjected to the high pressure due to the action of the piston throughout the elastic range and to determine the planes of formation of the plastic condition. The problem is reduced to a determination of elastic stress conditions in a three-dimensional axially symmetrical case. The main problem of contact elasticity which is treated in this paper is closely related to the so called Boussinesq problem. An extensive literature exists in this field and this complexity of theoretical approach may be judged by the array of famous names in the field of mathematics and engineering, directly connected with the closely related problems of three-dimensional elasticity.

Yale U., New Haven, Conn.
EXPERIMENTAL DETERMINATION OF CORNERS IN THE YIELD SURFACE, by Aris Phillips and George A. Gray. Technical rept. no. 5 on Contract Nonr-609(12). Dec 58, 67p. 16 refs.
Order from LC mi$3.90, ph$10.80 PB 143 848

Combined stress tests with variable stress ratios on annealed commercially pure aluminum made on a combined tension-torsion testing machine of a dead load type. The experiments indicate that the form of the yield surface at a considerable distance from the stress increment vector agrees much better with the prediction of the slip theory than it does with the prediction of the Mises theory.

Aerodynamics and Pneumatics

PREMIER SYMPOSIUM INTERNATIONAL SUR L'AÉRODYNAMIQUE ET L'AÉROTHERMIQUE DES GAZ RARÉFIÉS; RÉSUMÉS DES CONFÉRENCES ET COMMUNICATIONS, 2-5 JULY, 1958. 65p. 57 refs. AFOSR-TN-58-983; AD-205 874.
Order from LC mi$3.90, ph$10.80 PB 138 625

Abstracts (some in French) of papers presented.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
ON THE AEROELASTIC CHARACTERISTICS OF LOW ASPECT RATIO WINGS WITH CHORDWISE DEFORMATIONS, by John Dugundji and John D. C. Crisp. Rept. on Contract AF 49(638)219. July 59, 205p. 61 refs. ASRL Technical note 74-3; OSR Technical note no. 59-787.
Order from LC mi$9.30, ph$31.80 PB 143 960

An investigation is made into the nature of chordwise flutter and divergence characteristics of low aspect ratio wings. To this end, two simple low aspect ratio configurations are examined in considerable detail. The first is a cantilever rectangular wing possessing a bending, a torsion, and a first chordwise bending mode. The second is a free-free delta wing of sufficiently low aspect ratio so that spanwise deformations can be neglected. Some effects of aerodynamic heating and longitudinal accelerations on these planforms are also examined. Simple closed form solutions are developed for the flutter and divergence characteristics wherever appropriate. The general trends revealed by these analyses may prove to be of interest to persons involved in the interpretation of aeroelastic analyses of such surfaces. Among the more interesting trends indicated was the role played by mass density ratio for the delta wings. At the lower mass density ratios, more chordwise modes had to be included in the modal type analyses. Also, for high mass density ratios, the flutter characteristics became dependent on dynamic pressure q and independence of the mass density ratio.

Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DATA REDUCTION TECHNIQUES FOR FLIGHT VIBRATION MEASUREMENTS, by D. C. Kennard, Jr. and C. E. Thomas. Rept. on Environmental Criteria for Flight Vehicles and Related Equipment. Feb 59, 23p. 2 refs. WADC Technical note 59-44; AD-210 478.
Order from LC mi$2.70, ph$4.80 PB 144 204

The system used at Wright Air Development Center for recording and analyzing flight vibration data is described. It has made possible a significant increase in the quantities of raw data which can be acquired to define the vibration and sound environments in various aircraft. To reduce the large quantities of data to usable form, processing techniques have been evolved based upon the use of standard business machines and the ERA 1103 Computer. These techniques are described and methods are illustrated for presenting

data to define spectral and statistical qualities of the sound and vibration environment. A proposed system to provide still further automation of the data reduction process is described briefly. It is concluded that these recent advances in state-of-the-art make possible the acquisition of sufficient data to eliminate eventually the present inexact methods of estimating sound and vibration environments of aircraft and missiles.

Air Force Flight Test Center, Edwards AFB, Calif.
STANDARDIZATION OF TAKE-OFF PERFORMANCE MEASUREMENTS FOR AIRPLANES, by Kenneth J. Lush. [1948] 102p. 1 ref. Technical note R-12.
Order from LC mi$5.70, ph$16.80 PB 144 149

Formulae are derived by which take-off performance measurements may be standardized. These formulae are easy to use and they apply, with suitable numerical constants, to airplanes with any type of propulsive system, including mixed types and types using part-time assistance or boost. Numerical constants are proposed for use with these formulae. Experimental data available support these constants, but are insufficient to check them completely.

Air Force Missile Development Center, Holloman AFB, N. Mex.
GRAVITY SURVEY OF THE HOLLOMAN TRACK, by Ray L. Larkins and Frank J. Calkum. July 59, 25p. 3 refs. AFMDC-TR-59-31.
Order from LC mi$2.70, ph$4.80 PB 143 183

Tests of inertial guidance systems on the Holloman track require a precise knowledge of the gravity force. This report describes the instrument used, the evaluations of the measurements, and tabulates theoretical gravity, observed gravity, free-air anomaly, and Bouguer anomaly along the seven miles of the Holloman track.

Arnold Engineering Development Center [Tullahoma, Tenn.]
USE OF PERFORATED WALLS FOR SHOCK CANCELLATION AT SUPERSONIC SPEEDS, by H. Ramm and M. Jones. Rept. on ARO, Inc. Contract AF 40(600)800. Aug 59, 97p. 8 refs. AEDC-TR-59-15.
Order from LC mi$5.40, ph$15.30 PB 143 276

Tests have been conducted in the 1-Foot Supersonic Model Tunnel of the Propulsion Wind Tunnel Facility, AEDC, to determine shock cancellation characteristics of perforated walls at supersonic Mach numbers up to 3.15. The test section wall configurations investigated included walls with holes drilled normal to the wall surface and with holes slanted 60 deg to obtain differential resistance for inflow and outflow. Theoretical considerations helped to separate the influences that tend to make the wall characteristics nonlinear in an undesirable sense. These influences were found to be the ratio of the boundary layer thickness to hole diameter and the pressure recovery in the holes. Tests with two and three-dimensional models showed the feasibility of satisfactory shock cancellation for at least moderate model blockage values. Models with more than 4 percent blockage may require special means of improving the cancellation of the expansion waves following the bow wave compression.

Bell Aircraft Corp. [Buffalo, N. Y.]
CHEMICAL NON-EQUILIBRIUM EFFECTS IN THE LAMINAR HYPERSONIC BOUNDARY LAYER, by George R. Inger. Doctoral thesis. Rept. for June-Oct 58 on Contract AF 49(638)380. 30 Mar 59, 139p. 22 refs. Rept. no. 7010-6; AFOSR-TN-59-237; AD-212 007.
Order from LC mi$6.90, ph$21.30 PB 143 588

In view of the importance of dissociation-recombination chemistry of a flowing air mixture to the accurate calculation of aerodynamic design data, such as heat transfer, real gas dynamics research has focused attention on the theoretical study of the chemical non-equilibrium laminar boundary layer. The present report is concerned with the basic foundations of such studies - in particular, some new theoretical representations of a dissociating air mixture and a new method of non-equilibrium boundary layer solution are presented.

Bureau Technique Zborowski, Brunoy (France).
THEORETICAL INVESTIGATION AND EXAMINATION BY MEASURING TESTS IN WHAT A DEGREE THE ECONOMY OF FLYING VEHICLES IS INFLUENCED BY PRE-CAMBERED SKELETONS OF AIRFOILS CLOSED IN THEMSELVES. Final Technical rept. for 1 July 58-31 July 59 on Contract DA 91-508-EUC-393. 10 Aug 59, 68p. 17 refs.
Order from LC mi$3.90, ph$10.80 PB 143 446

The economy of high-speed flying vehicles depends not only on the choice of adequate profiles and wing dimensions as aspect ratio and span, but also and even more on the possibility of flight with reduced velocities at still acceptable lift-drag ratios as well as on good manoeuvring properties without risk of stall. Although ring airfoils present, in this domain, well-known advantages over plane wings, as e.g. lower induced-drag values for equal lift and aspect ratio and less inclination to stall phenomena, it seems worth while to apply to them the same devices as utilized in plane-wing theory by MALAVARD, i.e. precambering of the wing center-lines to guarantee a favorable behavior of the airfoil at a particularly interesting lift value ("adaptation" value).

California U., Berkeley.
VECTOR POLAR METHOD FOR SHOCK INTERACTIONS WITH AREA DISTURBANCES, by A. K. Oppenheim and P. A. Urtiew. Technical note no. DR 4 on Contract AF 49(638)166. July 59, 157p. 29 refs. AFOSR-TN-59-701.
Order from LC mi$7.50, ph$24.30 PB 143 670

The application of the vector polar method to the study of interactions between plane traveling shock waves and area disturbances involves the introduction of steady flow polars. The solutions obtained by the vector polar method are shown to compare favorably with analytical and experimental results obtained by

other investigators who studied the interactions of shocks with a variety of obstacles, such as grids and gauzes, in shock tubes.

Carnegie Inst. of Tech., Pittsburgh, Pa.
STUDIES RELATING TO CONDENSATION TRAILS. Final rept. on Contract AF 19(604)1944. July 59, 72p. 15 refs. AFCRC-TR-59-257; AD-217616
Order from LC mi$4.50, ph$12.30 PB 143 658

Three studies of importance in the analysis and understanding of condensation trail phenomena have been made. The first is an experimental determination of the effect of hygroscopic nuclei on the size and concentration of water drops in a contrail. The second is an analysis of the numerical evaluation of the equations of drop growth. In the third, a new theory of nuclei growth is presented, based on the kinetic theory of gases.

David Taylor Model Basin, Washington, D. C.
CONTRIBUTION TO THE THEORETICAL INVESTIGATION OF BLOWING AT THE TRAILING EDGE OF A WING PROFILE (Contribution a l'Etude Theoretique du Soufflage au Bord de Fuite d'un Profil d'Aile), by L. Malavard, tr. by S. T. de los Santos. July 55, 46p. ONERA Note Technique 4/1727 A; DTMB Aero rept. 879.
Order from LC mi$3.30, ph$7.80 PB 138 994T

Institute for System Research, U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING IN AN AIR VEHICLE: A REVIEW OF THE LITERATURE [PART 22] by M. Z. Krzywoblocki. Rept. for Apr-June 57 on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Aug 59, 311p. 1438 refs. WADC Technical note 56-360, Part 22, [AD-227 136]
Order from OTS $5.00 PB 161 140

This work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The present segment of the work includes material reviewed by the author in the period April 1957 through June 1957. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly; others are listed without comment. (See also PB 161 000-001).

Institute of Engineering Research, U. of California, Berkeley.
LIFT AND DRAG ON CONE CYLINDERS, by T. Nark. (Doctoral thesis). Rept. on Contract Nonr-222(45). 30 Dec 57, 43p. 10 refs. Rept. no. HE-150-154; Series no. 20, issue no. 117; AD-155 159.
Order from LC mi$3.30, ph$7.80 PB 138 634

The normal and axial forces were measured on a cone-cylinder body of revolution in a supersonic, rarefied gas flow at a Reynolds number of 4050 and Mach number of 4.0. The angle of attack was varied to a maximum of sixteen degrees. The final results, plotted in coefficient form, were compared to Newtonian hypersonic theory for an inviscid fluid. The test was conducted at such low Reynolds numbers that the Newtonian theory did not adequately represent the axial forces, but when a skin friction correction was applied to the theory, the experimental data are within 15 percent of the predicted values. The normal force coefficient was adequately predicted by the Newtonian theory, with the maximum error above 8 degrees being 10 percent.

Just, W.
A PRELIMINARY AERODYNAMIC STUDY OF THE HIGHSPEED-LONGRANGE-VTOL "JIFFY" OF MR. E. LAGELBAUER, by W. Just and H. Georgi. Final technical rept. no. 1 15 Mar-15 July 59, on Contract DA 91-591-EUC-1083, OI-1307-59. [1959] 82p. 2 refs.
Order from LC mi$4.80, ph$13.80 PB 143 602

This paper deals with the investigation into the capacities of the vertical-take-off-aircraft "Jiffy" suggested by E. Lagelbauer, during hovering, at vertical climbing, as well as in horizontal flight at low speeds, employing fixed rotors with unvariable blade angles of pitch. Following an introductory chapter as to layout, abbreviations, and design parameters the rotor coefficients are computed for hovering, vertical climbing, and horizontal flight, and the performance calculations are executed. The results of these calculations are shown on diagrams. The result of this aerodynamical investigation of the rotor has shown that, with the project proposed of a vertical-take-off-aircraft, satisfactory flight characteristics can be obtained only by employing a tiltable wing whereby the wing must be tilted by about 25° to 40° (with, and without, flap displacement), depending on whether the aircraft is operating in its state as helicopter or convertiplane. In its structural design, the aircraft thus resembles a tilting wing aircraft whereby, however, additional difficulties will have to be overcome on account of the shutting-off of the rotors. From the aerodynamical point of view this project can be realized. The definite acceptability of this project, however, can be established only through additional extensive investigations.

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
EFFECTS OF AIR DISSOCIATION AND IONIZATION AT HYPERSONIC SPEED, by Gianna Jarre. Technical note 14 on Contract AF 61(514)1124. July 59, 37p. 8 refs. AFOSR-TR-59-119.
Order from LC mi$3.00, ph$6.30 PB 143 910

This paper deals with the problem of dissociation and ionization of air components at the high temperatures produced by hypersonic speed, either behind a strong normal shock wave or at the wall of an adiabatic flat plate. The state of chemical equilibrium is studied with the aid of a thermodynamic chart of atmospheric air and using simplified schemes of real flows. The dynamic problem of relaxation is also investigated but only in the field of oxygen dissociation. Simplified methods for calculating the length of the relaxation processes are developed, discussed and applied to numerical examples.

National Research Labs., Ottawa (Canada).
APPROXIMATE METHOD FOR DETERMINING THE POTENTIAL FLOW ABOUT AN ARBITRARY AEROFOIL SECTION IN A TWO-DIMENSIONAL FINITE STREAM WITH PARTICULAR REFERENCE TO LARGE STREAM DEFLECTIONS, by D. G. Gould. Aug 59, 43p. 8 refs. Aeronautical rept. LR-260.
Order from LC mi$3.30, ph$7.80 PB 143 576

The flow about and on the surface of an aerofoil section in a finite stream and that about and on the surface of the same aerofoil section in an infinite symmetrical cascade are compared. It is shown that, for most cases of practical interest, the differences are small for stream deflection angles up to 90 degrees. Thus, the approximate flow about an arbitrary aerofoil section in a two-dimensional finite stream may be obtained by using the methods existing for the determination of the flow about an arbitrary section in a cascade. The procedure, as applied to the finite stream approximation, is given using the interference method of cascade theory.

National Research Labs., Ottawa (Canada).
METHODS OF MEASUREMENT OF AIRCRAFT DYNAMIC STABILITY DERIVATIVES, by K. Orlik-Rückemann. July 59, 57p. 217 refs. Aeronautical rept. LR-254.
Order from LC mi$3.60, ph$9.30 PB 143 578

The numerous methods available for determination of dynamic stability derivatives of aircraft are presented and grouped according to a convenient classification system. Both free flight and wind tunnel methods are considered. The basic aspects of each method are described in the text and illustrated by a schematic drawing. Detailed information can be obtained from a rather extensive bibliography, arranged according to the same classification system.

Naval Ordnance Lab., White Oak, Md.
TEMPERATURE RECOVERY FACTORS ON A 40-DEGREE CONE CYLINDER WITH TURBULENT BOUNDARY LAYER AT MACH NUMBERS 4.1 AND 4.8, S. M. Dmohoski. 20 Aug 57, 26p. 20 refs. Aerodynamics Research rept. 22; NAVORD rept. 5763.
Order from LC mi$2.70, ph$4.80 PB 143 309

Temperature recovery factors have been measured on the cylindrical surface of a 40-degree cone cylinder with turbulent boundary layer. The measurements were made with and without a turbulence promoter immediately upstream of the nozzle in the NOL Continuous 40 x 40 cm Aeroballistics Wind Tunnel No. 2 at Mach numbers 4.1 and 4.8. Though turbulent recovery factors have been studied extensively at lower Mach numbers, only isolated investigations have been reported at Mach numbers of 4 and above. However, the results of the present experiments demonstrate essentially the same effects observed at lower Mach numbers, i.e., the turbulent recovery factor is approximately equal to the cube root of the Prandtl number.

Princeton U., N. J.
EXPERIMENTAL STUDIES AT MACH NUMBERS 12 TO 19 OF CONICAL AND BLUNTED BODIES AT ZERO ANGLE OF ATTACK, by S. M. Bogdonoff and I. E. Vas. Rept. on Contract AF 18(600)498. Sep 58, 63p. 8 refs. Rept. no 435; AFOSR-TN-58-841; AD-203 181.
Order from LC mi$3.90, ph$10.80 PB 143 655

An experimental study on conical and blunted bodies was carried out at Mach numbers between 12 and 19 using the Princeton University Helium Hypersonic Tunnel. Pressure distributions and Schlieren photographs were obtained for bodies with cone half angles varying from 10° to 45°. Comparison with the theoretical inviscid and Newtonian pressures corrected for normal shock losses were made. The pressures on a body without corners can be predicted quite well. A corner at the junction of the nose section and conical afterbody results in large variations between the measured values and predicted ones. The pressures on the conical bodies were not affected by the nose shape for that part of the body downstream of a station located at 1 1/2 times the nose bluntness diameter.

Rensselaer Polytechnic Inst., Troy, N. Y.
NONEQUILIBRIUM FLOW IN GAS DYNAMICS, by T. Y. Li. Rept. on Contract AF 18(600)1591. May 59, 57p. 35 refs. TR AE 5901; AFOSR-TN-59-389; AD-213 893.
Order from LC mi$3.60, ph$9.30 PB 143 516

The present paper consists mainly of three parts. The first part deals with general concepts which include (1) the fundamental equations and boundary conditions in problems of steady adiabatic inviscid flow of a reacting mixture of perfect gases and (2) a general study of the chemical relaxation in a gaseous system. The second part deals with the steady one dimensional nozzle flow with nonequilibrium chemical reactions. An important nondimensional parameter is used to classify the nozzle flow into (1) equilibrium flow (2) nonequilibrium flow and (3) frozen flow. Significant departure from equilibrium flow in a hypersonic shock tunnel nozzle would lead to frozen flow further downstream. The third part presents a numerical method whereby the inviscid adiabatic flow of a reacting mixture of perfect gases past a blunt body may be calculated. Numerical examples show that significant changes in the flow conditions of the shock layer region can be attributed to the chemical nonequilibrium effects.

Hydrodynamics, Hydraulics, and Hydrostatics

Applied Mathematics and Statistics Lab., Stanford U., Calif.
WAVE GENERATION BY OSCILLATION OF SUBMERGED BODIES, by Harold Levine. Technical rept. no. 79 on Contract Nonr-225(11). 19 Nov 58, 39p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 143 408

This paper deals with some two-dimensional hydrodynamic problems of an ideal, incompressible fluid.

The fluid is assumed infinitely deep and to possess a horizontal free surface when a state of equilibrium in the field of gravity prevails. A steady motion of the fluid will result if there is a submerged contour which oscillates periodically, and waves are generated on the free surface. The large wave motions pose a formidable calculation, and it is therefore customary to assume that the oscillations of the contour and hence the wave amplitudes are infinitesimal. Then the problem is one of potential theory, with linear boundary conditions imposed at the fixed, equilibrium positions of the free surface and immersed contour.

David Taylor Model Basin, Washington, D. C.
CENTROID AND MOMENT OF INERTIA OF A SUPERCAVITATING SECTION, by W. B. Morgan. Aug 57, 20p. 6 refs. Rept. no. 1193.
Order from LC mi$2.40, ph$3.30 PB 138 642

Equations are derived by numerical integration for the ordinate of the centroid and moment of inertia about the x_0-axis of Tulin's SC section with the TMB modified thickness distribution. These equations are evaluated for a flat face section and for a section with a given relationship between design lift coefficient and design angle of attack. The results are plotted in a form convenient for propeller blade stress analysis.

David Taylor Model Basin, Washington, D. C.
THE DESIGN AND ESTIMATED PERFORMANCE OF A SERIES OF SUPERCAVITATING PROPELLERS, by A. J. Tachmindji and W. B. Morgan. July 58, 58p. 26 refs.
Order from LC mi$3.60, ph$9.30 PB 143 563

This paper outlines the procedure which has been developed for the design of supercavitating propellers and the possible range of application in which such propellers can be used. This design method has been used to predict the performance characteristics of a series of supercavitating propellers and compared with specific experimental results.

David Taylor Model Basin, Washington, D. C.
OPTIMUM SUPERCAVITATING SECTIONS by W. B. Morgan. Aug 57, 23p. 9 refs. Rept. C-856; AD-145 538.
Order from LC mi$2.70, ph$4.80 PB 138 643

If both the cavitation and friction drag of a supercavitating (SC) section are considered, a minimum drag-lift ratio occurs at a specific lift coefficient. This lift coefficient is mainly dependent on the type of SC section being considered.

David Taylor Model Basin, Washington, D. C.
A PHASE-COMPONENT MEASUREMENT SYSTEM, by R. G. Tuckerman. Apr 58, 25p. 3 refs. Rept. 1139.
Order from LC mi$2.70, ph$4.80 PB 144 206

This report describes an instrumentation system developed to indicate directly the first-order Fourier coefficients of the heaving force and pitching moment acting on a ship model when it is forcibly displaced. Provision is made for indicating the coefficients of the second or the third harmonics when desired. Direct recording of the force and moment signals is also provided. The report includes schematic diagrams, photographs, and operating instructions.

Experimental Towing Tank, Stevens Inst. of Tech., Hoboken, N. J.
THE FORCE CHARACTERISTICS OF SURFACE-PIERCING FULLY VENTILATED DIHEDRAL HYDROFOILS, by Peter Ward Brown. Rept. on Contract Nonr-263(20). Oct 58, 68p. 10 refs. Rept. no. 698.
Order from LC mi$3.90, ph$10.80 PB 143 209

Results of a theoretical and experimental investigation of the characteristics of surface-piercing, fully ventilated dihedral hydrofoils are presented. A range of dihedral angles from 20 to 40 degrees is covered in the experimental investigation. Good agreement between experiment and theory is obtained, the theory being applicable to surface-piercing, fully ventilated dihedral hydrofoils of zero sweep, taper and twist. The report includes experimental evidence and an analysis of cambered sections with partially attached flow to the upper surface.

Iowa Inst. of Hydraulic Research, Iowa City.
THE IOWA TOWING TANK, by Milton Martin. Rept. on Contract Nonr-1611(01). 1 Nov 58, 10p.
Order from LC mi$1.80, ph$1.80 PB 143 473

The towing tank of the Iowa Institute of Hydraulic Research at the State University of Iowa has now been in operation for approximately one year. It is being used for research in both naval and hydraulic problems. The design and construction of this new facility involved some novel features which should be of interest to other designers. A detailed discussion of these features will be included.

Rensselaer Polytechnic Inst., Troy, N. Y.
FINITE CAVITY CASCADE FLOW, by Hirsh Cohen and C. D. Sutherland. Rept. on Contract Nonr-591(08). 2 Apr 58, 30p. 13 refs. RPI Math Rep no. 14.
Order from LC mi$2.70, ph$4.80 PB 139 211

The problem considered in this paper is the steady flow of incompressible, non-viscous fluid past an infinite array of lifting foils under such conditions that fully-developed cavities appear on the foil surfaces. The discussion here will be limited to two dimensional flow past foils set at small angle of attack. Such cavitating cascade flows are of interest in many types of internal and external flow machines - axial compressors, propellers, and other multi-bladed devices.

Wichita U. [School of Engineering] Kans.
CONTRIBUTIONS TO JET PUMP THEORY, by H. B. Helmbold. Rept. on Contract Nonr-201(01). Sep 57, 105p. 4 refs. Rept. no. 294, supersedes Engineering Studies 105, 106, 107, 118, 137, 145.
Order from LC mi$5.70, ph$16.80 PB 138 959

Contents:
Part I. Comparison of ideal mixing processes
Part II. Integral relations on mixing processes
Part III. Simplified theory of mixing-zone spreading
Part IV. Approximate theory of jet diffusion in a constant-pressure mixing tube
Part V. Simplified theory of the plate jet in a parallel stream under constant pressure
Part VI. Perfect mixing processes in subsonic jet pumps

METALLURGY

Birmingham U. (Gt. Brit.)
RESEARCH ON STRAIN-AGING, HARDENING, AND SOFTENING OF METALS BY FATIGUE, by G. W. J. Waldron and J. M. Summerton. Technical summary rept. for Sep 57-Feb 59 on Contract AF 61(514)1182. [1959] 128p. 56 refs. AFOSR-TN-59-774; AD-219 717.
Order from LC mi$6.30, ph$19.80 PB 143 959

Increasing magnesium content reduces the width of slip marks which occur during fatigue, and the amount of surface cracking is also reduced. Experiments at -196°C have shown hardening and softening effects which it is suggested are due to interactions of vacancies and solute atoms with dislocations. A technique is outlined for growing large seeded zinc crystals of any desired orientation, and a method of acid machining gauge lengths in these crystals is described.

Cornell U., Ithaca, N. Y.
DENSITY MEASUREMENTS OF SOME THIN COPPER FILMS, by N. Wainfan, Nancy J. Scott and L. G. Parratt. Technical rept. no. 1 on Contract AF 49(638)402. 1 Dec 58, 21p. 12 refs. AFOSR-TN-58-1024; AD-162 289.
Order from LC mi$2.70, ph$4.80 PB 138 511

Density measurements on copper films, vacuum-deposited onto optically flat pyrex substrates, in the thickness range between 50 and 1000A. For a film thickness in excess of 120A the film density was found to be equal to the bulk density to within the limits of the experimental accuracy. Comparison of the x-ray method of measuring film thickness with an optical interference method.

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
FIELD EMISSION MICROSCOPY OF METAL CRYSTAL NUCLEATION, by K. L. Moazed and G. M. Pound. Final rept. on Oxidation, Vapor Nucleation and Surface Diffusion of Metals and Alloys, Contract AF 18(600)1572. 15 Sep 59, 114p. 56 refs. AFOSR-TR-59-131; AD-225 717.
Order from LC mi$6.00, ph$18.30 PB 143 829

A field emission microscopic investigation of the heterogeneous nucleation of metal vapors on metallic substrates. Nucleation of silver on tungsten was observed to occur when the population of adsorbed silver atoms reached a critical value at preferred sites on the substrate surface. Qualitative observations were also made on the evaporation and desorption of silver from a tungsten emitter tip.

Ferrous Metals

Curtiss-Wright Corp., Caldwell, N. J.
INVESTIGATION OF FATIGUE PROPERTIES AT ROOM TEMPERATURE OF HIGH STRENGTH STEELS HAVING HIGH TEMPERING TEMPERATURES, by Harold N. Cummings, Foster B. Stulen, and William C. Schulte. Rept. for 1 May 58-30 Apr 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5182. Sep 59, 105p. 8 refs. WADC Technical rept. 59-227.
Order from OTS $2.50 PB 161 144

High strength steels exhibiting some promise of good fatigue strength at temperatures up to about 1000°F were investigated. The tests reported herein were made at room temperature, as preliminary to later testing, under temperature, of the steels studied or modifications of them as suggested by the test results. Steels for (1) general structural use, (2) use for springs, (3) use for the surface of space vehicles, and (4) use for bearings, were investigated. Possibilities of improved fatigue performance were indicated provided the inclusion content could be lowered and the inclusion size restricted to below half a thousandth of an inch.

Engineering Materials Research Lab., Brown U., Providence, R. I.
ENERGY VERSUS STRESS THEORIES FOR COMBINED STRESS. A FATIGUE EXPERIMENT USING A ROTATING DISC [AND] BASIC RESEARCH ON FATIGUE FAILURES UNDER COMBINED STRESS, by W. N. Findley, P. N. Mathur and others. Technical rept. no. 7 (Final) on Contract DA 19-020-ORD-3520. Dec 58, 25p. 8 refs. EMRL-13.
Order from LC mi$2.70, ph$4.80 PB 143 069

An experiment in which the strain energy at the critical location for fatigue failure is maintained constant while the stresses on a given plane of the material at the same location are caused to fluctuate. Apparatus developed to produce this condition consisted of a circular disc with a wide-flanged rim which was loaded along a diameter by means of pivot-pad bearings. The disc was then rotated under a constant load.

Ingersoll Kalamazoo Div.; Borg-Warner Corp., Mich.
INVESTIGATION AND EVALUATION OF ULTRA STRENGTH STEEL FOR MISSILE BOOSTERS, by Arnold O. Moelk and R. A. Patterson. Rept. on Contract NOrd-15719. 10 Jan 58, declassified 17 Oct 58, 31p. 1 ref. Project rept. SPDIR-18; AD-155 241.
Order from LC mi$3.00, ph$6.30 PB 144 056

Three materials, SAE 4142, SAE 4340 and SAE 6140 were evaluated to determine the possibilities of finding a material that has the potentialities of developing a yield strength of 240,000 psi in the heat treated condition. A material designated as MBMC #1 was developed.

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
CHEMICAL METHODS OF DETERMINING SULFUR IN LOW ALLOY AND CARBON STEELS, by Walter L. Miller. Final rept. 14 Aug 51, 28p. Lab. Proj. 4933-A-5.
Order from LC mi$2.70, ph$4.80 PB 143 905

As a part of the program for standardization of chemical test methods, seven Naval Laboratories have completed a collaborative test of two methods for determining sulfur in low alloy steels or carbon steels. The methods tested and the results are included. On the basis of results obtained and convenience of the method, a combustion-titration method was found to be the better method. This method has been rewritten in a form suitable as a standard method.

Minerals Research Lab., U. of California, Berkeley.
HIGH TEMPERATURE HEAT CONTENTS OF SOME BINARY IRON ALLOYS, by Weston B. Kendall, Raymond L. Orr, and Ralph Hultgren. Technical note no. 2 on Contract AF 49(638)83. 1 July 59, 16p. 3 refs. Series no. 137, issue no. 2; AFOSR-TN-59-524; AD-216 258.
Order from LC mi$2.40, ph$3.30 PB 143 672

Measurements of the heat capacity at elevated temperatures for ferrochromium, ferromanganese, ferrosilicon, and ferrocobalt alloys.

Naval Weapons Plant, Washington, D. C.
FLAME HARDENING OF MODULAR CAST IRONS, by F. A. Caudle and V. DePierre. 14 Aug 59, 28p. 55 refs. NAVORD rept. 6505; NWPW-T-16-59; AD-226 028.
Order from LC mi$2.70, ph$4.80 PB 143 886

A flame-hardening procedure consisting of multiple flame passes followed by water quenching is described for surface hardening ferritic nodular irons, MIL-I-17166, to a surface hardness of Rockwell C 50-58, with 0.03 to 0.07 inch case depths. A preliminary literature survey on flame hardening cast irons and laboratory tests used for establishing the flame-hardening procedure are reported.

Naval Weapons Plant, Washington, D. C.
NOTCH TOUGHNESS OF SPHEROIDAL GRAPHITIC HIGH DUCTILITY IRON CASTINGS, by Vincent DePierre and Shingo Inouye. 10 Sep 59, 51p. 24 refs. NWPW-T-3-59; NAVORD rept. 6493.
Order from OTS $1.50 PB 161 120

Data from a literature survey of notch toughness of spheroidal graphitic iron castings and test results obtained in the U. S. Naval Weapons Plant were used to show the effect of material variables and external test factors on the notch toughness of spheroidal graphitic cast iron. Material variables consist of chemical composition, microstructure, and susceptibility to temper brittleness. External factors cover test temperature, specimen dimensions, speed of loading, and stress concentration. An equation correlating the nil ductility temperature with material variables and external test factors was obtained for spheroidal graphitic cast iron from literature and test data.

Rock Island Arsenal Lab., Ill.
A COMPARISON OF PHOSPHATE COATINGS FOR USE IN THE COLD SHAPING OF STEEL, by D. R. Johnson. 4 Feb 58, 43p. 12 refs. Rept. no. 58-248; AD-204 335.
Order from LC mi$3.30, ph$7.80 PB 144 053

Coatings produced in the room temperature zinc phosphate solution were compared to those produced in the chlorate-nitrate and nitrate-nitrite accelerated zinc phosphate solutions. The room temperature zinc phosphate solution produced coatings whose draw characteristics were comparable to those produced in the chlorate-nitrate and the nitrate-nitrite accelerated solutions. Steel grit blasting was found to be slightly superior in draw properties to pickling as a pretreatment.

Watertown Arsenal Labs., Mass.
NOTCH TOUGHNESS OF DUCTILE CAST IRON AS A FUNCTION OF COMPOSITION, by S. V. Arnold. Dec 57, 19p. Technical rept. WAL TR 330/17; AD-149 956.
Order from LC mi$2.40, ph$3.30 PB 138 581

The compositions tested show the effect of individual alloying elements or specific combinations of elements upon mechanical properties. Silicon contents commensurate with maximum toughness in the as-cast and annealed conditions are 3.17% and 2.15% respectively. Maximum rupture energies for as-cast and annealed irons were 12 and 14 ft-lbs respectively.

Light Metals

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF TITANIUM-BASE ALLOYS FOR ELEVATED TEMPERATURE APPLICATION, by Frank A. Crossley, William F. Carew, and David W. Levinson. Rept. for 1 Jan 56-31 Mar 57 on Metallic Materials, Contract AF 33(616)2853. Nov 57, 66p. 6 refs. WADC Technical rept. 54-278, Pt. 4; AD-142 147.
Order from OTS $1.75 PB 131 593

Evaluation of 7Al-3Mo-Ti alloy: Studies of the effect of forging and heat treatment variations on the mechanical properties of this alloy met with several difficulties. Material used initially was discarded because of low ductility; this was attributed to the 0.2% oxygen content. Substitute material was also low in ductility for undetermined reasons. Significant conclusions were that (1) in heat treating, increasing

the solution treating temperature followed by water quenching increases the time required for overaging, (2) the Widmanstatten structure had about 10,000 psi greater rupture strength at 1000°F than the equiaxed structure, and (3) forged specimens had lower creep-rupture strength at 1000°F than machined specimens. Evaluation of 6Al-3Nb, 6Al-3Mo-2Ge, and 6Al-3Mo-4Ge Ti alloys: These alloys were evaluated by tensile, creep-rupture, and stability tests. Tensile properties were determined at room temperatures, 570°, 800°, and 1020°F. The 6Al-3Nb alloy was stronger than the 6Al-3Mo alloy at room temperature but had marginal ductility. Both Ge-bearing alloys were much stronger than the 6Al-3Mo alloy. The 6Al-3Mo-4Ge alloy had very low ductility. The 6Al-3Mo-2Ge alloy lost ductility in the stability tests. (See also PB 121 467)

Titanium Metallurgical Lab., Battelle Memorial Inst., Columbus, Ohio.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM: STATUS REPORT NO. 2, by C. R. Simcoe. 25 Sep 57, 52p. 30 refs. TML rept. no. 46B; AD-153 855.
Order from OTS $1.50 PB 121 630

The objectives of this research program were: (1) To determine the effect of forging and heat treatment variables on the mechanical properties of the Ti-7Al-3Mo alloy. Evaluations were made of tensile specimens, both machined from bar stock and cut from plate fabricated in such a manner as to simulate compressor blade forging practice. The purpose of this dual evaluation was to determine what effect the forged skin had on mechanical properties. (2) To determine the effect of sponge quality on mechanical properties of 7Al-3Mo alloys. (3) To evaluate the tensile, creep-rupture and stability properties of the alloys Ti-6Al-3Nb, Ti-6Al-3Mo-2Ge and Ti-6Al-3Mo-4Ge.

Watertown Arsenal Labs., Mass.
THE HOT HARDNESS OF TITANIUM AND TITANIUM ALLOYS, by F. R. Larson. July 58, 39p. 9 refs. Technical rept. WAL TR 401/300; AD-200 193.
Order from LC mi$3.00, ph$6.30 PB 138 582

Low alloy heats lose their hardnesses at a fairly high even rate. High alloy heats hold their hardnesses well up to about 1100°F, and then the hardness drops offf very sharply with increasing temperature. The influence of alloying elements in promoting resistance to softening was evaluated at 900°F. Iron was found to be the most effective with the other elements being arranged in order of decreasing effect, as follows: manganese, molybdenum, aluminum, zirconium, and chromium.

Structural Metallurgy and Corrosion

Aeronautical Materials Lab., Naval Air Material Center, Naval Air Experiment Station, Philadelphia, Pa.
THE EFFECTS OF NAPHTHENIC ACIDS ON THE CORROSION BEHAVIOR OF ALUMINUM ALLOYS IN FUEL TANKS, by H. Paige and S. J. Ketcham. Rept. for 17 Mar 50-10 Mar 51. 13 Apr 51, 30p. 5 refs. Rept. no. AML NAM AE411049, Pt. 1.
Order from LC mi$2.70, ph$4.80 PB 144 096

The effects of fuels on metals and alloys used in naval aircraft have been investigated by means of weight loss measurements after immersion in quiescent fuel samples and by means of corrosion studies of aluminum alloys exposed to aqueous extracts of the fuels in the presence of other metals. Total immersion tests indicate that the presence of up to 0.2% naphthenic acid in the fuels has no appreciable effect on any of the metals tested, with the exception of lead. In water extracts of the fuels, 52S aluminum alloy suffered consistent pitting corrosion when coupled to brass, copper or lead. Less severe pitting also occurred on uncoupled 52S aluminum alloy specimens in water extracts as well as in distilled water, when lead or copper were present under certain conditions. Small amounts of naphthenic acids in the water extracts possessed a tendency to decrease the corrosion reactions on aluminum alloys. This inhibiting effect was more pronounced in uncoupled tests and in water extracts of fuels containing toluene.

California Inst. of Tech., Pasadena.
CATHODIC PROTECTION IN CAVITATION DAMAGE: TESTS OF MILD STEEL IN A SALT SOLUTION, by M. S. Plesset, B. C. Bass and R. Hickling. Rept. on Contract Nonr-220(28). Nov 58, 26p. 11 refs Engineering Div. rept. no. 85-10.
Order from LC mi$2.70, ph$4.80 PB 143 619

Tests on mild steel specimens subjected to cavitation attack in a 3 per cent salt solution. Cathodic currents reduced the damage rate as the current level was increased. It seems reasonable to ascribe reduction in the cavitation damage to a cushioning effect by the hydrogen.

Curtiss-Wright Corp., Caldwell, N. J.
QUALITATIVE ASPECTS OF FATIGUE OF MATERIALS, by Harold N. Cummings. Rept. for 1 May 58-30 Apr 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5182. Sep 59, 263p. 323 refs. WADC Technical rept. 59-230.
Order from OTS $4.00 PB 161 145

This report discusses qualitatively the variables that affect the fatigue life and strength of structural metals. Although the table of contents purports to list variables separately, the text reveals the fact that many variables are themselves functions of other variables. This requires that extrapolation, from effects discussed under any set of circumstances to those that might occur under different circumstances, be done with extreme caution. Some of the theories of the mechanism of fatigue are discussed briefly at the end of the report.

Illinois Inst. of Tech., Chicago.
AN INVESTIGATION OF FATIGUE PHENOMENA IN METALS BY MEANS OF A RECRYSTALLIZATION TECHNIQUE, by J. L. Peterson and N. H. Polakowski. Technical rept. no. 1 (Final) on Contract AF 18(603)68. Apr 59, 67p. 31 refs. AFOSR-TR-59-91; AD-220 924.
Order from LC mi$3.90, ph$10.80 PB 143 621

Experiments were conducted to determine the effect of combined static cold working and fatigue on the recrystallization behavior of several polycrystalline metals as indicated by the annealed grain size. A hypothesis based on possible polygonization and substructure formation in statically deformed metals under cyclic stress was advanced to account for the different effects of fatigue softening on mechanical properties on one hand and the recrystallization capacity on the other.

Naval Research Lab., Washington, D. C.
CORROSION OF METALS IN TROPICAL ENVIRONMENTS. PART 4. WROUGHT IRON, by C. R. Southwell, B. W. Forgeson, and A. L. Alexander. Interim rept. 13 Oct 59, 20p. 11 refs. NRL rept. 5370.
Order from OTS $0.50 PB 151 852

Aston-process wrought iron was exposed for eight years in the following environments: fresh and sea water continuous immersion, mean tide, and inland and marine atmospheres. In the underwater tests, wrought iron was most heavily corroded when continuously immersed in sea water. Only after eight years was the wrought iron weight loss in all three environments less than that for steel. When coupled with wrought iron, under specific conditions, corrosion of steel was reduced by about one-half. Exposure to the marine atmosphere resulted in 1.6 times more corrosion weight loss than the inland atmosphere. However, all four steels used were less heavily corroded than the wrought iron.

Naval Research Lab., Washington, D. C.
HYDROGEN-EMBRITTLEMENT SUSCEPTIBILITY OF SOME STEELS AND NONFERROUS ALLOYS, by J. E. Srawley. Final rept. 19 Oct 59, 28p. 12 refs. NRL rept. 5392.
Order from OTS $0.75 PB 151 937

A number of steels and nonferrous alloys have been tested to determine their comparative susceptibilities to hydrogen embrittlement. The criterion used was the ratio of the lowest nominal stress at which a hydrogen-charged notched tensile specimen fractured within 100 hours (the "static-fatigue limit") to the notched tensile strength of the uncharged material. Severe conditions of electrolytic charging were used (24 hours at 0.5 amp per square inch) so that a very slight degree of susceptibility might be detected. All steels examined, except cold-rolled AISI type 304 stainless steel, were susceptible in some degree. Hardenable steels harder than Rockwell C-30 were very susceptible, except AISI 1020, which was only moderately susceptible. AISI type 410 stainless was very susceptible at a hardness as low as Rockwell C-21. Of the nonferrous alloys examined, none showed marked susceptibility. It was found that beta brass was susceptible to delayed fracture under constant load, whether charged with hydrogen or not.

Northwestern U. [Evanston, Ill.]
CONTRIBUTION OF DISLOCATION LINE TENSION AND THE DENSITY OF THE SOLUTE ATMOSPHERE TO THE YIELD POINT IN STRAIN AGED INGOT IRON, by J. O. Brittain and T. Mura. Rept. on Contract AF 18(600)1598. 7 Aug 59, 25p. 11 refs. AFOSR-TN-59-760; AD-225 736
Order from LC mi$2.70, ph$4.80 PB 143 620

An investigation of the 77°K yielding behavior of ingot iron specimens that had been prestrained and aged while under stress at 303°K. The sharpness and magnitude of the yield point at both 303° and 77°K increased with an increase in the aging time and or an increase in the stress which was maintained upon the specimen during the aging treatment. The observations of the effect of the aging time and aging stress are discussed in terms of the contribution of the dislocation line tension and solute atmosphere density along the dislocation.

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by H. B. Whitehurst. Annual progress rept. no. 3, 15 Mar 57-15 Mar 58, on Contract NOrd-15764. [1958] 32p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 144 282

Process variables which can affect the tensile strength of glass-reinforced aluminum composites have been systematically investigated. Increasing the fluidity of the aluminum alloy resulted in better tensile strength.

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by H. B. Whitehurst. Quarterly progress rept. no. 10, 15 Mar-15 June 58, on Contract NOrd-15764. [1958] 26p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 144 283

The most promising method appeared to be an adaptation of some of the techniques which have proved successful for making powdered metal objects. Mixing the glass fibers uniformly throughout a bed of powdered metal, compressing the mixture to insure positive contact between the individual particles, and heat treating, or sintering, in order to achieve maximum strength and density. Sample bars were carried through the first two steps with powders of nickel, copper, stainless steel, chromium and brass; and either fused silica or the standard "E" composition glass. (See also PB 144 282)

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by H. B. Whitehurst. Quarterly progress rept. no. 11, 15 June-15 Sep 58, on Contract NOrd-15764. [1958] 30p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 144 281

Tests conducted using samples of powdered nickel, copper, stainless steel, chromium and brass reinforced with ceramic fibers to produce a high temperature analogue of glass fiber reinforced aluminum.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
TIN-ZINC ALLOY (72-28) ELECTRODEPOSITS, by E. MacNamara. Aug 58, 14p. 7 refs. Memo. rept. no. MR-685.
Order from LC mi$2.40, ph$3.30 PB 138 829

Electrodeposits of zinc, cadmium and tin-zinc (72-28) were made on low carbon, cold-rolled steel panels. With respect to corrosion resistance, the tin-zinc alloy was better than zinc, but not as good as cadmium. Solderability of the tin-zinc alloy was comparable to that obtained with zinc and cadmium, using 50-50 solder.

Watertown Arsenal Labs., Mass.
AN EVALUATION OF THE "SPATH METHOD" FOR PLOTTING FATIGUE TEST DATA, by Norbert H. Fahey. May 58, 22p. 3 refs. Technical rept. WAL TR 731/410; AD-158 459.
Order from LC mi$2.70, ph$4.80 PB 138 583

The resultant value for endurance limit, obtained by the "Spath Method" was found to be in error by as much as 12,000 psi or approximately 40% when compared with that obtained from the Wohler diagram. Although this method is quick and inexpensive to use, the results are not consistent enough to justify its use.

Watertown Arsenal Labs., Mass.
THE SPECTROPHOTOMETRIC DETERMINATION OF COPPER IN TITANIUM AND OTHER METALS WITH DICYCLOHEXANONE OXALYDIHYDRAZONE, by William K. Murray. May 58, 12p. 7 refs. Technical rept. WAL TR 401/299; AD-158 456.
Order from LC mi$2.40, ph$3.30 PB 138 591

Dicyclohexanone oxalyldihydrazone has been applied to the determination of copper in titanium alloys and other metals. This reagent reacts in alkaline solution with copper to form an intense blue colored complex which exhibits maximum absorption at a wave length of 600 mmu. The molar absorbancy of the complex is approximately 16,000. Other metals do not form colored complexes, thus allowing the direct determination of copper without extraction or preliminary separations. Ethanol stabilizes the complex in the presence of nickel, cobalt, and other metals.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
ANNUAL PROGRESS REPORT. Progress rept. no. 45, 1 June 56-31 May 57, on Contracts AT (30-1)-905 and Nonr-1841(16). [1957] 230p. 62 refs. AD-146 128.
Order from LC mi$9.90, ph$34.80 PB 144 104

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic and organic) groups
Cosmic ray group
High-energy accelerator project group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity, cyclotron, and theoretical groups
Cambridge electron accelerator project group
(See also PB 144 103)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
ANNUAL PROGRESS REPORT. Progress rept. no. 53, 1 June 57-31 May 58, on Contracts Nonr 1841(16), AT(30-1)-2098, and AF 49(638)181. [1958] 206p. 271 refs.
Order from LC mi$9.30, ph$31.80 PB 144 097

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
High-energy accelerator physics group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Theoretical group
Cambridge electron accelerator project group
(See also PB 144 101)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
FINAL REPORT OF RESEARCHES UNDER CONTRACT N5ori-07806 AND Nonr-1841(16). Rept. for 1 Apr 46-15 May 58. 15 May 58, 106p. 632 refs.
Order from LC mi$5.70, ph$16.80 PB 144 098

Contents:
Cosmic ray research
High energy nuclear physics: Introduction; 350 Mev M. I. T. synchrotron; Synchrotron research; Scattering of photons by protons, deuterons, and heavier nuclei; Review of photomeson experiments; Nuclear emulsion research; Bubble chamber research; Photo-nuclear research with the M. I. T. linear accelerator
Low energy nuclear physics: Research with the M. I. T. cyclotron; Research with the ONR generator; Research with the Rockefeller generator; Low energy scattering studies; Nucleon-nucleon scattering
Radioactivity research
Theoretical nuclear physics
Appendix A - List of degrees conferred by the Laboratory for Nuclear Science to students of physics from 1948 to 1958
Appendix B - Technical reports issued by the Laboratory for Nuclear Science from 1947 to 1958
Appendix C - Bibliography
(See also PB 144 097)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. nos. 42, 43, 1 June-30 Nov 56, on Contracts AT(30-1)-905 and Nonr-1841(16). 31 Aug 56, 30 Nov 56, 2 nos.
Order from LC

Progress rept. no. 42, 1 June-31 Aug 56, 87p. mi$4.80, ph$10.80, PB 144 099
Progress rept. no. 43, 1 Sep-30 Nov 56, 70p. mi$3.90, ph$10.80, PB 144 100

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. no. 44, 1 Dec 56-28 Feb 57, on Contracts AT(30-1)-905 and Nonr-1841(16). 28 Feb 58. 70p. 58 refs. AD-139 800.
Order from LC mi$3.90, ph$10.80 PB 144 103

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
Elementary particle scattering group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Synchrotron group
Theoretical group (See also PB 144 099)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. no. 50, 1 June-31 Aug 57, on Contracts AT(30-1)-905 and Nonr-1841(16). 31 Aug 57, 68p. 68 refs.
Order from LC mi$3.90, ph$10.80 PB 144 102

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
High energy accelerator physics group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Theoretical group
(See also PB 144 104)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. no. 52, 1 Dec 57-28 Feb 58, on Contracts AT (30-1)-905 and Nonr-1841(16). 28 Feb 58, 87p. 105 refs.
Order from LC mi$4.80, ph$13.80 PB 144 101

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
High Energy accelerator physics group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Theoretical group
(See also PB 144 102)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
PALLADIUM FILM FAST NEUTRON DETECTOR, by Ben R. Gossick. 8 Dec 49, 5p. 2 refs. NEPA 1228-ECR-6; AD-152 692.
Order from LC mi$1.80, ph$1.80 PB 138 455

Elementary Particles

California U., Los Angeles.
TECHNIQUES FOR CALCULATIONS OF FRACTIONAL PARENTAGE COEFFICIENTS AND NUCLEAR MATRIX ELEMENTS, by P. S. Kelly. Technical rept. no. 3 on Contract DA 04-495-ORD-913. June 59, 95p. 22 refs. OOR rept. no. 1784:6.
Order from LC mi$5.40, ph$15.30 PB 143 485

This paper has a dual purpose: (1) To provide sufficient background, references and explicative material to orient the reader in calculation of multiparticle matrix elements and wavefunctions; (2) To provide general and special case formulas for reference.

Maryland U., College Park.
K$^-$-NUCLEON SCATTERING LENGTHS AND THE K$^-$-d INELASTIC CROSS SECTION, by T. B. Day and J. Sucher. Rept. on Contract AF 49(638)24. July 59, 8p. 10 refs. Physics Dept. Technical rept. no. 146; AFOSR-TN-59-819.
Order from LC mi$1.80, ph$1.80 PB 143 640

Maryland U., College Park.
K$^-$-NUCLEON SCATTERING LENGTHS AND THE K$^-$-d SCATTERING REACTIONS, by T. B. Day, G. A. Snow, and J. Sucher. Rept. on Contracts AF 49(638)24 and AT (40-1)2504. July 59, 17p. 14 refs. Physics Dept. Technical rept. no. 142; AFOSR-TN-59-772; AD-220 579.
Order from LC mi$2.40, ph$3.30 PB 144 038

The K$^-$-d elastic and total cross sections are calculated, using a model which includes multiple scattering effects. The scattering lengths which Dalitz and Tuan [Phys. Rev. Lett. 2:425(1959)] find as fits to the K$^-$-p data are used in an attempt to distinguish between the 4 possible solutions. The impulse approximation fails to give sensible results in this problem.

Stanford Research Inst., Menlo Park, Calif.
A FEASIBILITY STUDY: SCATTERING OF ELECTRONS BY IONS, ATOMS, AND MOLECULES, by Donald C. Lorents and Charles J. Cook. Scientific rept. no. 2 on Contract AF 19(604)3475. 17 Sep 59, 29p. 22 refs. AFCRC-TN-59-473; AD-226 316.
Order from LC mi$2.70, ph$4.80 PB 143 684

The experimental determination of electron differential scattering cross sections is considered in the light of recently developed experimental techniques. The techniques should be applicable to the study of a broad field of low energy electron interactions with atomic systems.

Nuclear Engineering and Power

Alco Products, Inc., Schenectady, N. Y.
CORROSION OF FUEL ELEMENTS MATERIALS FOR A LOW ENRICHMENT POWER REACTOR. Rept. on Contract DA 44-009-eng-2868. 1 Aug 56, declassified 3 July 57. 173p. APAE Memo. 44.
Order from LC mi$8.10, ep$28.80 PB 136 475

Alco Products, Inc., Schenectady, N. Y.
PREASSEMBLY AND TESTING STUDY OF AN APPR TYPE SYSTEM. Rept. on Contract DA 44-009-eng-3371. 31 Oct 57, 92p. APAE No. 22.
Order from LC mi$5.40, ph$15.30 PB 143 330

The primary objective of this study was the development of revisions in design, changes in equipment types, or changes in installation methods that will result in reduced overall costs, installation costs, and/or installation labor. These developments were primarily for the betterment of future APPR type plants. Where it is practical, the specific application of any improvements to APPR-1a was intended.

Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART 10. SOME REACTIVITY MEASUREMENTS, by K. W. Marlow, E. I. Nowstrup, and R. H. Vogt. Final rept. 21 Oct 59, 23p. 7 refs. NRL rept. 5389.
Order from OTS $0.75 PB 151 956

Reactivity measurements have been made on the modified swimming-pool nuclear reactor at the U. S. Naval Research Laboratory. The reactivity effect was measured for a change from a configuration with three sides of the core reflected by water and three sides reflected by graphite to a configuration with all sides water reflected. Other reactivity effects measured include those due to movement of beam-port plugs, adjustment of control and safety rods, addition and subtraction of fuel, power changes, exposure thimbles at the edge of the core, and cadmium and gold in the center of the core. (See also PB 151 058)

Nuclear Development Corp. of America, White Plains, N. Y.
A PROGRAM FOR THE DEVELOPMENT OF A FIELD EXPEDIENT SHIELD DESIGN MANUAL, by R. Schamberger. Rept. on Contract DA 44-192-eng-3. 6 Feb 59, 25p. 56 refs. NDA 2281-1.
Order from LC mi$2.70, ph$4.80 PB 143 116

In the design of field expedient secondary shields the radiation emitted by the reactor and primary shield combination must first be specified. It is shown that the reactors under consideration will emit a moderated fission neutron spectrum in addition to a variable gamma ray spectrum. The intensity of the neutron and gamma ray leakage, and the energy distribution of the gamma rays must be determined for each reactor.

Vitro Corp. of America, New York.
CONCEPTUAL DESIGN OF 2 Mw NUCLEAR HEATING PLANT, by F. Corio, R. Epstein, and J. E. Colgan. Rept. on Contract DA 44-009-eng-2861. 1 Nov 56 (Addendum 2 Jan 57) declassified 3 July 57. 218p. 31 refs. KLX-1768; KLX-1768A.
Order from LC mi$9.60, ph$33.30 PB 143 554

A conceptual design has been prepared for a nuclear heating plant to produce 7,300 lb/hr of steam at 150 psia and 358°F. This steam will supply a heat exchanger whose secondary steam is to be used for space heating and other low temperature applications. The thermal output of the reactor is 2,000 kw. The fuel plates consist of highly enriched (93.5%) uranium alloyed with an aluminum-nickel alloy and clad with aluminum-nickel alloy. Purified light water is used as the moderator and coolant. Boiling heat transfer is utilized. The reactor, when loaded with 6.84 kg of U-235, provides 2 Mw-yr of power before refueling. In order to reduce the reactivity excursion and facilitate control a burnable poison, in the form of boron, is incorporated in the fuel elements. The estimated capital investment, not including the uranium, is $675,800. The cost of operation is $267,620 per year of 15.3 mils/kw hr$_h$.

Radioactivity

Air Force Cambridge Research Center, Bedford, Mass.
ARTIFICIAL RADIOACTIVITY FROM NUCLEAR TESTS UP TO NOVEMBER 1958, by E. A. Martell. Sep 59, 22p. 31 refs. GRD Research notes no. 19; AFCRC-TN-59-444.
Order from OTS $0.75 PB 161 150

The production of fission products, carbon-14 and tritium in all United States, United Kingdom, and Soviet nuclear tests up to the end of 1958 is summarized and discussed. Major features of the atmospheric-mixing history and world-wide distribution of fallout are outlined. Some major differences between United States and Soviet tests are pointed out. Nuclear tracer experiments which will contribute to better understanding of atmospheric circulation and fallout are briefly described.

Convair, Fort Worth, Tex.
SPECTRAL AND ANGULAR DISTRIBUTIONS OF AIR SCATTERED Co^{60} GAMMA RAYS: SUPPLEMENT I, by B. S. Burton, Jr. Rept. on Contract AF 33(600)32054. 5 Mar 59, 14p. MR-N-168-1; NARF-59-10T.
Order from LC mi$2.40, ph$3.30 PB 142 900

This supplement presents all the raw data upon which MR-N-168 (PB 139 022) was based and gives certain corrections to be made to that report.

[Defense Atomic Support Agency] Washington, D. C.
GAMMA SPECTRA OF URANIUM-235 FISSION PRODUCTS AT VARIOUS TIMES AFTER FISSION, by P. J. Dolan. Mar 59, 75p. 6 refs. AFSWP-524.
Order from LC mi$4.50, ph$12.30 PB 144 105

Calculated gamma spectra produced by Uranium-235 fission are tabulated for various times after fission. Similar tabulations are given omitting certain volatiles and portions of their daughter products.

Lockheed Aircraft Corp., Marietta, Ga.
CONVERSION OF RADIATION DATA TO COMMON DENOMINATORS, by W. T. Harper. Rept. on Contract AF 33(600)32055. Oct 58, 28p. 3 refs. Nuclear rept. -45.
Order from LC mi$2.70, ph$4.80 PB 144 065

This report provides a detailed procedure with sample calculations for converting radiation data to units useful for comparing data obtained at different facilities. Gamma radiation data are converted to units of carbon gamma dose (erg g^{-1}), and neutron data are converted to water neutron dose (erg g^{-1}).

Naval Radiobiological Defense Lab., San Francisco, Calif.
A FALLOUT FORECASTING TECHNIQUE WITH RESULTS OBTAINED AT THE ENIWETOK PROVING GROUND, by E. A. Schuert. 3 Apr 57, 47p. 5 refs. Research and Development Technical rept. USNRDL-TR-139; AD-133 541.
Order from LC mi$3.30, ph$7.80 PB 144 150

A technique which was developed for rapid fallout forecasting not only satisfied the needs of the fallout program but also was accurate enough to allow a comparison between the meteorological aspects of model work and the results obtained from surface measurements. The technique is restricted to describing quantitatively the perimeter of the fallout, the axis of the hot line, and to determining the time of arrival of fallout throughout the pattern. No attempt was made to quantitate the expected levels of γ activity or to develop radiation contour lines. The method employs a simplified cloud model and distribution of particles in the cloud based on parameters which were obtained from previous weapons tests and from theory. The particles are tracked to the earth's surface by considering their falling speeds and effects of the winds existing aloft. Tracking is simplified by using a plotting device.

Naval Research Lab., Washington, D. C.
MEASUREMENTS OF THE AIR CONCENTRATION OF GROSS FISSION PRODUCT RADIOACTIVITY DURING THE IGY, JULY 57-DECEMBER 58, by L. B. Lockhart, Jr., R. L. Patterson, Jr., and W. L. Anderson. Interim rept. 18 Sep 59, 17p. 8 refs. Rept. 5359.
Order from LC mi$2.40, ph$3.30 PB 140 821

Measurements of the gross fission product radioactivity in the air at 21 sites along the 80th meridian and 4 sites in the North Pacific area are reported for the period July 1957-December 1958. The activity levels at the various sites are related both to the stratospheric deposition of nuclear debris and to the direct introduction of radioactive material into the troposphere upwind of the collecting sites. The fission product radioactivity of the air on the Northern Hemisphere increased markedly as the result of the extensive series of tests carried out during this period. Fission products, however, still contribute only a small fraction of the total radioactivity of the ground-level air. Radioactive debris injected into the troposphere at any particular site spreads rather rapidly throughout the same hemisphere but rarely crosses the equator in any quantity. An exception of this occurred during the Hardtack series in the Pacific when massive quantities of activity were transported to the Southern Hemisphere by winds in the upper troposphere. It is again shown that periods of heavy rainfall, such as occur during the rainy season in Panama, cause a general decrease in the concentration of fission products in the air.

Naval Research Lab., Washington, D. C.
RADIOCHEMICAL ANALYSES OF AIR-FILTER SAMPLES COLLECTED DURING 1958, by L. B. Lockhart, Jr., R. A. Baus and others. Interim rept. 23 Oct 59, 25p. 15 refs. NRL rept. 5390.
Order from LC mi$2.70, ph$4.80 PB 142 489

A number of radioisotopes formed in high-yield by nuclear explosions have been determined quantitatively in the gross fission product conglomerate collected by air filters at sites along the 80th meridian during 1958. This period of measurement is of particular interest since, during this time, the Soviet Union carried out two intensive test programs with high-yield weapons, primarily in the Arctic, and the United States carried out one such program at the Pacific Proving Grounds. Some of the debris from tests of the latter series were tagged with W^{185}, produced through the reaction W^{184} (n, γ) W^{185}. The presence of W^{185} in one case, and its absence in another, proved that debris from two nuclear tests of the Hardtack Series crossed that Equator. Save for the period of gross contamination in the troposphere by these debris, the average age of the fission product conglomerate in the air has been consistently older in the Southern than in the Northern Hemisphere. Furthermore, the Sr^{90} content of the air has shown a general pattern of maxima in the region between 20 and 40°N and 20 and 40°S latitudes and a minimum in the equatorial region. The maximum in the north, during early 1958, averaged about 7 times that in the south.

University of Southern California, Los Angeles.
SEMIANNUAL REPORT, by H. H. Forster. Rept. on Contract Nonr-1160(00). Dec 58, 3p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 143 931

Plans for the future are outlined. The previous experiments are designed for the purpose of measuring the relative magnitudes of the coupling constants in beta interactions and to test for time reversal invariance.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Human Resources Research Office, George Washington U., Washington, D. C.
THE EFFECTS OF WEARING THE CBR PROTECTIVE MASK UPON THE PERFORMANCE OF SELECTED INDIVIDUAL COMBAT SKILLS, by William E. Montague, Robert D. Baldwin, and Andrew H. McClure. June 59, 41p. Technical rept. 57.
Order from LC mi$3.30, ph$7.80 PB 143 538

One-Hour Effects of Masking. Wearing the protective mask tended to lower performance on all tests. The average masking losses ranged from 1 per cent on the test requiring detection of human targets by unaided vision and on one measure of firing shoulder weapons (rifle hits), up to 36 per cent for unaided voice communication at the 90-yard range. Five-Hour Effects of Masking. With one exception, all tests again showed mean differences indicating loss in performance due to masking. The average losses ranged from 2 per cent on the tests requiring detection of human targets by unaided vision and on radio communication, up to 41 per cent for unaided voice communication at the 90-yard range.

Naval Supply Research and Development Facility, Bayonne, N. J.
PROPERTIES AND POTENTIAL CLOTHING USES OF CELLULAR FORMS, by Lionel Weinstock. 23 Oct 59, 23p. 7 refs. Clothing and Textile Division rept. no. 34.
Order from OTS $0.75 PB 161 260

A cellular foam was first used in Navy cold weather clothing in 1942. This clothing was used by submariners early in World War II but was discontinued due to excessive weight and the shortage of rubber. Cellular foam elastomers, now available in a range of lower densities, were introduced in Western Europe and, more recently, in the United States as insulating materials for clothing. This report discusses the laboratory evaluation of three types, polyvinylchloride, neoprene and polyurethane, and notes the characteristics important to this end use.

Naval Supply Research and Development Facility, Bayonne, N. J.
SHIPBOARD EVALUATION OF EXPERIMENTAL WINTER FLIGHT DECK IDENTIFICATION CLOTHING, by Frank Merz, Jr. Rept. on Shipboard Combat and Occupational Clothing. 20 June 59, 12p. 4 refs. Research and Development rept. no. 32.
Order from LC mi$2.40, ph$3.30 PB 143 533

This identification garment, which represents a complete departure in design from the standard item, was evaluated on a comparative basis to determine whether visibility, functionability, and durability were improved. A description of the test and the results obtained are included in the report.

Quartermaster Research and Engineering Center, Natick, Mass.
WORLD GUIDE TO FIELD CLOTHING REQUIREMENTS, by Merle E. Sprague and Carl W. Ross. July 59, 44p. 57 refs. Technical rept. EP-115.
Order from LC mi$3.30, ph$7.80 PB 143 719

Present methods for determining the type and amount of clothing required for seasonal wear in a given world area are time-consuming, a more rapid method for obtaining such information has been developed and is presented in this Guide. The world has been classified into nine types of field clothing requirement areas. It has been determined that four distinct ensembles are required to protect troops adequately against all types of natural environments encountered in these nine areas. Maps and tables comprising the Guide (1) indicate the general amount of clothing required as protection against natural environmental conditions in all world areas, (2) prescribe the assortment of field clothing required for environmental protection in each place in each season, and (3) designate camouflage requirements for the issue of hot-weather assortments and overwhites.

PHYSICS

Army Chemical Warfare Labs., Army Chemical Center, Md.
STABILITY OF PYRIDINE-2-ALDOXIME METHIODIDE (2-PAM). I. MECHANISM OF BREAKDOWN IN AQUEOUS ALKALINE SOLUTION, by Robert I. Ellin. Oct 58, 15p. 10 refs. CWLR-2251; AD-207 511.
Order from LC mi$2.40, ph$3.30 PB 138 274

Pyridine-2-aldoxime methiodide (2-PAM, 2-formyl-1-methyl-pyridinium iodide oxime) has been found to be an effective chemical for overcoming the neuromuscular block that occurs in nerve gas poisoning. As part of a program leading to the development of a stable and effective therapeutic formulation of 2-PAM, the mechanism of the deterioration of 2-PAM in aqueous solutions of pH values ranging from 7 to 13 has been studied. The results given in this report show that at the indicated pH values 2-PAM breaks down to N-methyl-alpha-pyridone. A mechanism is given which suggests that the breakdown occurs in three steps: first, the formation of 2-cyanopyridine methiodide; second, the formation of 2-hydroxypyridine methiodide; and third, the rearrangement of the latter to N-methyl-alpha-pyridone. The postulated mechanism may account for three observations made in this laboratory: (1) the presence of traces of cyanide ion in 2-PAM even after three recrystallizations from ethyl alcohol; (2) the presence of a green color in commercial preparations of 2-PAM, since N-methyl-alpha-pyridone turns green on exposure to light; and (3) the formation of two spots when commercial samples were chromatographed on paper.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
COMPARISON OF THE PAIR THEORY AND THE QUASI-PARTICLE METHOD FOR THE EVALUATION OF THE PROPERTIES OF AN INTERACTING BOSE SYSTEM, by J. Peretti. Rept. on Contract AF 18(600)1315. Aug 59, 15p. 5 refs. Technical note BN-182; AFOSR-TN-59-850.
Order from LC mi$2.40, ph$3.30 PB 143 153

We investigate the connection existing between the theories of Lee, Huang and Yang on one hand and of Boboliubov on the other for the interacting Bose systems. We perform the comparison in such a way that any physical quantity calculated in one of the two formalisms can be transcribed very easily in the other. This allows us in each case to evaluate any physical quantity with the formalism which seems the more appropriate for this purpose.

National Research Labs., Ottawa (Canada).
THE FREEZING AND MELTING TIMES OF SLABS AND CYLINDERS, by D. C. Baxter. Feb 59, 47p. 14 refs. Mechanical Engineering rept. MK-1.
Order from LC mi$3.30, ph$7.80 PB 142 878

General results for the time required to freeze or melt slabs or circular cylinders of a pure substance initially at the fusion temperature and exposed to a constant ambient temperature have been obtained on the PACE analogue computer. A six-lump model was used. The results for slabs agree with previously published results, while those for the cylinder with finite convection rates have not been available before.

Stanford Research Inst., Menlo Park, Calif.
EFFECTS OF NUCLEAR RADIATION ON MAGNETIC AND FERROELECTRIC MATERIALS AND QUARTZ: A LITERATURE SURVEY, by S. I. Taimuty. Scientific rept. no. 2 on Contract AF 19(604)4141. 28 July 59, 27p. 66 refs. AFCRC-TN-59-563.
Order from OTS $0.75 PB 161 115

Contents:
Ferroelectric materials
Magnetic materials
Quartz
  Optical properties
  Density and lattice constants
  Piezoelectric and dielectric properties
  Paramagnetism
  Thermal conductivity
Bibliography
(See also PB 138 723)

Acoustics

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
BIBLIOGRAPHY OF RESEARCH REPORTS AND PUBLICATIONS ISSUED BY THE BIO-ACOUSTICS BRANCH (1947-1957) by Anita Boes. Sep 57, 26p. 164 refs. AD-140 501.
Order from LC mi$2.70, ph$4.80 PB 143 944

This bibliography is a tabulation of publications considered to be of lasting interest as a result of research activities. The 164 references are listed under 12 subject headings pertaining to specific areas in physical and biological acoustics. Technical reports and notes, memorandum reports, and the more important journal publications are included.

California U., Los Angeles.
GRAZING INCIDENCE SOUND PROPAGATION OVER AN ABSORBING BOUNDARY, by Robert W. Lawhead. Technical rept. no. 2 on Contract N6onr-275(07). Feb 51, 121p. 33 refs.
Order from LC mi$6.30, ph$19.80 PB 143 104

California U., Los Angeles.
MOLECULAR ABSORPTION OF SOUND IN CARBON DIOXIDE, by Donald E. Chandler. Technical rept. no. 11 on Contract Nonr-233(48). May 58, 73p. 17 refs.
Order from LC mi$4.50, ph$12.30 PB 143 243

Very pure carbon dioxide was tested as well as the same gas with varying but accurately measured amounts of specified impurities. The apparatus is described and techniques are discussed. The equipment has been found to be an excellent apparatus for investigating the acoustical behaviour of highly absorptive gases in the temperature range from room temperature to 100° C and pressure ranges from a few millimeters of mercury to about one half of atmospheric, allowing measurement at any equivalent frequency (ratio of frequency to pressure) between 10 and 1000 kilocycles.

Electronics Research Lab., Northeastern U., Boston, Mass.
SPEECH ANALYSIS, by S. H. Chang, C. R. Howard and others. Final rept. on Contract AF 19(604)3465. 31 Aug 59, 71p. 18 refs. AFCRC-TR-59-187. AD-226 291
Order from LC mi$4.50, ph$12.30 PB 143 660

Chapter I describes several experiments designed to evaluate the importance of the Formoder parameters in the analog forms. Chapter II describes the performance of the Formoder when its parameters are time quantized and digitized by means of delta modulation. It is found that the articulation score on phonetically-balanced word lists averages nearly 70 percent for several male voices using only 1750 binits per second for the parametric transmission rate. Chapter III describes some recent instrumentation for the Formoder system. This includes a novel

R-C active filter for low frequencies, a plan for the digitization of the frequency parameters and the redesign of the Formoder synthesizer.

Navy Underwater Sound Reference Lab., Orlando, Fla.
DEVELOPMENT OF USRL TYPE J9 TRANSDUCER, by Claude C. Sims. 20 Mar 59, 16p. 4 refs. USRL Research rept. no. 49; AD-219 716.
Order from LC mi$2.40, ph$3.30 PB 143 331

Underwater sound transducers for the audio-frequency range have always been unsatisfactory in many respects: They are heavy and large; they cover a narrow frequency range; they have unstable and irregular frequency responses; and they are difficult to repair. The reasons for these difficulties are discussed in this report, and a new transducer free of these difficulties is described. The new transducer, USRL type J9, has a smooth response at frequencies from about 40 cps to about 20 kc, it is small and lighweight, and it is easier to repair than earlier audio-frequency transducers.

Research Lab. of Heat Transfer in Electronics, Mass. Inst. of Tech., Cambridge.
THE EFFECT OF HIGH INTENSITY STATIONARY AND PROGRESSIVE SOUND FIELDS ON FREE CONVECTION FROM A HORIZONTAL CYLINDER, by R. M. Fand and J. Kaye. Rept. on Contract AF 33(616)3157. Mar 59, 138p. 62 refs. WADC Technical note 59-18; AD-209 532.
Order from OTS $2.75 PB 161 076

This study consists of an experimental investigation of the rate of convective heat transfer to air from a horizontal cylinder, 3/4" in diameter, under the following four different test conditions: free convection in the absence of sound; free convection with superposed plane stationary transverse sound fields, cylinder located at antinodes; free convection with superposed simple-harmonic plane stationary transverse sound fields, cylinder not at antinodes; and free convection with superposed simple-harmonic plane progressive transverse sound fields.

Electricity and Magnetism

California U., Los Angeles.
AN EXPERIMENT IN MAGNETOELASTICITY, by Robert A. Willett. Technical rept. no. 9 on Contract N6onr-275(07). July 57, 57p. 15 refs.
Order from LC mi$3.60, ph$9.30 PB 143 213

Ecole Nationale Supérieure de Chemie de Strasbourg (France).
CHEMICAL REACTIVITY NEAR CURIE POINTS, by H. Forestier. Final status rept. for 1 July 58-30 June 59 on Contract DA 91-508-EUC-395. [1959] 15p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 143 451

The chemical reactivity is discontinuous, not only near the ferromagnetic Curie point of an alloy, but besides near the Curie point of the pure ferromagnetic component (magnetogen component). The anomaly of reactivity near the Curie point of the magnetogen metal should be limited to primary solid solutions and connected with the possibility of ferromagnetism.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
MAGNETIC ANALYSIS OF THE PRECIPITATION OF IRON FROM BETA BRASS, by Ami E. Berkowitz and Philip J. Flanders. Rept. on Contract AF 49(638)159. Aug 59, 30p. 31 refs. Interim rept. I-A2026-2; AFOSR-TN-59-762; AD-226 492.
Order from LC mi$2.70, ph$4.80 PB 143 830

Single crystals of beta brass containing 0.07 weight percent iron were annealed at 300 and 400°C to precipitate the iron. Magnetic data were analyzed in terms of the concepts of fine particle ferromagnetism to derive size and shape distributions of the iron precipitate particles and the orientations of their crystallographic and shape symmetry axes.

Michigan State U. [East Lansing]
ELECTRICAL RESISTIVITY OF THIN METALLIC WIRES, by H. G. Satz. Rept. on Contract AF 49(638)70. 25 July 59, 49p. 26 refs. AFOSR-TN-59-639.
Order from LC mi$3.30, ph$7.80 PB 143 671

Measurements on thin indium wires at low temperatures have demonstrated that not only the residual but also the temperature dependent part of the resistivity increases as the wire diameter decreases. Electron-phonon scattering and Electron-electron scattering processes lead to a size and temperature dependent contribution to the total resistivity of thin wire.

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
ELECTROMECHANICAL EVALUATION OF MAGNETROSTRICTIVE CYLINDERS BY RESONANCE-ANTIRESONANCE MEASUREMENTS, by Ralph S. Wooliett. 15 Dec 53, 16p. 9 refs. USL Research rept. no. 225.
Order from LC mi$2.40, ph$3.30 PB 144 113

While the electromechanical coupling coefficient of piezoelectric crystals is commonly determined by measuring the resonant and antiresonant frequencies of the electrical impedance of the crystals, this method has had little use in evaluations of magnetostrictive material. To enable the advantages of this method to be exploited in magnetostrictive work, an analysis is presented in this report which shows the application of resonance-antiresonance measurements to magnetostrictive cylindrical-shell vibrators. Formulas are derived for the determination of the effective electromechanical coupling coefficient and mechanical Q, and the results are applied to the calculation of equivalent-circuit parameters. Dissipation is neglected in most of this analysis, but corrections are applied for leakage inductance. Formulas

are presented for determining fundamental material constants from data for short, thin cylinders, and a comparison of the resonance-antiresonance method with the impedance-circle method is made. The results of this analysis are particularly useful for the evaluation of magnetostrictive ferrites.

Swarthmore Coll., Pa.
TABLES OF THE INTERNAL MAGNETIC SOURCE FUNCTIONS U_n FOR THICK SOLENOIDS AND DISK COILS: n=3 TO n=17, TO COSINE ARGUMENTS, 8 TO 5 DECIMALS, WITH SECOND DIFFERENCES. WITH A SHORT TABLE OF THE EXTERNAL SOURCE FUNCTIONS W_n AND NUMERICAL EXAMPLES OF SOME APPLICATIONS OF THE FUNCTIONS, WITH NOTES, EQUATIONS, AND AUXILIARY TABLES, by Milan Wayne Garrett. Tables of U_n computed on UNIVAC by Joseph D. Rutledge, Milton D. Fisher and Winifred J. Goldberg (Remington Rand, Inc.) Rept. on Contract DA 36-034-ORD-594. Oct 53, 95p. 4 refs.
Order from LC mi$5.40, ph$15.30 PB 138 800

Westinghouse Electric Corp., East Pittsburgh, Pa.
PREPARATION OF MnBi BY REACTION OF FINELY DIVIDED POWDERS, by A. Goldman and G. I. Post. Rept. on Magnetic Phenomena of Matter, Contract AF 33(616)309. Mar 59, 26p. 12 refs. WADC technical note 59-205.
Order from OTS $0.75 PB 161 149

The process for producing manganese bismuthide by a low temperature reaction of manganese and bismuth powders has been studied with the purpose of obtaining reproducibly high purity MnBi. The most important factors in the preparation of the material were found to be the inertness of atmosphere, particle size, and state of agglomeration of reactants. A series of experiments showed that optimum size reduction could be obtained by ball milling, for at least 65 hours, a mixture of the elements which had previously been hammer milled. When packing occurred during ball milling, the cause was traced to the characteristics of the bismuth. If the particle size was small (~/u), the approach to reaction temperature could be quite rapid. Manganese-bismuthide of 90% purity was obtained with finely ground reactants. This material had a considerable amount of leeway in the type of reaction used in alloying and was reproducible. Tumbling the reactants while heating was not possible due to packing. Neither compression of the powders before reaction nor seeding it with MnBi appeared to improve the yield. Runs were tried with chemically precipitated bismuth, but explosion of the tubes always occurred.

Electronics

Antenna Lab., Calif. Inst. of Tech., Pasadena.
TRANSIENTS ON A LINEAR ANTENNA, by Georges G. Weill. Technical rept. no. 20 on Contract AF 18(600)1113. Aug 59, 15p. AFOSR-TN-59-791; AD-225 003.
Order from LC mi$2.40, ph$3.30 PB 143 158

Antenna Lab., Ohio State U. Research Foundation, Columbus.
CALCUATED PHASE VELOCITY OF LONG END-FIRE UNIFORM DIPOLE ARRAYS, by F. Serriocchioli and C. Lewis. Rept. on Contract DA 36-039-sc-70174. 13 Apr 59, 30p. 12 refs. Rept. 662-24.
Order from LC mi$2.70, ph$4.80 PB 143 353

Surface waves have been applied recently to the study of endfire arrays. An important step in the theory of surface-wave antennas is the calculation of the local phase velocity of the surface wave from the antenna geometry. While experimental work has been done along this line, no adequate theoretical solution seems to be available. In this report a mathematical procedure is presented for obtaining an approximate value of the phase velocity for long end-fire uniform dipole arrays, as a function of the antenna geometry. Results have been reported for a number of geometrical parameters and curves plotted to facilitate the analysis and design of arrays. The results have been compared with experimental measurements and an explanation has been given for the discrepancies found, and finally a criterion for correcting the results has been outlined.

Cruft Lab., Harvard U., Cambridge, Mass.
LINEAR ARRAYS: CURRENTS, IMPEDANCES AND FIELDS, I, by Ronald King. Scientific rept. no. 1, series 2, on Contract AF 19(604)4118. 1 May 59, 55p. 11 refs. AFCRC-TN-59-357; AD-217 409.
Order from LC mi$3.60, ph$9.30 PB 143 397

The radiation field of dipoles is usually expressed in the form of a product of a field factor and one or more arrays factors. Actually, such a formulation depends on the implicit assumption that the distributions of current along all elements are the same regardless of the location in the array or differences in driving conditions. Since this is a satisfactory approximation only when the elements are near a half-wavelength long, a study of the fields of arrays of longer elements in terms of the actual distributions of current is indicated.

Missouri U., Columbia.
ADIABATIC VS. BLOCH APPROXIMATION IN LATTICE SCATTERING OF ELECTRONS, by Bernard Goodman. Technical rept. no. 22 on Contract N7onr-292, T. O. 5. 15 Jan 58, 11p. 5 refs. AD-155 303.
Order from LC mi$2.40, ph$3.30 PB 138 279

The time dependence of an electron-phonon system described by means of Born-Oppenheimer states is shown to be the same to first order in the coupling as the usual Bloch theory.

Brown U., Providence, R. I.
THE INFRARED ABSORPTION SPECTRUM OF THE AMMONIUM ION IN LATTICES OF THE NaCl TYPE, by Willem Vedder. Rept. on Contract N6ori-88, T. O. 1. 1958, 91p. 140 refs; AD-162 484.
Order from LC mi$5.40, ph$15.30 PB 143 474

Carnegie Inst. of Tech., Pittsburgh, Pa.
RESEARCH IN THEORETICAL CHEMISTRY, by Robert G. Parr and Frank O. Ellison. Technical rept. for 1 Jan-31 Dec 57 on Theoretical Studies of the Electronic Structure of Diatomic and Simple Polyatomic Molecules, Contract DA 36-061-ORD-466; and Electronic Structure of Molecules, National Science Foundation Research Grant NSF-G3318. 1 Apr 58, 125p. 20 refs. AD-157 838.
Order from LC mi$6.30, ph$19.80 PB 143 839

A series of eight lectures given at Univ. of Chicago, June-July 1957. Also seven additional papers as follows: Special topics in the quantum theory of molecular electronic structure; On the diamagnetic anisotropy of benzene; A one-center wave function for the hydrogen molecule; The dipole moment of p-benzoquinone; On the nuclear magnetic shielding in the hydrogen molecule; Some extraordinary functions for improving calculations of electronic energies; and Improved simple analytical atomic wave functions.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
EMISSION OF DIFFUSE BANDS OF SODIUM BEHIND SHOCK FRONTS (I). MOLECULE FORMATION IN INERT GASES (II) by H. Takeyama and A. Guttman. Technical rept. no. 10 on Contract AF 18(603)02. Aug 59, 21p. 4 refs. AFOSR-TN-59-822; AD-225 671.
Order from LC mi$2.40, ph$3.30 PB 143 522

A diffuse emission band, centered near the resonance lines of sodium and attributed to van der Waals molecules Na_2, has been observed in a shock tube. A small quantity of finely-ground sodium salt (e.g., NaCl, NaBr or Na_2CO_3) was placed at the end of the low-pressure section of a shock tube containing an argon atmosphere. Spectra were recorded photographically with a 1.5 m grating spectrograph. Microwave absorption spectra on inert gases (He, Ne, A, Kr, Xe) or inert gas mixtures at low temperatures can probably be used to determine the interaction parameters required for the calculation of transport properties. This conclusion is reached from a study of predicted molecular spectra based on a determination of the Morse interaction potential through a second-order fit to the known Lennard-Jones potential.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
RELATIONS BETWEEN MOLECULAR GAS ABSORPTIVITIES AND EMISSIVITIES, by S. S. Penner, D. Olfe, and A. Thomson. Technical rept. no. 29 on Contract Nonr-220(03). Oct 58, 30p. 11 refs.
Order from LC mi$2.70, ph$4.80 PB 143 242

Theoretical expressions have been derived for the relations between gas absorptivities and emissivities for the limit of zero optical depth and for various models of vibration-rotation bands. Representative results for selected band models have been described elsewhere. The present research contains an exhaustive review and extension of the earlier work, with the limitation that the temperatures used for making the studies had to be sufficiently close to justify the assumption that neither the spectral line shape nor the band model are changed in character. Theoretical relations for important band models are derived. Correlations are developed to cover experimental data for CO_2, H_2O and CO and in terms of suitable theoretical expressions.

Institute of Optics, U. of Rochester, N. Y.
ULTRAVIOLET ABSORPTION IN THALLOUS HALIDES, by Simpei Tutihasi. Rept. on Contracts AF 49(638) (432, 433). July 59, 15p. 16 refs. AFOSR-TN-59-753.
Order from LC mi$2.40, ph$3.30 PB 143 635

The ultraviolet absorption in TlCl and TlBr has been measured on thin films and fused samples as a function of temperature. The effect of excessive chlorine or thallium on the optical absorption of TlCl has been studied. The experiments of Vysochanskii are discussed in the light of our observations. The first absorption band in TlCl, which peaks at 3.44 ev at -185° C, is absent in films condensed on a cold substrate of KCl and appears after annealing. It seems that the crystal structure of evaporated films of TlCl changes from the NaCl-type to the CsCl-type.

Instituto de Optica, Madrid (Spain).
INFRA-RED C=O BAND INTENSITY OF ACETIC ACID DERIVATIVES AND CHEMICAL ACTIVITY, by Jose R. Barcelo and Juana Bellanato. Final technical rept. no. 1, July 58-July 59, on Contract DA 91-508-EUC-357. [1959] 41p. 25 refs. AD-225 534.
Order from LC mi$3.30, ph$7.80 PB 143 452

The intrinsic intensity of the C=O infra-red band has been measured for various acetic acid derivatives, these measurements being carried out in carbon tetrachloride solutions of these substances. Twelve substances were studied, none of which were halogenated derivatives of acetic acid. All the chlorinated and fluorinated derivatives were studied and likewise two brominated and one iodinated derivative. For reference purposes, formic and acetic acids were studied. A deuterated compound was also studied -dichloroacetic acid with the carboxylic hydrogen substituted by deuterium. The method followed to measure the intensity was Wilson and Wells's and the correction used for the "wings" was that given by Ramsay.

Kansas State U., Manhattan.
THE SPECTRA OF NITROGEN OXIDES. I. THE SPECTRUM OF N_2O_4, by I. C. Hisatsune. Scientific rept. no. 1 on Contract AF 19(604)2255. [1959] 66p. 56 refs. AFCRC-TN-59-453.
Order from LC mi$3.90, ph$10.80 PB 143 667

A brief review of the structural and spectroscopic data on the known nitrogen oxides has been made in order to gain an overall picture of the present status of research on these molecules. A detailed discussion on N_2O_4, the first molecule investigated in this laboratory, is then given. This discussion includes results obtained from the experimental studies of the infrared spectra of the liquid and solid, the Raman spectra in the liquid and solid phases, the assignment of the spectra, the calculation of heat capacities and entropy of the solid, and the normal coordinate analysis using a modified valence force field. Experimental evidence showing the existence of isomers of N_2O_4 is also given.

Klyne, W.
OPTICAL ROTATORY DISPERSION OF ORGANIC COMPOUNDS, by W. Klyne. Final technical rept. no. 1, 1 May 58-30 Apr 59, on Contract DA 91-508-EUC-308. 25 May 59, 40p. 16 refs.
Order from LC mi$3.00, ph$6.30 PB 143 292

The general purpose of the work has been to explore the use for structural purpose of rotatory dispersion measurements on compounds which do not absorb light within the spectral range studied (600-280 mμ). The results show that much less information can be obtained from the rotatory dispersion of non-absorbing compounds than from that of absorbing compounds. However, the plain dispersion curve of a non-absorbing compound is worth more than a single point at one wave-length. No complex mathematical analysis of the curves has been carried out. Several different simple treatments of the data are considered. Much of the work has been concentrated on steroid alcohols and their derivatives. Results for these derivatives: (RR':C:N.NH.CO.NH_2) are generally disappointing.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
MICROWAVE SPECTRUM, INTERNAL BARRIER, STRUCTURE, EQUILIBRIUM CONFIGURATION, AND DIPOLE MOMENT OF METHYL MONOFLUOROSILANE, by Louis Pierce. Rept. on Contract N5ori-1866, T. O. 14. [1957] 22p. 11 refs; AD-153 018.
Order from LC mi$2.70, ph$4.80 PB 138 448

The microwave spectrum of methylmonofluorosilane was investigated between 18 and 38 kmc. Several transitions of the isotopic species CH_3SiH_2F and CH_3SiD_2F were split into doublets because of coupling internal and over-all rotation; these splittings gave a barrier to internal rotation of 1559±30 cal/mol. The form of the potential barrier was assumed to be $V = 1/2V_3(1-\cos 3\alpha)$, where V_3 is the barrier height, and α is the angle which gives the relative orientation of the rotor and the framework. V_3 may be calculated in 2 ways. One method is to calculate a value of V_3 from each splitting; the results of such analysis are given for CH_3SiH_2F and CH_3SiD_2F. The over-all spread in V_3 for 9 transitions was 2%. An alternate method for determining V_3 is to adjust the rotational constants to give the best possible fit of the entire spectrum; the resulting values of Δa and Δb can be used to determine V_3. The observed and calculated transition frequencies and splitting for CH_3SiH_2F and CH_3SiD_2F are given. The best fit, was at V_3 = 1562 and 1556 cal/mol for CH_3SiH_2F, and CH_3SiD_2F, respectively. The splittings in the excited state were constant with the barrier as determined from ground state observations. Rotational constants were also determined for $C^{13}H_3SiH_2F$, CD_3SiH_2F, and CH_3SiDHF.

Microwave Lab., Stanford U., Calif.
THE PARAMAGNETIC RESONANCE SPECTRUM IN SINGLE CRYSTALS OF BARIUM TITANATE, by John Edwin Maling. Technical rept. on Contract Nonr-225(18). Dec 58, 100p. 36 refs. ML Rept. no. 563.
Order from LC mi$5.40, ph$15.30 PB 143 841

Structure of barium titanate as a basis for understanding the symmetry analysis of the single-crystal paramagnetic resonance spectrum. Experimental and theoretical evidence is presented showing the presence of energy "gaps" in the energy-level system where crossings occur.

Missouri U., Columbia.
THERMOELECTRIC PROPERTIES OF POROUS SEMICONDUCTORS, by Eugene B. Hensley. Technical rept. no. 24 on Contract Nonr-2296(01). 1 Dec 58, 22p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 143 928

The properties of a class of porous semiconductors known as pore conductors are re-evaluated with regard to the possible application of these materials for thermoelectric power conversion. In general, the results appear very pessimistic as far as any prospect of high conversion efficiences are concerned.

Oslo U. (Norway).
INVESTIGATION OF MOLECULAR STRUCTURES, by O. Hassel. Technical scientific note no. 1 on Contract AF 61(052)71. 30 June 59, 41p. 10 refs. AFOSR-TN-59-916.
Order from LC mi$3.30, ph$7.80 PB 143 638

Contents:
Crystal structure of the addition compound 1,4-dioxan-chlorine.
Crystal structure of the addition compound benzene-chlorine (1:1).
Crystal structure of the addition compound 1,4-dioxan-sulphuric acid.
Charge transfer compounds with a halogen atom linked to carbon, halogen being the electron acceptor.
Crystal structure of the compound $CHI_3 \cdot 3$ Quinoline.
Crystal structure of the 1:1 addition compound formed by acetone and bromine.

Syracuse U., N. Y
EFFECT OF TEMPERATURE ON CARBONYL AND NITRILE STRETCHING FREQUENCIES IN SOLUTION, by E. Fishman and N. Krascella. Technical rept. on Contract AF 49(638)3. 1 July 59, 21p. 12 refs. AFOSR TN-59-660.
Order from LC mi$2.70, ph$4.80 PB 143 169

The present study of the effect of wide temperature variations on particular bond frequencies in solution was undertaken with the objective of seperating the effect of temperature dependent dipole-dipole interactions from other intermolecular forces causing frequency shifts. The results of the present investigation show that it is unlikely that any simple theory involving the physical properties of solvent and solute will have general applicability.

Technical U., Copenhagen (Denmark).
OPTICAL ROTATORY DISPERSION OF TRANSITION METAL COMPLEXES, by Flemming Woldbye. Final Technical rept. no. 1 for 1 Oct 57-31 May 59 on Contract DA 91-508-euc-246. 30 June 59, 64p. 37 refs.
Order from LC mi$3.90, ph$10.80 PB 143 117

A review of current theory observed leads to a set of criteria by which compounds for a fundamental study of optical activity may be selected. The octahedral complexes of the metals in the first transition group appear to be well suited to this purpose. The principle and the operation of the Keston Model D Polarimetric Unit by means of which most of the measurements reported herein have been performed are accounted for. The principle, construction and performance of a recording spectropolarimeter (based on the Cary MS-11 Recording Spectrophotometer) which has been developed in the course of this work are described in detail. A number of robust complexes have been prepared and resolution has been attempted. Solutions containing equilibrium complexes of Ni(II), Cu(II) and Co(II) with I-pn have been shown to exhibit Cotton effect within their visible absorption bands. Absorption spectra and rotatory dispersion curves in the range 750-375 mμ of 16 different complexes of the two types are reported. A few theoretical comments on the rotatory dispersion curves are made and the absence of a pronounced solvent effect is demonstrated in the case of $[Co(tn)_3]^{+++}$.

Texas U. [Austin].
SPECTROSCOPIC EVIDENCE FOR LONG-RANGE REPULSIVE, INTERMOLECULAR FORCES, by W. W. Robertson and A. D. King, Jr. Rept. on Contract AF 49(638)35. [1959] 18p. 17 refs. AFOSR-TN-59-688.
Order from LC mi$2.40, ph$3.30 PB 143 021

Experimental results are presented on the shift of wave-length of absorption of benzene, naphthalene, pyrene and phenanthrene with density of the diluents helium and nitrogen. Arguments are presented to show that the blue shift observed in the benzene ^1L_b spectrum in helium are neither due to short-range repulsive forces nor to long-range dispersive forces. It is presumed that there are weak, long-ranged, non-dispersive forces present in the benzene-helium interaction that have the character of repulsive forces.

Optics

Centro di Studio per la Fisica Delle Microonde (Italy).
EXPERIMENTAL TEST ON A STEPPED ZONE MIRROR FOR MICROWAVES, by G. Toraldo di Francia, L. Ronchi, and V. Russo. Technical note no. 5 on Contract AF 61(052)67. Apr 59, 20p. 5 refs. AFCRC-TN-59-385.
Order from LC mi$2.40, ph$3.30 PB 143 790

Florida State U., Tallahassee.
AN EXPERIMENTAL STUDY OF X-RAY ATTENUATION COEFFICIENTS, 8-30 kev, by Richard D. Deslattes. Final rept. on Contract AF 18(603)64. 1958, 97p. 24 refs. AFOSR-TN-58-784; AD-202 009.
Order from LC mi$5.40, ph$15.30 PB 138 270

Precise values for the total attenuation coefficients have been obtained at approximately 1 kv. intervals from 8 to 30 kv. for 15 pure elements using a two-crystal spectrometer of high resolving power. These span the range of atomic numbers from 12 to 79. (Possibly disturbing effects of small-angle scattering were investigated.) The resulting values of μ for some elements may be assigned an average standard deviation of 0.2 percent.

Institute of Mathematical Sciences, New York U., N. Y.
ANNUAL SUMMARY REPORT. Rept. for 1 Dec 57-30 Nov 58 on Contract Nonr-285(25). [1958] 4p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 143 469

This report outlines the work done in exploring the exploitation of persistent internal polarization (p. i. p.) in phosphors for information storage. (See also PB 136 750)

Institute of Research, Lehigh U., Bethlehem, Pa.
USE OF WHITE LIGHT IN THE MEASUREMENT OF GAS DENSITY BY OPTICAL INTERFEROMETRY, by C. W. Curtis. Technical rept. no. 9 on Contract N7onr-39302. 15 Feb 58, 18p. 3 refs. AD-162 605.
Order from LC mi$2.40, ph$3.30 PB 138 254

The form of white light fringe patterns is derived for 2 symmetrical spectral distributions of intensity, and the effects of dispersion in the gas are computed. The shift of fringes through the maximum of the envelope of intensity for white light fringes is given in terms of coefficients in the Cauchy dispersion formula. Experiment verifies the applicability of the formula in nitrogen gas where the maximum intensity of a white light pattern is displaced about one fringe for a monochromatic (5460A) fringe shift of 15.

Laboratoire D'Infra Rouge Technique et Applique, Gif Sur Yvette (France).
CONSTRUCTION OF AN INFRA RED SOURCE OF HIGH LUMINANCE. Final technical rept. for May 58-May 59 on Contract DA 91-508-EUC-312. [1959] 22p. 3 refs; AD-225 643.
Order from LC mi$2.70, ph$4.80 PB 143 279

During the year 1958-1959 we have investigated the construction of a point source of radiation, with a modulated output and a high intensity in the far red and the near infra-red. The gun itself has been constructed with its focussing system enclosed in a vacuum-tight container, together with a motor which is also vacuum-tight. The conventional method for the preparation of luminescent screens has been modified to fit the particular case of cadmium sulphide. A large number of samples of copper, or silver, activated powders have been prepared.

Michigan U. Research Inst., Ann Arbor.
A SINGLE-CRYSTAL PHOTOCONDUCTIVE TELLURIUM DETECTOR, by G. Suits and P. Rice. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 58, 10p. 4 refs. 2144-240-T.
Order from LC mi$1.80, ph$1.80 PB 138 802

The special properties of tellurium detectors make them appear particularly promising for the following applications: (1) Two-color infrared scanning systems, (2) Scanning systems using matched linear arrays of detectors, and (3) Infrared sensors which operate under conditions of high atmospheric attenutation.

[Physical] Research [Labs.] Boston U., Mass.
A COLLECTION OF GRAPHS CONCERNING ATMOSPHERIC TRANSMISSION, NATURAL ILLUMINATION AND REFLECTANCE OF TERRAIN. Rept. on Contracts W33-038-ac-14075 and AF 33(038)15615. 1 July 52, declassified 26 Sep 55, 52p. 34 refs. BUORL Technical note no. 87; AD-489.
Order from LC mi$3.60, ph$9.30 PB 144 265

Curves and a tabulation of their sources are given for microwave, IR, and visual-light transmission; reflectance of several materials, water vapor and zone concentrative; rainfall distributions; sky brightness; and spectral distributions.

Ramo-Woolridge, Los Angeles, Calif.
INFRARED BACKGROUND INVESTIGATION, by R. E. Eisele. Scientific rept. no. 1, 15 Mar 58-15 Apr 59, on Contract AF 19(604)3473. 30 June 59, 59p. 6 refs. C20-9U9; AFCRC-TN-59-843; AD-220 027.
Order from LC mi$3.60, ph$9.30 PB 143 106

The contract was issued to measure the radiant intensity of the infrared sky background and to measure the amplitude of the frequencies distributed in the sky gradient. The data would be obtained through the use of an instrument known as the radiometer-gradient meter.

Syracuse U., N. Y.
WASHOUT EFFECT IN INFRARED BACKGROUND STUDIES, by W. R. Fredrickson, N. Ginsburg, and R. Paulson. Scientific rept. no. 1 on Contract AF 19(604)3908. June 59, 18p. 2 refs. AFCRC-TN-59-445, AD-220 724.
Order from LC mi$2.40, ph$3.30 PB 143 193

In the investigations of the spectral distribution of background radiation in the infrared, it was found that there was, in general, ready distinguishability between various objects at any one time. Such discrimination has been reported by us in a previous report and by the Ohio State group. It was found, however, that at certain times, this distinguishability disappeared. This effect is called washout. It has also been reported by various other investigators in the field, whose work is classified. In this report, the results of our efforts to determine the time and weather condition in which the washout effect might become apparent are given.

Solid State Physics

Armour Research Foundation, Chicago, Ill.
EFFECTS OF NUCLEAR RADIATION ON SOLID CATALYSTS, by Robert H. Bragg, Fred L. Morritz and others. Rept. for 15 June 58-30 Apr 59 on Contract AF 33(616)5896. June 59, 77p. 31 refs. WADC Technical rept. 59-286.
Order from OTS $2.00 PB 161 130

Both gamma ray and fast neutron irradiation causes changes in the electrical characteristics of single crystals and powders of zinc oxide. The two major effects of fast neutrons on single crystals are an enhanced conductivity when the irradiation is begun and a subsequent decrease as the irradiation is continued up to doses of 10^{15} nvt. Hydrogenation of ethylene occurs readily at 30°C over calcined zinc oxide powder, and a marked increase in activity is observed after further calcination in vacuo at temperatures up to 615°C. After irradiation to a dose of 10^{13} nvt the catalytic activity is decreased. In-pile experiments on the hydrogenation of ethylene over zinc oxide catalyst show that during irradiation the rate of the reaction is increased compared to the rate observed with the freshly calcined material without irradiation. Rather extensive irradiation experiments have been performed on mixtures of hydrogen and ethylene in the absence of a catalyst.

Armour Research Foundation, Chicago, Ill.
EXCESS NOISE IN SEMICONDUCTORS. Final rept. for 15 Nov 57-15 Nov 58 on Contract Nonr-1800(00). 10 Nov 58, 77p. 34 refs.
Order from LC mi$4.50, ph$12.30 PB 143 463

In a study of 1/f noise in single crystal silicon and germanium it is found that crystalline imperfections reduce the noise level. Naturally occurring

imperfections, those produced by plastic deformations and those generated by fast neutron bombardment all act in the same fashion. The results may be quantitatively explained by accounting for the decrease in minority carrier lifetime by crystalline imperfections. An experiment which allows an effective surface to volume change in the same sample has shown that surfaces dominate as the origin of 1/f noise. Using the field effect to alter occupancy of surface states it has been determined that the noise level decreases as the surface barrier is reduced. There is some evidence for a noise minimum when the surface fermi level matches that of the bulk, but this needs further confirmation. A search for critical fluctuations in solids has discovered the existence of such a phenomena at the curie point in single crystal $BaTiO_3$. Experiments on critical point fluctuations at the superconducting transition of single crystal tin are also in progress.

Armour Research Foundation, Chicago, Ill.
PRESSURE EFFECTS AND CONFIGURATION COORDINATE MODELS OF KCl(Tl) by L. Reiffel. Technical note no. 3 on Contract AF 49(638)113. 24 July 59, 8p. 9 refs. AFOSR-TN-59-761.
Order from LC mi$1.80, ph$1.80 PB 143 523

Since a straightforward extension of the Williams and Johnson configuration coordinate curves for the first excited state of KCl(Tl) coupled with their assumption of thermodynamic equilibrium requires very large changes in the emission ratio, these results do not lend support to their model. It appears that alternatives of the sort considered by Patterson and Klick and Knox may be better able to describe the actual situation. These latter suggestions can be arranged to predict small changes in intensity ratio due to pressure.

Brown U. Div. of Applied Mathematics, Providence, R. I.
SINGLE CRYSTAL PLASTICITY: A SURVEY. PART III. THEORIES OF PLASTIC DEFORMATION OF SINGLE CRYSTALS, by Robert C. Meacham. Rept. on Contract N7onr-358, T. O. I. 15 Aug 48, 161p. 72 refs. A11 S-3, ATI-143 136.
Order from LC mi$7.80, ph$25.80 PB 144 287

Contents:
An estimate of the shear strength of a perfect single crystal
The Becker-Orowan theory of slip
A two-dimensional dislocation--edge type
Taylor theory of work hardening
The Burgers' combination of the Becker-Orowan and Taylor theories
Kochendörfer's contribution to the dislocation theory of plastic deformation
Further applications of the dislocation concept

California U., Los Angeles.
DIELECTRIC AND MAGNETIC PROPERTIES OF MATERIALS AT MICROWAVE FREQUENCIES, by W. D. Hershberger. Summary rept. for Dec 50-31 Dec 57 on Contract N6onr-27519. Apr 58, 5p. 20 refs. Dept. of Engineering rept. 58-31.
Order from LC mi$1.80, ph$1.80 PB 138 839

A summary including a list of technical papers.

Carnegie Inst. of Tech., Pittsburgh, Pa.
THEORY OF SHALLOW ACCEPTOR STATES IN SILICON AND GERMANIUM, by Daniel Schechter. Technical rept. no. 4 on Contract Nonr-760(13). 7 Mar 58, 137p. 48 refs. AD-207 307.
Order from LC mi$6.90, ph$21.30 PB 138 559

A qualitative discussion is presented of shallow impurity states in Si and Ge, with emphasis on the acceptor states. The experimental data concerning the bound acceptor states is summarized. The valence band structure in Si and Ge in the vicinity of the band maxima is reviewed. The derived effective mass equations have the form of a system of coupled equations, but due to the complexity of these equations exact solution was impossible for Si and Ge. The standard variation method for calculation of energy levels was followed. Trial functions were obtained for the ground state and the first 4 excited states using group theoretic considerations. The energies of these states were then calculated in the extreme limits of zero and infinite spin-orbit coupling. Corrections were made to these energy levels to take account of the actual spin-orbit coupling. When the results were compared with experiment, the agreement was found to be only qualitative. Possible reasons for this are discussed.

Colorado State U., Fort Collins.
STUDIES, RESEARCH AND INVESTIGATIONS OF THE OPTICAL PROPERTIES OF THIN FILMS OF METALS, SEMI-CONDUCTORS AND DIELECTRICS, by Lawrence N. Hadley, Jr. Final rept. for 16 Feb-13 Aug 58 on Contract DA 44-009-eng-3410. 13 Sep 58, 20p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 143 448

Cornell U., Ithaca, N. Y.
MICROWAVE STUDIES OF COLOR CENTERS IN BARIUM OXIDE, by J. W. Carson, D. F. Holcomb, and H. Ruchardt. Technical rept. no. 3 on Contract Nonr-401(15). 20 Nov 58, 19p. 16 refs: AD-207 203.
Order from LC mi$2.40, ph$3.30 PB 143 470

Electron spin resonance absorption measurements have been made at 9300 mc/sec on BaO crystals with excess barium. No spin resonance is observed which can be associated with the imperfection responsible for the optical absorption band at 2.0 ev. Large non-resonant microwave losses are also observed in the colored crystals. The present measurements are unable to distinguish between conduction in colloidal barium particles and electronic conduction in crystalline BaO itself as the source of the large losses.

Cornell U., Ithaca, N. Y.
SECONDARY POSITIVE ION EMISSION FROM METAL SURFACES, by Richard C. Bradley. Technical rept. no. 8 on Theoretical and Experimental Investigations of the Atomic Phenomena Occurring

on and near the Surfaces of Solids, Contract AF 18(600)674. 1 Sep 58, 33p. 11 refs. AFOSR-TN-58-642; AD-162 174.
Order from LC mi$3.00, ph$6.30 PB 138 503

Secondary positive ions ejected from surfaces of Mo, Ta, and Pt under bombardment by inert gas ions of low energy ($<$ 1000 ev) have been studied in high vacuum ($\leq 10^{-8}$mm of Hg of background gases) using a mass spectrometer. Quantitative analyses based on abundance ratios of the ions are unreliable. Application of the technique to the investigation of surface kinetics seems highly promising.

Cornell U., Ithaca, N. Y.
THALLIUM TUNGSTEN BRONZE; A NEW DEFECT STRUCTURE, by M. J. Sienko. Rept. on Contract AF 49(638)191. 1 July 59, 21p. 7 refs. AFOSR-TN-59-504; AD-215 929.
Order from LC mi$2.70, ph$4.80 PB 143 000

Thallium tungsten bronzes, Tl_xWO_3, have been prepared ranging in composition from $x = 0.19$ to $x = 0.36$. Preparation methods included: (1) heating Tl_2WO_4, WO_3, and W; (2) vapor phase reaction of Tl and WO_3; (3) electrolysis of Tl_2CO_3 and WO_3 mixtures.

Diamond Ordnance Fuze Labs., Washington, D. C.
FREQUENCY SHIFT CAUSED BY FERRITE SPHERE IN A RECTANGULAR COAXIAL CAVITY, by John E. Tompkins. 20 Jan 58, 8p. 8 refs. TR-549.
Order from LC mi$1.80, ph$1.80 PB 138 894

A frequency-shift expression is obtained for a rectangular-coaxial cavity containing a small magnetized ferrite sphere, utilizing a method of characteristic impedance due to Magnus and Oberhettinger.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
EFFECT OF HEAVY DOPING ON THE DIFFUSION OF IMPURITIES IN SILICON, by Michael Francis Millea. Technical note no. 3 on Contract AF 49(638)417. 15 July 59, 50p. 27 refs. AFOSR-TN-59-460; AD-215 265.
Order from LC mi$3.30, ph$7.80 PB 143 673

The diffusivities of P, Sb, Sn and In in heavily doped n-type (5×10^{19} atoms/cm^3), and heavily doped p-type (2×10^{20} atoms/cm^3) silicon have been measured to obtain information on diffusion. The measured diffusivities of P and Sb in n-type are twice their values in intrinsic silicon; their diffusivities in p-type are one half those in intrinsic silicon. Possible diffusion mechanisms for substitutional impurities in silicon are discussed in the light of these and other data.

General Electric Research Lab., Schenectady, N. Y.
ION DRIFT IN AN N-P JUNCTION, by E. M. Pell. Scientific rept. no. 1 on Contract AF 19(604)5551. 14 Aug 59, 39p. 21 refs. AFCRC-TN-59-586. AD-225 984.
Order from LC mi$3.00, ph$6.30 PB 143 361

If a reverse bias is applied to an np junction at a sufficiently elevated temperature to give either the donor or the acceptor ions appreciable mobility, the ions will drift in the electric field of the junction to produce an intrinsic semiconductor region between the n and p regions. Such ion drift offers a simple and straightforward method for investigating diffusion constants, as well as chemical interactions within the host lattice which affect this diffusion. Preliminary results indicate its feasibility for measuring the diffusion constant of Li in Si to as low as 10^{-18} cm^2/sec and also for measuring the effect of Li-oxygen and Li-acceptor interactions in decreasing the diffusion rate.

Illinois U., Urbana.
PHOTOCONDUCTIVE HALL EFFECT IN SILVER BROMIDE, by Dwight C. Burnham. Rept. on Contract AF 18(600)662. June 59, 225p. 84 refs. AFOSR-TN-59-717; AD-226 402.
Order from LC mi$9.90, ph$34.80 PB 143 598

Using techniques developed by Kobayashi and Brown, the Hall mobility of electronic carriers in silver bromide was investigated in the low-temperature range. Other features of the transient photoconductivity of silver bromide were studied. Two of the samples used in the Hall effect studies were cut from an ingot purified by zone-refining techniques. Zone-refining procedures and results are described.

Illinois U., Urbana.
THE SELF ENERGY OF A HELICAL DISLOCATION, by Ronald de Wit, Doctoral thesis. Rept. on Contract Nonr-1834(12). Nov 58, 131p. 31 refs.
Order from LC mi$6.90, ph$21.30 PB 143 435

A review of dislocation theory is given, which includes Kröner's "continuum theory of dislocations and internal stresses." This theory leads to an energy expression for a dislocation in terms of a double line integral along the dislocation line. For the isotropic case this expression is used to find the self energy of straight, circular, cylindrical and helical dislocations. The connection with magnetostatics is pointed out. The helical dislocation is assumed to have a uniform shape with the Burgers vector along its axis. The axial length of the helix is large compared to its radius and the radius is large compared to the dislocation "cross section", which is of the order of a Burgers vector. For a helix of many turns and arbitrary pitch an expansion in a Fourier cosine series is used. The self energy is found in terms of elementary functions and Kapteyn series of Bessel functions.

Institute of Mathematical Sciences, New York U., N. Y.
ELECTROLYTIC CONTACTS FOR PHOTOCONDUCTIVITY MEASUREMENTS, by H. Kallman and M. Pope. Technical rept. on Contract Nonr-285(25). 4 Dec 58, 5p.
Order from LC mi$1.80, ph$1.80 PB 143 846

A cell was made which provided simultaneous electrical and optical access to an anthracene single crystal, facilitating photoconductivity studies. The cell

and electrolyte transmitted more than 90 per cent of the incident radiation at 3650 A. The results of A. C. and D. C. photoconductivity measurements made with this cell will be published in a forthcoming article.

Maryland U., College Park.
VIBRATIONAL THERMODYNAMIC PROPERTIES OF LATTICES WITH DEFECTS, by Jagadishwar Mahanty. Rept. on Contract AF 49(638)399. Aug 59, 100p. 34 refs. Dept. of Physics. Technical rept. no. 145; AFOSR-TN-59-758.
Order from LC mi$5.40, ph$15.30 PB 143 680

Techniques have been developed for evaluating the changes in the vibrational properties of a lattice due to the presence of defects, and they have been applied to the study of the effect of defects on some lattice models. Methods for extending the applicability of these techniques to the case of more complicated lattices are indicated and the discrete frequencies that arise due to an isotope defect in lattices with coupled displacement components are computed.

Massachusetts Inst. of Tech., Cambridge.
THE DUCTILE FRACTURE OF METALS, by Walter A. Backofen, Merrill L. Ebner, and Donald H. Avery. Technical rept. no. 7 on Contract Nonr-1841(25). 1 May 58, 61p. 20 refs; AD-161 847.
Order from LC mi$3.90, ph$10.80 PB 142 905

Contents:
Hardening characteristics of polycrystalline copper under fatigue loading
Fatigue in single crystals of copper
Electroshaping of copper single crystals

Massachusetts U., Amherst.
GEOMETRIC RELATIONSHIPS FOR X-RAY DIFFRACTION FROM ORIENTED FILMS OF POLYETHYLENE, by Richard S. Stein. Technical rept. no. 8 on Contract Nonr-2151(00). 13 Nov 58, 12p. AD-207 348.
Order from LC mi$2.40, ph$3.30 PB 143 475

An automatic x-ray diffractometer employing geiger counter or scintillation counter scanning has been constructed. The geometric relationships involved in determining the distribution of crystal orientations of polyethylene with this diffractometer are developed.

Microwave Lab. [Stanford U.] Calif.
PROPERTIES OF FERROELECTRIC CRYSTALS AT HIGH FREQUENCIES, by E. T. Jaynes. Final rept. for 1 Nov 54-31 Dec 58 on Contract Nonr-225(18). [1958] 3p. ML Rept. no. 565.
Order from LC mi$1.80, ph$1.80 PB 143 842

New York State Coll. of Ceramics, Alfred U.
PHOTOCONDUCTIVITY IN CADMIUM TELLURIDE, by Clyde Emerson McNeilly. Rept. on Contract Nonr-1503(01). July 58, 98p. 59 refs. AD-202 407.
Order from LC mi$5.40, ph$15.30 PB 144 263

Single crystals of cadmium telluride with an impurity concentration of about 10^{17} cc^{-3} have been prepared. Vacuum plated indium electrodes were used on n-type crystals while gold deposited from gold chloride solution was used on p-type. Thermal activation energy measurements indicate an intrinsic activation energy of 1.5 eV in the temperature range 350° - 20°C. The wavelength for maximum intrinsic photoconductivity is given by the expression:

$$\lambda(\text{Å}) = 8100 + 2.06\ T.$$

Pennsylvania State [U.] Mineral Industries Experiment Station [University Park].
HYDROTHERMAL CRYSTAL STUDIES, by Rustum Roy, R. C. DeVries and others. Rept. no. 4 for 1 July 51-30 June 52 on Contract DA 36-039-sc-5594. 15 July 52, 150p. 41 refs.
Order from LC mi$7.20, ph$22.80 PB 143 125

Studies on phase equilibrium in the systems $KF-MgF_2$ and $AgF-ZnF_2$, structural relations among the mixed oxides of the trivalent elements, and the crystal structure of $Y(OH)_3$ and $La(OH)_3$. Phase equilibrium studies in the system $K_2O-Al_2O_3-SiO_2-H_2O$ have been undertaken to define the pressure, temperature and composition limits for the synthesis of muscovite. (See also PB 140 448)

Pennsylvania State [U.] Mineral Industries Experiment Station [University Park].
INVESTIGATIONS CONCERNING SYNTHETIC LAYER LATTICE SILICATES. I. THE SERPENTINE-AMESITE JOIN IN THE SYSTEM $MgO-Al_2O_3-SiO_2-H_2O$ AND CLASSIFICATION OF THE CHLORITE MINERALS, by B. W. Nelson and Rustum Roy. Technical rept. no. 9 (Quarterly progress rept. no. 9), 1 July-30 Sep 53, on Hydrothermal Crystal Studies, Contract DA 36-039-sc-5594. 5 Oct 53, 79p. 45 refs.
Order from LC mi$4.50, ph$12.30 PB 143 128

The two-layer and four layer silicate structures are being studied with respect to limits of ionic substitution. The formation and stability of the brittle micas is also being studied. New areas of work include anion and cation substitution in the silica structures especially quartz, and the attempts to make more inverse, semi-inverse and partial semi-inverse perovskite structures. (See also PB 140 192)

Pennsylvania State [U]. Mineral Industries Experiment Station [University Park].
MULTIPLE ION SUBSTITUTION IN THE PEROVSKITE LATTICE [AND] PHASE EQUILIBRIA IN THE SYSTEM $BaTiO_3-CaTiO_3$, by Rustum Roy and R. C. DeVries. Technical rept. nos. 10-11 (Quarterly progress rept. no. 11) 1 Jan-31 Mar 54, on Hydrothermal Crystal Studies, Contract DA 36-039-sc-5594. 8 Apr 54, 53p. 15 refs.
Order from LC mi$3.60, ph$9.30 PB 143 127

A fairly large number of new oxide phases typified by such compositions as $KLaTi_2O_6$, Sr_2CrTaO_6, $Ba_3NiNb_2O_9$ and $BaKTiNbO_6$ have been synthesized and shown to have the perovskite structure. Anion substitution successfully yields compounds with this structure only when it is complete - no mixed-anion perovskites were encountered. Very few perovskites with anions other than O^{2-} or F^- have been found. Phase equilibria in the system $BaTiO_3$-$CaTiO_3$ have been investigated by quenching, thermal analysis and pellet-melting methods. The system is characterized by extensive solid solution with a minimum at 17% $CaTiO_3$, 1585 ± 5°C. The extent of the hexagonal $BaTiO_3$ phase region toward $CaTiO_3$ is less than 1%. The temperature of the tetragonal-cubic $BaTiO_3$ inversion is lowered gradually by additions of $CaTiO_3$ to 88°C. Due to the small temperature range of the $BaTiO_3$ ss + liquid regions a wide range of compositions are satisfactory for crystal growing in this system.

Syracuse U. Research Inst., N. Y.
ELECTRON SPIN LATTICE RELAXATION IN PHOSPHORUS DOPED SILICON, by A. Honig and E. Stupp. Technical rept. no. 1 on Contract AF 18(603)50. 30 June 59, 48p. 18 refs. AFOSR TN-59-715.
Order from LC mi$3.30, ph$7.80 PB 143 023

Electron spin - lattice relaxation in phosphorus doped silicon has been investigated over a magnetic field range of 0 - 11,000 oersteds, a temperature range of 1.25°K. to 4.2°K. Three distinct relaxation mechanisms have been identified, and their functional dependence on magnetic field, temperature and concentration have been determined.

Uppsala U. (Sweden).
BORIDES AND SILICIDES OF THE PLATINUM METALS, by Bertil Aronsson, Jan Aselius and Erik Stenberg. Technical note no. 5 on Contract AF 61(052)40. 3 July 59, 6p. 7 refs. AFOSR TN-59-414; AD-214 561.
Order from LC mi$1.80, ph$1.80 PB 142 971

Three new structure types (tentatively notated as Ru_7B_3-, RhB- and IrB-1-2-types) are discussed briefly.

Uppsala U. (Sweden).
THE CRYSTAL STRUCTURE OF $SnCl_4.2SeOCl_2$, by Yngve Hermodsson. Technical note no. 6 on Contract AF [61](052)43. 20 Aug 59, 15p. 25 refs. AFOSR-TN-59-723.
Order from LC mi$2.40, ph$3.30 PB 143 636

The crystal structure of the addition compound $SnCl_4.2SeOCl_2$ has been determined and refined from three-dimensional X-ray data.

Uppsala U. (Sweden).
THE CRYSTAL STRUCTURE OF $(TiCl_4.POCl_3)_2$, by Carl-Ivar Branden and Ingvar Lindqvist. Technical note no. 7 on Contract AF 61(052)43. 20 Aug 59, 13p. 17 refs. AFOSR-TN-59-722; AD-226 387.
Order from LC mi$2.40, ph$3.30 PB 143 918

The crystal structure of $(TiCl_4.POCl_3)_2$ has been determined from three-dimensional X-ray data. The structure is built up of dimeric molecules $(TiCl_4.POCl_3)_2$ with double chlorine-bridges between the two titanium atoms of the dimer. The coordination around the titanium atom is octahedral. The oxygen atom in $POCl_3$ functions as donor atom. The approximately tetrahedral structure of $POCl_3$ is preserved. The nature of the acceptor-donor interaction in addition compounds where oxychlorides function as donor molecules is discussed.

Uppsala U. (Sweden).
AN X-RAY STUDY OF PHOSPHIDES OF THE PLATINUM METALS, by Stig Rundqvist. Technical note no. 7 on Contract AF 61(052)40. 29 July 59, 5p. 11 refs. AFOSR-TN-59-656.
Order from LC mi$1.80, ph$1.80 PB 143 919

The present author has started an X-ray powder and single-crystal investigation of phosphides of the platinum metals in order to establish the compositions of the phases and to determine the crystal structures. A preliminary report of the work is given.

Westinghouse Electric Corp., East Pittsburgh, Pa.
MAGNETO-OPTICAL EFFECTS IN FERROMAGNETIC OXIDES, by P. Bailey. Scientific rept. no. 1, 15 Mar-15 June 59, on Contract AF 19(604)5529. 15 June 59, 17p. 11 refs. AFCRC-TN-59-395; AD-225 [illegible]
Order from LC mi$2.40, ph$3.30 PB 143 629

The Faraday rotation exhibited by magnetized sections of yttrium and gadolinium iron garnets was measured in the wavelength range 1 - 15μ. Measurements made on α-Fe_2O_3 in the visible and near infra-red at room temperature indicated absorption peaks.

Willow Run Labs., U. of Michigan, Ann Arbor.
RESONANCE ABSORPTION OF PARAMAGNETIC IONS WITH SPIN 5/2: $CaCO_3$:Mn, by Chihiro Kikuchi. Technical memo. on Proj. Michigan, Contracts AF 49(638)68 and DA 36-039-sc-78801. Aug 59, 39p. 12 refs. 2616-10-R; AFOSR-TN-59-220; AD-211 802.
Order from LC mi$3.00, ph$6.30 PB 143 181

The theory of the paramagnetic resonance absorption of ions with S=5/2 in crystalline fields of trigonal symmetry is presented using manganous ions in calcite as an example. It is shown that the experimental results observed by Hurd, Sachs, and Hershberger can be accounted for by assuming that the manganous ions occupy the two nonequivalent Ca^{++} sites at random. Much of the theory presented here is also applicable to Al_2O_3:Fe, which is a potential material for a zero-field maser.

Theoretical Physics

Avco Research Lab., Everett, Mass.
THE PRODUCTION AND STUDY OF HIGH SPEED SHOCK WAVES IN A MAGNETIC ANNULAR SHOCK TUBE, by Richard M. Patrick. Rept. on Contract

AF 49(638)61. July 59, 42p. 15 refs. Research rept. 59. AFOSR-TN-59-845; AD-225 292.
Order from LC mi$3.30, ph$7.80 PB 143 155

A magnetic annular shock tube has been used to produce magnetically driven shock waves with very high velocities. Experiments were carried out with this device with two magnetic field configurations ahead of the shock front. The first configuration had a magnetic field ahead of the shock front in the direction of motion of the shock. In the second configuration the magnetic field ahead of the shock had its principal component in the plane of the shock front and a small component in the direction of motion of the shock. The continuum radiation emitted by the shock-heated plasma was measured with photomultipliers. The use of probes to measure the change in the local magnetic field in the shock front was investigated. With the second configuration shock velocities in excess of 4×10^7 cm/sec were measured in hydrogen. For these high speed shock waves, a shock thickness was obtained from measured rise times of the emitted visible radiation. These shock thicknesses are thinner than the mean free path in the shock-heated plasma, an observation which agrees with a theoretical prediction.

Avco Research Lab., Everett, Mass.
THEORY OF THE FLOW IN THE MAGNETIC ANNULAR SHOCK TUBE, by Nelson H. Kemp and Harry E. Petschek. Rept. on Contract AF 49(638)61. July 59, 37p. 7 refs. Research rept. 60; AFOSR-TN-59-846; AD-225 774.
Order from LC mi$3.00, ph$6.30 PB 143 521

This paper gives a theoretical description of the properties of the gas flow in the magnetic annular shock tube. This shock tube uses a magnetic field to drive a shock wave through an annular region, producing a very high temperature plasma. It is shown that this particular configuration allows a fairly precise calculation of the flow parameters. Numerical calculations of the significant flow properties for a complete range of the initial field strength and orientation have been made and are presented graphically.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE WAVE MOTIONS OF SMALL AMPLITUDE IN RADIATION-ELECTRO-MAGNETO-GAS DYNAMICS, by S. I. Pai and A. I. Speth. Rept. on Contract AF 49(638)401. July 59, 23p. 8 refs. Technical note BN-180; AFOSR-TN-59-879; AD-225 691.
Order from LC mi$2.70, ph$4.80 PB 143 387

The fundamental equations of radiation-electromagneto-gas dynamics are first discussed. These equations are linearized under the condition there exists an externally applied uniform magnetic field. Wave motions of infinitesimal amplitude which may be divided into a transverse wave and a longitudinal wave, are analyzed. Radiation phenomena exert influence only on the longitudinal wave while the transverse wave is independent of the radiation field. The radiation effect is characterized by introducing a radiation parameter which is the ratio of radiation pressure to the gasdynamic pressure. For ideal plasma, it may be expressed in terms of an effective radiation sound speed. Various simple cases of this wave motion of small amplitude in radiation electro-magneto-gas dynamics have been discussed. The condition where the radiation effect becomes important is also discussed.

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
IMPROVED MICROWAVE TECHNIQUES FOR MEASURING PLASMA PARAMETERS, by Jaan Kannelaud and Romayne F. Whitmer. Scientific rept. no. 1 on Investigation of Non-Linear Phenomena Associated with Ionized Plasmas, Contract AF 19(604)4083. 22 July 59, 39p. 9 refs. AFCRC-TN-59-578, AD-225 405.
Order from LC mi$3.00, ph$6.30 PB 143 494

A study is made of microwave methods for performing measurements of plasma characteristics. A discussion is given of the assumptions made in the theoretical analysis and of means for satisfying these conditions experimentally. An experimental arrangement was designed and tested in an attempt to determine the relative importance of experimentally satisfying the various assumptions. It was found that the phase shift measurements (which yield the electron density in the plasma) were relatively insensitive to many of the analytical conditions. However, the plane wave--infinite medium assumption imposes serious restrictions on the manner in which attenuation measurements (which yield the electron-neutral particle collision frequency) are performed.

Rome Air Development Center, Griffiss AFB, N. Y.
THE STATUS OF MICROWAVE PLASMA PHYSICS, by Daniel J. Kenneally. Summary rept. Aug 59, 34p. 105 refs. RADC-TN-59-200; AD-217 680.
Order from LC mi$3.00, ph$6.30 PB 143 907

An attempt is made to determine the present status of those aspects of plasma physics which are mainly concerned with the interaction of microwave signals with plasma media. The basic equations are presented. Typical methods of plasma generation and shock simulation are presented. Certain recommendations are shown to be appropriate with respect to facilities and technical manpower presently available. In particular, the study and exploitation of hot plasma interactions is shown to be worthy of further effort. In addition, a cold plasma as a microwave network element is shown to be an extremely desirable and technically feasible area for unique exploitations.

Thermodynamics

Air Force Missile Development Center, Holloman AFB, N. Mex.
CALCULATION OF THE CONCENTRATION OF THE SOLAR RADIATION THROUGH THE FOCAL SPOT OF A PARABOLIC MIRROR ON THE BASIS OF A NON-UNIFORM SUN, by Alfred W. Simon. Sep 59, 17p. 5 refs. AFMDC TN-59-23.
Order from LC mi$2.40, ph$3.30 PB 143 186

The concentration of energy through the focal spot of a parabolic mirror is calculated on the basis of data given by Abetti on the variation of intensity across the face of the image of the solar disc as a function of the radius of the point considered. The result is 66,078 cal/cm^2/minute on the basis of a value of the solar constant of 1.76 cal/cm^2/minute. The value agrees closely with that of Jose obtained on the basis of an empirical formula.

Air Force Missile Development Center, Holloman AFB, N. Mex.
SOLAR FURNACE SUPPORT STUDIES, VOLUME II. 1959, 292p. 38 refs. AFMDC-TR-59-15; AD-213 260.
Order from LC mi$11.10, ph$44.10 PB 143 633

Contents:
Design of a solar furnace and the calculation of concentration using spherical-mirror elements
Aerodynamic stability of a heliostat structure
Oscillations of a rigid heliostat mirror caused by fluctuating wind
Studies on thermal effects on solar furnace mirrors
A radiation fluxmeter for high intensity applications
Instrumentation for the 108-foot diameter cloudcroft solar furnace
The proof of certain laws of optics used in solar furnace calculations
The design of a heliostat mirror for a solar furnace
The design of the condenser of a solar furnace using non-parabolic elements
The flux through a focal spot of a solar furnace
Calculation of the concentration of energy at points outside the focal spot of a parabolic condenser

Armour Research Foundation, Chicago, Ill.
THE MECHANICAL PROTECTION OF THE W/Ir THERMOCOUPLE, by Gary Steven and Walter C. Troy. Rept. no. 21. 13 Aug-5 Sep 49. 9 Sep 49, 11p. NEPA 1153-ARM-22; AD-206 714.
Order from LC mi$2.40, ph$3.30 PB 138 456

The installation of a gas-fired muffle furnace was completed. Constructional details as well as data on the furnace operation are included in this report. The performance of the furnace was checked during a 12-hour run at a temperature of 1950° to 1980°C. During this high temperature run, an unprotected Ir/60% Rh, 40% Ir thermocouple was operated satisfactorily inside the furnace muffle.

Arnold Engineering Development Center [Tullahoma, Tenn.]
A METHOD OF FORMING CONTINUOUS EMPIRICAL EQUATIONS FOR THE THERMODYNAMIC PROPERTIES OF AIR FROM AMBIENT TEMPERATURES TO 15,000°K, WITH APPLICATIONS, by Martin Grabau. Rept. on ARO, Inc. Contract AF 40(600)800. Aug 59, 37p. 7 refs. AEDC-TN-59-102.
Order from LC mi$3.00, ph$6.30 PB 143 920

This work relates generally to automatic data reduction for arcdriven, hotshot-type wind tunnels which operate at high stagnation temperatures. Pressure and density are used as the simplest independent variables.

Brown U. Div. of Engineering, Providence, R. I.
THE ELECTROPLASTIC THICK-WALLED SPHERE SUBJECTED TO RISING TEMPERATURE GRADIENTS, by G. R. Cowper. Technical rept. no. 9 on Contract Nonr-562(20). Nov 58, 30p. 8 refs. Nonr-562(20)9; AD-207 361.
Order from LC mi$2.70, ph$4.80 PB 143 412

An exact solution is obtained for the behavior of an ideal elastoplastic hollow sphere subjected to a monotonically increasing temperature gradient. An approximate rigid-plastic solution is also developed and compared with the exact solution. A technique for improving the approximate solution is indicated. Finally, the extension of the analysis to the case in which yield stress depends on temperature is discussed.

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC DATA BOOK, by Dudley B. Chelton and Douglas B. Mann. Mar 59, 155p. WADC Technical rept. 59-8; AD-208 155.
Order from OTS $3.00 PB 151 837

A compilation of the physical properties of several liquefied gases and a number of structural and thermal insulating materials in the temperature region of liquefied gases are presented. Specifically, the liquefied gases treated are helium, hydrogen (para and ortho), hydrogen deuterids, deuterium, nitrogen, oxygen and air. The data is presented in the English system of units.

Diamond Ordnance Fuze Labs., Washington, D. C.
THE THERMAL CONDUCTIVITY OF SOLIDS AT HIGH TEMPERATURES: A BIBLIOGRAPHY, by W. T. K. Johnson. 1 June 59, 71p. 474 refs. TM-59-4.
Order from OTS $2.00 PB 161 118

A total of 474 references is given. Most of the references since 1940 are accompanied by a brief description of content. This information has been compiled in connection with studies on thermoelectric generators.

Electrical Engineering Research Lab., U. of Texas [Austin].
APPARENT TEMPERATURES OF SOME TERRESTRIAL MATERIALS AND THE SUN AT 4.3 MILLIMETER WAVELENGTHS, by C. W. Tolbert, C. O. Britt, and A. W. Straiton. Rept. on Contract Nonr-375(01). 1 July 57, 37p. 6 refs. Rept. no. 93.
Order from LC mi$3.00, ph$6.30 PB 138 960

This report describes the 4.3 millimeter radiometer and its operational characteristics, the temperature of various terrestrial materials, the attenuation through the atmosphere and the temperature of the sun. The

temperatures of the terrestrial materials were measured for vertical and horizontal polarization over an angular range from normal incidence to near grazing. The attenuation vertically through the atmosphere ranged between 1.6 and 2.3 decibels during the measurement program. The sun of optical disk size was found to be between 10^4 and 1.2×10^4 degree Kelvin on May 3 and June 17 of 1957. Since the apparent temperature of the materials measured is dependent upon their reflectivity, a measure of the reflecting characteristics of water, wood, metal, grass, asphalt, gravel and asbestos at 4.3 millimeter wavelengths was obtained.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DEVELOPMENT OF THERMOCOUPLES FOR USE ON THERMOELECTRIC GENERATORS. Final rept. for 30 Apr 47-30 Sep 50 on Contract W36-039-sc-33654. [1950] 48p. Rept. no. F-1992-13; ATI-89 883.
Order from LC mi$3.30, ph$7.80 PB 144 088

The development of Zn-Sb alloys, properties of PbS, and the design and construction of an experimental thermoelectric generator. Thermoelectric properties have been investigated most thoroughly for PbS and the intermetallic compound Zn-Sb.

Illinois U. [Urbana].
A GENERAL INVESTIGATION OF THERMAL STRESSES IN SHELLS, by H. L. Langhaar and A. P. Boresi. Technical rept. no. 1 on Contract Nonr-1834(14). Oct 57, 63p. 14 refs. T & AM rept. no. 124.
Order from LC mi$3.90, ph$10.80 PB 138 898

A general theory of thermal stresses in shells is developed. The equations for small deflections of any shell are generalized to include the effects of a temperature distribution that is an arbitrary function of the curvilinear coordinates (x, y, z) of the shell. Additionally, the strain energy expression for any elastic isotropic shell is developed for an arbitrary temperature distribution.

Institute of Flight Structures, Columbia U., New York.
UPPER BOUNDS AND SAINT-VENANT'S PRINCIPLE IN TRANSIENT HEAT CONDUCTION, by Bruno A. Boley. Technical rept. no. 13 on Contract Nonr-226(20). Dec 58, 8p. 7 refs. CU-13-58-ONR266(20)-CE.
Order from LC mi$1.80, ph$1.80 PB 143 608

An investigation is carried out on transient heat-conduction problems with prescribed surface temperature, and the validity of Saint-Venant's principle in parabolic boundary-value problems is discussed.

James Forrestal Research Center, Princeton, N. J.
THERMAL CONDUCTION IN LIQUIDS, by William J. Scheffy. Rept. on Contract Nonr-1858(25). Oct 58, 105p. 86 refs. Proj. Squid Technical rept. PR-85-R.
Order from LC mi$5.70, ph$16.80 PB 143 293

A study of heat conduction in pure liquids has been undertaken from the point of view that the primary problem is that of prediction of the thermal conductivity of a liquid at any conditions which may happen to be of interest to the engineer. The experimental, empirical approach has been taken, since the more rigorous theories of liquids are not yet of practical value for liquids more complex than argon. Prediction must be based on measured values for a variety of polyatomic liquids. An apparatus was constructed to measure the thermal conductivities of liquids over a wide temperature range. The various simplified theoretical approaches are discussed and the prediction equations to which they lead are criticized. Recommendations are made regarding the calculation of thermal conductivity at temperatures near the critical.

Little, Arthur D., Inc., Cambridge, Mass.
THE IGNITION OF GASES BY ELECTRICALLY HEATED WIRES, PART I, by Leland E. Ashman and William E. Gordon. Rept. on Contract AF 18(603)109. 19 Jan 58, 23p. 2 refs. AFOSR-TN-58-1010; AD-206 153.
Order from LC mi$2.70, ph$4.80 PB 143 595

If a 1-1/2-cm length of 2-mil tungsten wire is heated in a period of about 100 microseconds, such as by the discharge of a condenser, at the end of the heating period, the temperature distribution along the wire is essentially flat. This fact is used in the investigation of the ignition of gases by electrically heated wires. Since the temperature distribution is flat, the current to maintain the center of the wire at a constant temperature is a measure of the heat flux from the wire to the gas. A theoretical analysis of the heat flow shows that the temperature of the center of the wire is independent of end losses for about 100 milliseconds. A general formulation of the problem is applicable to wires of any length and diameter.

Little, Arthur D., Inc., Cambridge, Mass.
THE IGNITION OF GASES BY ELECTRICALLY HEATED WIRES, PART TWO, by Leland E. Ashman and William E. Gordon. Rept. on Contract AF 18(603)109. 19 Jan 58, 24p. 17 refs. AFOSR-TN-58-1011; AD-206 154.
Order from LC mi$2.70, ph$4.80 PB 143 594

Experimental studies have been conducted on the ignition of gases with constant temperature wire ignition sources. Some effects of wire size, wire composition, and gas pressure on the ignition delay have been investigated for the case of the hydrogen-air mixture. For a given wire temperature, the ignition delay increases when either the diameter of the wire or the gas pressure is reduced. The magnitude of this reduction in ignition delay agrees, at least to a first approximation, with theoretical considerations of the effect of wire size and gas pressure on ignition delay. (See also PB 143 595)

Massachusetts Inst. of Tech., Cambridge.
HEAT TRANSFER IN DISSOCIATED COMBUSTION GASES, by John C. Cutting, James A. Fay and others Rept. on Contract AF 49(638)375. July 59, 49p. 25 refs. AFOSR-TR-59-78.
Order from LC mi$3.30, ph$7.80 PB 143 150

This report outlines a series of experiments and theoretical calculations performed to determine the rate of heat transfer from gases in detonation waves.

Minerals Research Lab., U. of California, Berkeley.
ARC IMAGE FURNACE, by D. O. Horning and Earl R. Parker. Final rept. on Contract AF 18(603)123. May 59, 30p. 28 refs. Series 141; AFOSR-TR-59-88.
Order from LC mi$2.70, ph$4.80 PB 143 622

The design details, optical calibration, and operating conditions of the high temperature research facility known as the Arc Image Furnace are discussed. Initial operating conditions are given and some observed data are explained.

Naval Ordnance Test Station, China Lake, Calif.
TENSORS AND THERMODYNAMICS, by A. S. Filler. 12 Sep 56, 134p. 6 refs. NOTS-1581; NAVORD rept. 5331; AD-157 058.
Order from LC mi$6.90, ph$21.30 PB 138 561

The basic principles of thermodynamics and their expression as the first and second laws are examined using tensor analysis. The required tensor methods are those of pure vector geometry and are developed in the report. Several aspects of tensor analysis which are particularly important for physical applications are emphasized. These, in turn, call attention to certain conceptual difficulties in thermodynamics, which are discussed in some detail.

Naval Research Lab., Washington, D. C.
INTERACTION BETWEEN ELECTROMAGNETIC WAVES AND FLAMES. PART 6. THEORETICAL PLOTS OF ABSORPTION, PHASE SHIFT, AND REFLECTION, by W. W. Balwanz. Interim rept. 23 Sep 59, 31p. 7 refs. Rept. 5388.
Order from LC mi$3.00, ph$6.30 PB 142 454

Theoretical studies which attempt to follow the motion of an average particle under a Lorentz force provide expressions for the attenuation of electromagnetic waves in ionized media. The resulting equations are fairly complicated, particularly near the critical (plasma-resonance) frequency of interest in flame studies. As a consequence, graphical presentations are utilized to provide for the interpretation of experimental results. The curves are plotted as a single family in a three-dimensional space, thus simplifying the graphical presentation over the usually presented. This single family may be expanded into the usual series of families by relabeling coordinates. The influence of the magnetic field is ignored, since it is normally a negligible factor in flame studies.

Naval Research Lab., Washington, D. C.
RADIANT HEATING FROM ROCKET EXHAUSTS, by D. C. Rohlfs and W. W. Balwanz. Interim rept. 20 Aug 58, 24p. 4 refs. Rept. 5174.
Order from LC mi$2.70, ph$4.80 PB 133 234

Radiant energy from the exhaust of a static-fired 11-pound-thrust rocket motor has been measured as a function of simulated altitude. Liquid oxygen and RP-1 were used as propellants. The radiant energy was measured with aneroid calorimeters. The exhaust is assumed to have constant total radiated energy, to be non-self-absorbing, and to be homogeneous with cylindrical symmetry. Experimental and theoretical results are in rough qualitative agreement. The effect of conduction currents in the closed chamber was minimized by proper placement of the calorimeters, but the accuracy in evaulating the effect of these currents limits the comparison between theory and experiment. Impingement temperature of the exhaust on a steel plate was also measured as a function of altitude. Experiment shows that the impingement heating becomes more concentrated toward the center of the exhaust with increasing altitude.

Padova U. (Italy).
NUCLEAR RESONANCE IN CONDENSED SYSTEM AT LOW TEMPERATURES. Final technical rept. for 15 May 57-15 May 59 on Contract DA 91-508-EUC-187. 15 June 59, 13p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 143 109

A program on experimental study of nuclear resonance in condensed systems was initiated to understand some microscopic features of the atomic movements. The apparatus needed to accomplish this investigation consists essentially of the following components. (1) The electromagnet, (2) The electronics, (3) The gas manifold system, (4) The cryostat.

Plasmadyne Corp., Santa Ana, Calif.
A CONTINUOUS HIGH TEMPERATURE GAS FLOW FACILITY FOR MAGNETOHYDRODYNAMIC STUDIES, by Vernon H. Blackman. Rept. on Contract AF 49(638)334. 26 June 59, 37p. 7 refs. T-1TN069-334; AFOSR-TN-59-681; AD-225 412.
Order from LC mi$3.00, ph$6.30 PB 143 163

In order to study phenomena which require both a long testing time and high temperature it would be most desirable to combine the steady state flow characteristics of a wind tunnel with the high gas temperature capabilities of a shock tube. This report will describe an attempt to accomplish such a union. The facility to be described was set up in order to study the steady state Hall effect in an ionized gas flow and as a convenient arrangement to look at fluctuations introduced into a flow by means of an electric arc heater. It has also proven to be useful for preliminary experimental studies of the steady acceleration of an ionized gas flow by means of crossed electric and magnetic fields.

Vitro Labs., West Orange, N. J.
ROTATIONAL "TEMPERATURE" MEASUREMENTS OF THE HIGH INTENSITY ARC TAIL FLAME, by A. W. Diniak, C. Roth and others. Technical note no. 4 on Contract AF 18(603)3. 7 Aug 58, 16p. 11 refs. KLX-10113; AFOSR-TN-58-735; AD-201 351.
Order from LC mi$2.40, ph$3.30 PB 143 936

Rotational temperatures in the tail flame of the high intensity arc at atmospheric and at reduced pressures are determined by measuring the radiation

intensity distribution of the rotational fine structure of the C_2 (0, 0) Swan band at λ 5165, and of the OH (0, 0) ultraviolet band at λ 3064. A comparison is made between temperatures obtained from the C_2 species, and those obtained from the OH species by both the fundamental and the iso-intensity methods. A discussion of the rotational temperature results obtained is included.

Wave Propagation

Air Force Cambridge Research Center, Bedford, Mass.
TROPOSPHERIC AND IONOSPHERIC SCATTER PROPAGATION IN THE TRANSITION ZONE, by Frank A. Pivarunas. Apr 59, 37p. 15 refs. AFCRC-TR-59-136; AD-214 498.
Order from LC mi$3.00, ph$6.30 PB 143 721

There is a zone of receiver distances in which a transition from tropospheric to ionospheric scatter propagation for the received signals can and does take place for frequencies generally used for ionospheric scatter propagation (between about 35 and 60 Mcps). The diurnal and seasonal variations of the median signal levels in each mode determine when and where the signal levels of both modes are within a few db of each other so that the transition region can occur. Since the fading rates peculiar to the ionospheric scatter mode are different from those of the tropospheric scatter, the transition region is readily recognized by the superimposed fading rates on signal level recordings. The scatter volumes for the transition zone are in the stratosphere for the "tropospheric" scatter mode. This may account for some of the changes in tropospheric scatter signal characteristics as distance increases to reach the transition zone. A mode diversity system to improve reception of signals in this zone by using optimum beamwidths and orientations of the antennas used in transmitting and receiving has been proposed.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
EQUIPMENT FOR CONTINUOUS ECHO AMPLITUDE RECORDING, by Murray E. Sherry. Technical rept. no. 24 on Contract DA 36-039-sc-56748. 1 July 55, 19p. 1 ref. Research rept. EE 251; AD-70 609.
Order from LC mi$2.40, ph$3.30 PB 138 547

A logarithmic amplifier and a pulse shaper were added to the sounder at the Cornell Ionosphere Laboratory in order to take measurements of the amplitude of reflected pulses from the ionosphere as a continuous function of frequency. Details of the construction and diagram are presented here.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
INVESTIGATION OF SUPERSONIC PHENOMENA UNDER EXPLOSIVE CONDITIONS, by W. Philippoff. Final rept. for 28 Feb 58-27 Feb 59 on Contract DA 36-034-ORD-2627. [1959] 38p. 1 ref. F-A2142.
Order from LC mi$3.00, ph$6.30 PB 143 456

We were concerned with the measurement of the propagation of shock waves in transparent materials. Instantaneous photography of the stress pattern in polarized light was used. A number of cases were found that suggested supersonic propagation of stress waves in glass. As the verification of such propagation could be of interest, it was decided to sponsor research to ascertain the existence, nature and behavior of this new kind of wave.

Institute of Aerophysics, U. of Toronto (Canada).
BLAST FROM A PRESSURIZED SPHERE, by D. W. Boyer, H. L. Brode and others. Rept. on Contract Nonr-2335(00). Jan 58, 100p. 20 refs. Rept. no. 48; AD-162 002.
Order from LC mi$5.40, ph$15.30 PB 142 915

Numerical solutions are given for the variation of all flow quantities, as functions of time and space, for the 2-inch diameter air and helium sphere cases. Schlieren photographs of the corresponding experimental blasts are in good qualitative agreement with the theoretical wave diagrams and a quantitative comparison of the 2-inch diameter air sphere blast with theory shows fair agreement. The schlieren and shadowgraph flow records show that the main spherical shock wave is formed by a process of overtaking and coalescing compression waves in a manner somewhat similar to the development of a plane shock wave in a conventional shock tube. Differences between the theoretical and experimental flows are principally due to the finite bursting time of the glass spheres in practice.

Institute of Mathematical Sciences, New York U., N. Y.
BOUNDS ON THE ELEMENTS OF THE EQUIVALENT NETWORK FOR SCATTERING IN WAVEGUIDES. I. THEORY, by Larry Spruch and Ralph Bartram. Rept. on Contract AF 19(604)5238. Apr 59, 33p. 14 refs. Research rept. no. EM-132; AFCRC-TN-59-187. AD-215 064.
Order from LC mi$3.00, ph$6.30 PB 142 811

For a few particular waveguide problems, standard variational expressions have previously been shown to be upper or lower bounds on the quantities of interest. However, bounds have not previously been obtained for any truly three dimensional problem, that is, where the fields cannot be derived from a single scalar potential. An example is a three dimensional obstacle which contacts only one waveguide surface. As one consequence, no straightforward procedure exists for improving the approximations. Recently, Kato devised a rather general method for bounding the cotangent of the phase shift for a given angular momentum in a quantum mechanical central potential scattering problem. This method should be applicable whenever a system can be analyzed in terms of uncoupled standing waves each characterizable by one real phase shift. The method is here adapted to waveguides, including truly three dimensional problems. The obstacle must be symmetric about a plane perpendicular to the waveguide axis, with certain exceptions only one mode should propagate, and the system should be lossless. Analysis is then possible in terms of η_e and η_o, the real uncoupled phase shifts associated with the even and odd

standing waves, respectively. The bounds obtained on $\cot\eta_e$ and $\cot\eta_o$ determine bounds on the equivalent network elements.

Michigan U. Coll. of Engineering, Ann Arbor.
TRANSVERSE WHISTLER PROPAGATION, by C. O. Hines, W. C. Hoffman, and H. Weil. Final rept. on Contract AF 19(604)5553. June 59, 38p. 21 refs. 2894-1-F; AFCRC TR-59-180, AD-226 123.
Order from LC mi$3.00, ph$6.30 PB 143 019

Transpolar propagation of ion-electron whistler modes is investigated and shown, with the help of numerically computed rays, not to be useful for transmitting information. The first two sections of the report comprise a summary of whistler phenomena and theory to provide a background for the present investigation. In Section III a specific ion-electron density distribution is introduced and applied to the appropriate Haselgrove ray tracing equations. In Section IV the numerical results for transpolar propagation are presented.

Naval Research Lab., Washington, D. C.
EFFECT OF DIELECTRIC CONSTANT ON CERTAIN CHARACTERISTICS OF PLANE ELECTROMAGNETIC WAVES IN NONMAGNETIC CONDUCTIVE MEDIA, by L. S. Bearce and R. W. Zeek. Final rept. 19 Oct 59, 10p. Rept. 5381.
Order from LC mi$1.80, ph$1.80 PB 142 452

The error resulting from omission of the dielectric constant as a factor in expressions for the rate of attenuation, the phase velocity, and the wavelength of plane electromagnetic waves in nonmagnetic media has been considered. The variation of these quantities as a function of frequency for water of various conductivities has been calculated, with special attention given to the case of sea water. Universal curves applicable to any nonmagnetic media are presented for use in propagation studies.

Naval Research Lab., Washington, D. C.
PROPAGATION MEASUREMENTS IN THE 5-MILLIMETER REGION, by K. M. Decker and R. C. Dodson. Final rept. 19 Oct 59, 15p. 7 refs. Rept. 5385.
Order from LC mi$2.40, ph$3.30 PB 142 453

The atmospheric absorption of electromagnetic radiation in the region of 5 to 6 mm has been measured and has been found to vary from 14.1 db/km at 5.08 mm to 1.02 db/km at 5.66 mm for dry air at a temperature of 68°F and a pressure of 29.92 in. Hg. Corrections for temperature and pressure, as determined theoretically by previous investigators, have been assumed correct, whereas the corrections due to uncondensed water vapor were determined experimentally and were found to vary from 0.05 db/km at 5.6 mm to 0.09 db/km at 5.08 mm for each gram of uncondensed water vapor per cubic meter.

Radiation Lab., Johns Hopkins U., Baltimore, Md.
BACK-SCATTERING CHARACTERISTICS OF THE SEA IN THE REGION FROM 10 TO 50 KMC, by J. C. Wiltse, S. P. Schlesinger, and C. M. Johnson. Rept. on Contract Nord--11299. May 56, 70p. 5 refs. RL/JHU/TR-35; AD-156 438.
Order from LC mi$3.90, ph$10.80 PB 138 595

Measurements of back scattering from the ocean have been made over the frequency range from 10 to 50 kMc by means of several CW doppler microwave systems operating simultaneously. The systems were mounted on the bow of a ship and various antenna depression angles from 0° (horizontal) to 90° were used. Data were obtained for vertical, horizontal, and circular polarization, and for the cross-polarized component of vertically polarized radiation. Horn antennas of 20 db gain were used at each frequency of operation, and, in addition, higher and lower gain antennas were used at certain selected frequencies. Signals recorded from a variety of sea conditions have been used to calculate the back-scattering cross section per unit area, σ^o. These calculations indicate that σ^o is nearly constant with microwave frequency and increases as the antenna depression angle is increased. The doppler frequency characteristics of the returned signals have also been obtained from the measurements. A comparison is made between the results obtained and those predicted theoretically from simple scattering mechanisms.

Stanford Electronics Labs., Stanford U., Calif.
AIR MOTIONS AND THE FADING DIVERSITY AND ASPECT SENSITIVITY OF METEORIC ECHOES, by L. A. Manning. Technical rept. no. 50 on Contract Nonr-225(24). 10 Dec 58, 33p. 14 refs.
Order from LC mi$3.00, ph$6.30 PB 143 844

A theory is presented that relates those properties of meteoric echoes that depend on distortion of the trail by winds. It is shown that existing results concerning the delay in the start of echo fading (Greenhow), the delay in echo appearance with aspect (McKinley and Millman), the spectral composition of the received signal (Manning, Villard, and Peterson), and the regularity of the fading pattern, are quantitatively explicable. In addition, the theory predicts that the ensemble average rate of echo fading should rise characteristically with time, and should then drop precipitously at the end of the ensemble echo; moreover, it predicts that the correlation of fading patterns at two ground receivers should be a Gaussian function of the product of receiver spacing and echo fading cycle-number. Experimental results are given confirming these predictions, and making possible the determination of the principal properties of the wind profile.

Stanford Electronics Labs., Stanford U., Calif.
THEORY OF RADAR STUDIES OF THE CISLUNAR MEDIUM, by V. R. Eshleman, R. C. Barthle, and P. B. Gallagher. Scientific rept. no. 5 on Contract AF 19(604)2193. 8 July 59, 25p. 13 refs. AFCRC-TN-59-381.
Order from LC mi$2.70, ph$4.80 PB 143 199

In two of the methods described here, the full average-power capability of an h-f transmitter can be used without regard to high stability or precise lunar range. In one method, three equally-spaced

frequencies are sent in the form of an amplitude-modulated wave. Thus a reference quantity is, in effect, sent with the measuring quantities. The relative phases, and hence the character of the modulation, are changed due to dispersion in the cislunar medium. For example, a direct measure of the integrated ion density would be the value of the modulating frequency at which an amplitude-modulated signal is changed to a frequency-modulated echo. In another method an h-f and a vhf transmitter are modulated by the same audio signal. The difference of the audio phase in the simultaneously-recorded echoes should be a measure of the integrated ion density.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
PROCEEDINGS OF CONFERENCE OF LABORATORY CHIEFS NO. 1, 24-27 OCTOBER 1955. 223p.
Order from LC mi$9.90, ph$34.80 PB 143 438

Improving Relationships and Personnel Management in Research and Development Laboratories.

Communication Theory

Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.
RESEARCH INVOLVING COMMUNICATION PROCESSES IN TASK ORIENTED GROUPS, by Thornton B. Roby, Bernard W. Harleston and Lorraine D. Eyde. Technical rept. no. 1 on Contract Nonr-494(15). 15 Nov 58, 5p.
Order from LC mi$1.80, ph$1.80 PB 143 465

Willow Run Labs., U. of Michigan, Ann Arbor.
RESEARCH IN MACHINE TRANSLATION, II. RUSSIAN PHYSICS VOCABULARY WITH FREQUENCY COUNT: RIGHT-TO-LEFT ALPHABETIZATION, by A. Koutsoudas and A. Halpin. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Sep 58, 81p. Rept. no. 2144-312-T.
Order from LC mi$4.80, ph$13.80 PB 143 545

A list of words, with frequencies, occurring in a Russian physics text of 73,364 running words, was taken from the Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki (Journal of Experimental and Theoretical Physics), and alphabetized from right to left. The list provides raw data for a morphological analysis of compound words and derivational and inflectional suffixes.

Zator Co., Cambridge, Mass.
A PROGRESS REPORT ON MACHINES TO LEARN TO TRANSLATE LANGUAGES AND RETRIEVE INFORMATION, by R. J. Solomonoff. Rept. on Contract AF 49(638)376. Oct 59, 21p. 4 refs. ZTB-134; AFOSR-TN-59-646.
Order from OTS $0.75 PB 161 263

This paper discusses theoretical work which makes it possible for a machine to be programmed to learn to translate between two simple, synthetic languages, after it has been given a large set of correct examples in a suitable training situation. The limitations of the methods are discussed. A system is described in which a machine would learn to assign descriptors or other search indices to documents, after having been given a large set of documents and the search indices that have been assigned to them by humans. Some of the problems that must be solved before such a system can be realized are discussed. A unified method is proposed for resolving the difficulties of both the information retrieval and the mechanical translation routines.

Photographic Equipment

Georgetown Coll. Observatory, Washington, D. C.
A FAST-ACTION MULTIPLATE CAMERA, by F. J. Heyden and Mark W. Rudy. Technical rept. no. 10 on Contract AF 19(604)2229. Aug 58, 5p. Monograph no. 11; AFCRC-TN-58-612; AD-207 640.
Order from LC mi$1.80, ph$1.80 PB 138 413

The following is a description of a mechanically operated camera in which glass photographic plates may be rapidly exposed and shifted to a light-tight storage chamber. The camera will hold fifty 2-1/4 by 3-1/4 plates and the entire load may be run through the camera in approximately one minute.

International Telemeter Corp., Los Angeles, Calif.
DISC PROCESSING. Technical rept. no. 19 on [Contract AF 30(602)1566] 12 Nov 57, 12p. RADC-TN-58-9; AD-148 542.
Order from LC mi$2.40, ph$3.30 PB 144 031

The disk, after exposure to the various films, will be located emulsion side down on the platen in the top of the film-to-disk camera. In the center hole of the disk is a plastic bushing, and the disk holder rests on the disk. A disk processing procedure is outlined which includes unloading of the camera, chemical processing, and washing. In this connection, it appeared most practical to keep the developer always at 70°F. A survey of imperfections in the films and disks indicated 2 types of imperfections with regard to nature and origin: dirt and electromechanical difficulties.

SOCIAL SCIENCES

Columbia U., New York.
LIST OF SAMPLE PARAMETERS OF QUANTITATIVE PROPERTIES OF LANDFORMS: THEIR USE IN DETERMINING THE SIZE OF GEOMORPHIC EXPERIMENTS, by Mark A. Melton. Technical rept. no. 16 on Contract N6onr-271, T. O. 30. 1958, 20p. 19 refs. AD-206 831.
Order from LC mi$2.40, ph$3.30 PB 144 147

Considerable time, money, and effort in conducting experiments of a statistical nature can be saved by planning the size of an experiment in accordance with chosen values for (1) the probability of incorrectly accepting or rejecting the null hypothesis, and (2) the minimum difference in population parameters to be detected. For student's tests and analyses of variance, estimates of population variances are necessary. Investigations into quantitative properties of landforms are made difficult by scarcity of such estimates. The list of sample parameters presented provides estimates of variance, means, and coefficients of variation for populations that were studied. Brief descriptions of the geologic and climatic environments from which each sample was drawn allow selection of the sample most nearly like the experimental material.

National Bureau of Standards, Washington, D. C.
DISTRIBUTION OF MAIL BY DESTINATION AT THE SAN FRANCISCO, LOS ANGELES AND BALTIMORE POST OFFICES, by Norman C. Severo and Arthur E. Newman. Dec 59, 55p. Technical note 27.
Order from OTS $1.50 PB 151 386

This report presents the results of the application of the sampling method presented in a paper by Norman C. Severo and Arthur E. Newman entitled "A statistical chain-ratio method for estimating relative volumes of mail to given destinations", to appear in NBS Journal of Research 64C, No. 1 (Jan.-Mar. 1960) These studies were made at the San Francisco, Los Angeles, and Baltimore Post Offices.

Princeton U., N. J.
ON THE MAGNIFICATION OF DERIVED DEMAND, by R. G. Davis and W. G. Mellon. Research memo. no. 4 on Econometric Research Program, Contract Nonr-1858(16). 12 Nov 58, 24p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 143 570

Stanford U., Calif.
WELFARE ECONOMICS AND EXISTENCE OF AN EQUILIBRIUM FOR A COMPETITIVE ECONOMY, by Takashi Negishi. Technical rept. no. 62 on Contract N6onr-25133. 9 Dec 58, 10p. 9 refs.
Order from LC mi$1.80, ph$1.80 PB 143 843

It is proven that a competitive equilibrium is the maximum of a social welfare function which is a linear combination of utility functions of consumers, with the weight in the combination being in inverse proportion to the marginal utility of income.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Jan 60.
Order from OTS $1.25, $10.00/year PB 161 277

Contents:
Articles:
A Co^{60} source for radiation chemistry research, by V. J. Linnenbom, C. H. Cheek, and J. M. Frame
Electron spin resonance line shape of diphenyl-picryl-hydrazyl dissolved in benzene, by J. I. Kaplan
Scientific Program:
Applications Research: Naval data handling system communication facilities
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Metallurgy and Ceramics: Effects of environment on the high-temperature properties of metals. The structure of $CbZn_3$. Determination of zirconium in columbium. Explosion test performance of small-scale submarine hull weldments. Notch toughness evaluations of modified HY-80 steel in heavy-gage plates. Effect of some composition variables on the performance of zinc anodes for cathodic protection in sea water
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Radio: Thermionic properties of uranium monocarbide cathodes
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Biology and Medicine

Radium and mesothorium poisoning and dosimetry and instrumentation techniques in applied radioactivity. Annual progress report, by Robley D. Evans. U. S. Atomic Energy Commission, Division of Biology and Medicine, Oak Ridge, Tenn. May 59. Contract AT(30-1)-952. 164p. Order from OTS. $3.00. AECU-4285

The development of chelating agents for enhancing the urinary excretion of strontium. Period covered: September 1, 1958 to September 1, 1959, by Harry Kroll and others. Montefiero Hospital, New York. Sep 59. Contract AT(30-1) 2094. 44p. Order from LC. Mi $3.30, ph $7.80. AECU-4322

The metabolism and toxicology of strontium-90 in the rat. Rationale, experimental procedures, pilot experiments, by L. W. Tuttle, R. C. Baxter, M. Goldman, and W. F. Bale. University of Rochester. Atomic Energy Project, Rochester, N. Y. Sep 59. Contract W-7401-eng-49. 28p. Order from OTS. $1.00. UR-424

Field studies of fission product inhalation. Part III: Fission product field release test series one (EPERT-I), by Robert G. Thomas and Robert H. Wilson. University of Rochester. Atomic Energy Project, Rochester, N. Y. Oct 59. Contract W-7401-eng-49. 145p. Order from OTS. $2.75. UR-555

Metabolism in the rat studied by isotope techniques. II. The body burden of mercury after single and multiple injections, by A. Rothstein and A. Hayes. University of Rochester. Atomic Energy Project, Rochester, N. Y. Oct 59. Contract W-7401-eng-49. 17p. Order from OTS. 50 cents. UR-556

Deposition of a radioactive aerosol in excised guinea pig lungs, by F. R. Gibb, Paul E. Morrow, and Lucien Dautrebande. University of Rochester. Atomic Energy Project, Rochester, N. Y.. Nov 59. Contract W-7401-eng-49. 18p. Order from OTS. 75 cents. UR-560

Proceedings of the second annual meeting on bioassay and analytical chemistry, November 3 and 4, 1958, by T. Kwasnoski and others. University of Rochester. Atomic Energy Project, Rochester, N. Y. Sep 59. 153p. Order from OTS. $3.00. WASH-1023

A review of potential radionuclides produced in weapons detonations, by Alfred W. Klement, Jr. U. S. Atomic Energy Commission, Division of Biology and Medicine, Washington, D. C. July 59. 111p. Order from OTS. $1.00. WASH-1024

Chemistry—General

Nuclear magnetic resonance spectra of nitrogen-1 in ruthenium nitrosyl complexes, by B. B. Murray. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Analytical Chemistry Division, Aiken, S. Car. June 59. Contract AT(07-2)-1. 8p. Order from OTS. 50 cents. DP-391

Determination of deuterium, oxygen, and nitrogen in helium by gas chromatography, by D. L. West. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Analytical Chemistry Division, Aiken, S. Car. Sep 59. Contract AT(07-2)-1. 8p. Order from OTS. 50 cents. DP-392

Power reactor fuels reprocessing progress report on corrosion studies, by R. F. Maness. Hanford Atomic Products Operation, Chemical Research and Development Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 61p. Order from OTS. $1.50. HW-61662

Analytical program for processing stainless steel uranium dioxide reactor fuel elements, by G. A. Huff. Phillips Petroleum Co. Atomic Energy Division, Idaho Falls, Idaho. Sep 59. Contract AT(10-1)-205. 20p. Order from OTS. 75 cents. IDO-14493

Quantitative gamma-ray spectrometric analysis of nuclide mixtures consecutive standard sources nullification, by D. G. Olson. Chemical Processing Plant. Operated by Phillips Petroleum Co. Atomic Energy Division, Idaho Falls, Idaho. Oct 59. Contract AT(10-1)-205. 23p. Order from OTS. 75 cents. IDO-14495

Observations on creep of tantalum, by G. Murphy and R. E. Uhrig. Iowa State University of Science and Technology. Ames, Laboratory, Ames, Iowa. Aug 59. Contract W-7405-eng-82. 29p. Order from OTS. $1.00. IS-26

A method of specimen corrosion protection for high temperature creep testing, by J. R. Bohn, R. E. Uhrig and G. Murphy. Iowa State University of Science and Technology. Ames Laboratory, Ames, Iowa. Oct 59. Contract W-7405-eng-82. 16p. Order from OTS. 50 cents. IS-48

Phase diagrams of nuclear reactor materials, by R. E. Thoma. Oak Ridge National Laboratory, Reactor Chemistry Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 206p. Order from OTS. $3.50. ORNL-2548

Thermodynamic estimate of the reaction of hydrogen with oxygen-bearing impurities in Salado salt at elevated temperatures, by W. D. Bond and W. E. Clark. Oak Ridge National Laboratory. Chemical Technology Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 24p. Order from OTS. 75 cents. ORNL-2600(Deleted)

The configurational relationship of 1, 2, 2-triphenylethylamine and 1, 2, 2-triphenylethanol, J. B. Christie. Oak Ridge National Laboratory. Chemistry Division, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 79p. Order from OTS. $2.25. ORNL-2786

Electrolytic disintegration of Zircaloy-2 in nitric acid solutions, by W. E. Clark and S. Peterson. Oak Ridge National Laboratory. Chemical Technology Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 18p. Order from OTS. 75 cents. ORNL-2824

Micro-electrophoretic determination of the zeta potential of thorium oxide, by C. M. Boyd, H. P. House and O. Menis. Oak Ridge National Laboratory. Analytical Chemistry Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 24p. Order from OTS. 75 cents. ORNL-2836

Hydroclimatology and surface hydrology of San Clemente Island, by J. B. Knox and H. Zodtner. University of California. Lawrence Radiation Laboratory, Livermore, Calif. Oct 59. Contract W-7405-eng-48. 22p. Order from OTS. 75 cents. UCRL-5709

Bio-organic chemistry quarterly report, March, April, May 1959, by G. Tollin, D. R. Kearns and others. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 59. Contract W-7405-eng-48. 80p. Order from OTS. $2.25. UCRL-8848

The crystal structures of several organic compounds, by F. J. Strieter. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 41p. Order from OTS. $1.50. UCRL-8906

The recovery of uranium from reduction residues by semicontinuous ion exchange, by N. J. Setter, J. M. Googin, and G. B. Marrow. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 21p. Order from OTS. 75 cents. Y-1257

Chemistry—Separation Processes for Plutonium and Uranium

Characterization of surfactants in aluminum-uranium fuel reprocessing solutions, by R. D. Cannon. Phillips Petroleum Co. Atomic Energy Division, Idaho Falls, Idaho. Oct 59. Contract AT(10-1)-205. 17p. Order from OTS. 75 cents. IDO-14489

Recovery of uranium and plutonium from sulfuric acid decladding solutions, by D. E. Horner and C. F. Coleman. Oak Ridge National Laboratory. Chemical Technology Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 46p. Order from OTS. $1.50. ORNL-2830

Controlled Thermonuclear Processes

Proceedings of symposium on magnetic field design in thermonuclear research held at Gatlinburg, Tennessee, December 11 and 12, 1958. Oak Ridge National Laboratory, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 90p. Order from OTS. $2.25. ORNL-2745

Cross sections for the dissociation of H_2^+ and D_2^+ by a vacuum carbon arc, by R. G. Alsmiller, Jr. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 19p. Order from OTS. 75 cents. ORNL-2766

Coherent radiation from a plasma, by E. G. Harris and A. Simon. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 11p. Order from OTS. 50 cents. ORNL-2803

Diffusion of plasma particles across a magnetic field, by A. Isihara and A. Simon. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 10p. Order from OTS 50 cents. ORNL-2826

Critical current for burnout in an OGRA-type device, by A. Simon. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 50p. Order from OTS. $1.50. ORNL-2831

Proceedings of a conference on the theoretical aspects of controlled fusion research held at Gatlinburg, Tennessee, April 27-28, 1959. Oak Ridge National Laboratory, Oak Ridge, Tenn. Nov 59. 22p. Order from OTS. $3.00 TID-7582

A theory on a homopolar device, by C. C. Chang and T. S. Lundgren. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 23p. Order from OTS. 75 cents. UCRL-8877

Criticality Studies

An empirical interpretation of annuli critical mass data, by C. L. Schuske and G. H. Bidinger. The Dow Chemical Co. Rocky Flats Plant, Technical Section, Denver, Colo. Oct 59. Contract AT (29-1)-1106. 25p. Order from OTS. 75 cents. RFP-149

Critical measurements on near-homogeneous BeO-moderated, oralloy-fueled systems, by F. A. Kloverstrom, R. M. R. Deck, and A. J. Reyenga. University of California Lawrence Radiation Laboratory, Livermore, Calif. July 59. Contract W-7405-eng-48. 14p. Order from OTS. 50 cents. UCRL-5369 Pt. 1

Geology and Mineralogy

Induced polarization. A study of its causes and magnitudes in geologic materials, by T. R. Madden and D. J. Marshall. Massachusetts Institute of Technology, Cambridge, Mass. June 59. Contract AT(05-1)-718. 71p. Order from OTS. Order from OTS. $2.25. RME-3160

Health and Safety

Fisson product release from uranium heated in air, by R. K. Hilliard. Hanford Atomic Products Operation, Chemical Effluents Technology, Chemical Research and Development Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 36p. Order from OTS. $1.25. HW-60689

Evaluation of fallout data, by A. A. Jarrett. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 16p. Order from OTS. 50 cents. NAA-SR-3972

Radiation accidents: Dosimetric aspects of neutron and gamma-ray exposures, by G. S. Hurst and R. H. Ritchie. Oak Ridge National Laboratory, Health Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 120p. Order from OTS. $2.75. ORNL-2748

Health Physics Division annual progress report for period enging July 31, 1959, by K. Z. Morgan. Oak Ridge National Laboratory, Oak Ridge Tenn. (nd). Contract W-7405-eng-26. 221p. Order from OTS. $3.50. ORNL-2806

Instruments

Development of remote metallographic equipment for the ANL Metallurgy Division, by S. H. Paine and F. L. Brown. Argonne National Laboratory, Metallurgy Division, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 29p. Order from OTS. $1.00. ANL-5364

A cladding thickness tester for zirconium over uranium, by A. P. Holt. E. I. du Pont de Nemours & Co. Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. Car. Sep 59. Contract AT(07-2)-1. 12p. Order from OTS. 50 cents. DP-408

An aural alpha-beta-gamma monitor, by W. G. Spear and G. D. Crouch. Hanford Atomic Products Operation. Instrument Research and Development, Physics and Instrument Research and Development Operation, Richland, Wash. May 59. Contract W-31-109-Eng-52. 22p. Order from OTS. 75 cents. HW-56128 REV

A stack effluent radioisotope monitor, by R. A. Harvey. Hanford Atomic Products Operation. Instrument Research and Development, Physics and Instruments Research and Development Operation, Richland, Wash. Oct 58. Contract W-31-109-Eng-52. 36p. Order from OTS. $1.25. HW-56151 REV

A null balance x-ray absorption instrument for chemical process monitoring, by B. E. Dozer. Hanford Atomic Products Operation. Chemical Research and Development Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 62p. Order from OTS. $1.75. HW-60898

Dose and flux measurements on Godiva radiation effects experiments, by P. S. Harris, E. F. Montoya, and W. H. Schweitzer. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Nov 59. Contract W-7405-ENG-26. 16p. Order from OTS. 75 cents. LA-2355

Instrumentation and controls division annual progress report for the period ending July 1, 1959, by C. J. Borkowski and C. S. Harrill. Oak Ridge National Laboratory, Oak Ridge, Tenn. 1959. Contract W-7405-eng-26. 160p. Order from OTS. $3.00. ORNL-2787

A magnetic core circuit for the reliable production of single pulses from contacts, by R. J. Klein. Oak Ridge National Laboratory. Instrumentation and Controls Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 47p. Order from OTS. $1.50. ORNL-2794

A versatile instrument camera with a microsecond electronic shutter, by C. H. Schalbe. Oak Ridge National Laboratory. Instrumentation and Controls Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 52p. Order from OTS. $1.50. ORNL-2804

Single-channel gamma ray spectrometer, model G-1, by J. R. Mann. The Dow Chemical Co. Rocky Flats Plant, Health Physics Department, Denver, Colo. Nov 59. Contract AT(29-1)-1106. 32p. Order from OTS. $1.00. RFP-162

Inflatable gasket for the 72-inch bubble chamber, by L. R. Lucas and H. P. Hernandez. University of California. Laboratory, Berkeley, Calif. July 59. Contract W-7405-eng-48. 50p. Order from OTS. $1.50. UCRL-8526Rev

Production leak rate detection systems, by H. S. Corey, III. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Nov 59. Contract W-7405-eng-26. 26p. Order from OTS. $1.00. Y-1275

Determination of metallic impurities in uranyl nitrate solutions by X-ray fluorescence, by R. E. Sladky. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Dec 59. Contract W-7405-eng-26. 25p. Order from OTS. 75 cents. Y-1276

Optimizing the ratio of time constant to radiation level for precision count-rate meters, by A. H. Fowler and R. A. McLean. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Dec 59. Contract W-7405-eng-26. 18p. Order from OTS. 75 cents. Y-1278

Metallurgy and Ceramics

Hanford experience in the nondestructive testing of nuclear process vessels and process piping, by R. B. Socky. Hanford Atomic Products Operation, General Electric Co., Richland, Wash. Oct 58. 68p. Order from OTS. $2.00. AECU-4274

Some aspects of the beta to alpha transformation in uranium: Metallographic structure and orientation relationships, by H. H. Chiswick and L. T. Lloyd. Argonne National Laboratory, Metallurgy Division, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 22p. Order from OTS. 75 cents. ANL-5777

Corrosion of aluminum-uranium alloys in high-temperature water, by W. E. Ruther and J. E. Draley. Argonne National Laboratory, Metallurgy Division, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 8p. Order from OTS. 50 cents. ANL-6053

Solubility limits of yttrium and the lanthanide rare-earth elements in chromium and chromium-iron alloys, by S. G. Epstein, A. A. Bauer, and R. F. Dickerson. Battelle Memorial Institute, Columbus, Ohio. Sep 59. Contract W-7405-eng-92. 16p. Order from OTS. 75 cents. BMI-1376

Progress relating to civilian application during August, 1959, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Sep 59 Contract W-7405-eng-92. 99p. Order from OTS. $2.50. BMI-1377

Progress relating to civilian application during September, 1959, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 95p. Order from OTS. $2.50. BMI-1381

A study of the effects of fabricating conditions on some properties of sintered uranium monocarbide, by A. B. Tripler, Jr., M. J. Snyder, and W. H. Duckworth. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 15p. Order from OTS. 75 cents. BMI-1383

The solid solubility and constitution of yttrium in iron-20 to 40 w/o chromium alloys, by M. S. Farkas and A. A. Bauer. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 22p. Order from OTS. 75 cents. BMI-1386

A visual study of the corrosion of defected Zircaloy-2-clad fuel specimens by hot water, by E. F. Stephan, P. D. Miller, and F. W. Fink. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405- eng-92. 31p. Order from OTS. $1.00. BMI-1387

Mechanical properties of uranium plate, by G. R. Caskey, Jr. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Lab., Aiken, S. Car. June 59. Contract AT(07-2)-1. 22p. Order from OTS. 75 cents. DP-376

Interim report on the hydrostatic destructive testing of Zircaloy-2 pressure tubing, by V. E. Kahle. Hanford Atomic Products Operation. Richland, Wash. Oct 59. Contract AT(45-1)-1350. 51p. Order from OTS. $1.50. HW-61272 REV

Corrosion of Inconel in 600°F static water, by G. E. Galonian and H. L. Tymchyn. General Electric Co. Knolls Atomic Power Lab., Schenectady, N. Y. May 59. Contract W-31-109-Eng-52. 25p. Order from OTS. 75 cents. KAPL-2047

Terminal status report for the processing refabrication experiment, by D. I. Sinizer, K. L. Mattern, E. G. Kendall and others. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 202p. Order from OTS. $3.50. NAA-SR-3269

Hot-pressure bonding of OMR fuel plates, by G. V. Alm, M. H. Binstock, and E. E. Garrett. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 61p. Order from OTS. $1.75. NAA-SR-3583

Casting development for uranium-molybdenum alloy shapes, by M. H. Binstock and J. A. Stanley. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 28p. Order from OTS. 75 cents. NAA-SR-4030

Fused silica for reactor applications. Progress report no. 1, project no. B-153 for November 14, 1958 to August 15, 1959, by J. D. Fleming and J. W. Johnson. Georgia Institute of Technology, Atlanta, Georgia. Nov 59. Contract AT-(40-1)-2483. 65p. Order from OTS. $1.75. ORO-209

Thoria-urania pellet preparation, by H. Shapiro and R. M. Powers. Sylvania-Corning Nuclear Corp., Bayside, Long Island, N. Y. Aug 59. Contract AT-30-GEN-366. 34p. Order from OTS. $1.00. SCNC-290

Recoil range of fission fragments in zirconium, by E. R. Smith and P. W. Frank. Westinghouse Electric Corp. Bettis Atomic Power Laboratory, Pittsburgh, Pa. Nov 59. Contract AT-11-1-GEN-14. 8p. Order from OTS. 50 cents. WAPD-TM-198

Cost of blending uranium of two different U^{235} isotopic enrichments. {Values of uranium from the "USAEC unclassified pricing list"). Union Carbide Nuclear Company. Division of Union Carbide Corp., Process Analysis Department, Y-12 Plant, Oak Ridge, Tenn. Dec 59. Contract 7405-eng-26. 270p. Order from OTS. $4.00. Y-1258

Physics and Mathematics

Flow through microporous media vapor transfer through barriers, by L. O. Rutz and K. Kammermeyer. State University of Iowa. Department of Chemical Engineering, Iowa City, Iowa. July 59. Contract AT(11-1)-237. 59p. Order from OTS. $1.75. AECU-4328

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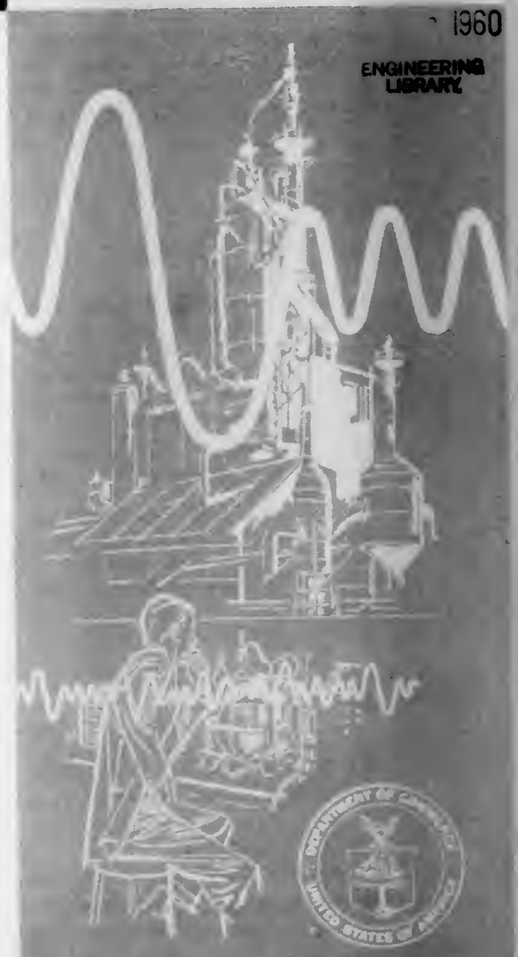

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BIBLIOGRAPHY

Edo Corp., College Point, N. Y.
BIBLIOGRAPHY OF REFERENCES RELATED TO HYDRO-SKI LOADS, by L. Kaplan. Rept. on Contract NOas 56-376-c. 16 Feb 59, 82p. 622 refs. Rept. no. 4438; AD-216 363.
Order from LC mi$4.80, ph$13.80 PB 144 303

The references listed are the result of a survey of hydro-ski literature, including reports on model, full scale and theoretical data. Since it was felt that some of the experience acquired in the development of hull seaplanes would be useful to the objectives of the subject contract, this bibliography contains a number of listings related to hull seaplane investigations.

ASTRONOMY

Astrophysics

Centro di Studio per la Fisica Delle Microonde (Italy).
ON THE VELOCITY OF METEORS DURING THEIR EVAPORATION, by F. Verniani. Technical note no. 1 on Contract AF 61(052)227. June 59, 9p. 5 refs. AFCRC-TN-59-575.
Order from LC mi$1.80, ph$1.80 PB 143 976

From Herlofson's equations for meteoric evaporation, it is deduced that part of the meteors cannot evaporate completely, owing to their excessive loss in speed; moreover, it is shown that the flight of all meteors is considerably retarded during the entire process of evaporation.

Flower [Astronomical] Observatory [Philadelphia] Pa.
W URSAE MAJORIS SYSTEMS, by L. Binnendijk. Final rept. on Contract Nonr-2320(00). [1958] 9p.
Order from LC mi$1.80, ph$1.80 PB 143 715

Princeton U., N. J.
ON THE MECHANISMS OF METEORIC ABLATION, by Sin-I Cheng. Rept. on Contract AF 18(600)498. Apr 58, 37p. 14 refs. Rept. no. 427; AFOSR-TN-58-649; AD-162 181.
Order from LC mi$3.00, ph$6.30 PB 144 042

The deceleration of the meteor and the presence of a molten layer over the meteoric body results in an unstable liquid-gas interface that leads to the direct loss of mass as liquid droplets flying away from the meteoric surface. The feasibility of this mechanism is analytically shown and demonstrated with typical examples. By incorporating the present mechanism, the irregularity of the meteoric luminosity when compared with the calculated results of Opik's theory may be qualitatively explained and the occasional burst or flare of some meteors may be visualized. Several other observations of the meteoric phenomena also tend to verify the plausibleness of the proposed mechanism. (Portions of this report are illegible)

University of Southern California. Engineering Center, Los Angeles.
PRODUCTION OF CARBON IN THE UPPER ATMOSPHERE, by K. P. Chopra. Technical note on Contract AF 18(603)95, 31 July 59, 11p. 10 refs. USCEC rept. 56-208; AFOSR-TN-59-902.
Order from LC mi$2.40, ph$3.30 PB 144 474

This technical note describes a process by which penetrating cosmic rays may produce atomic carbon in the upper atmosphere. High energy cosmic ray particles bombard the atoms and molecules of the upper atmosphere and release neutrons along with other products of disintegration. Some of these neutrons escape outwards and undergo a natural free decay. Some others may collide with nitrogen atoms and produce atomic carbon with the release of a proton. These carbon atoms are radio-active and decay back into atomic nitrogen with the release of a high energy electron. But the fairly long lifetime (5569 years) ensures a copious supply of carbon atoms in the upper atmosphere. The other products of this process, viz. protons and electrons, may get trapped in the earth's magnetic field, and hence contribute to the formation of the inner radiation belt.

BEHAVIORAL SCIENCES

Human Engineering

Educational Research Corp. [Cambridge, Mass.]
A SET OF DISCRIMINABLE SURFACE COLORS ANI SYMBOLS FOR CODING IN ANIMATED TRAINING PANELS, by Milton W. Horowitz and Robert Fromer. Rept. on Contract N61339-294. 5 May 59, 22p. 4 refs. Technical rept. NAVTRADEVCEN 20-OS-52.
Order from LC mi$2.70, ph$4.80 PB 143 821

This study, developed a simple reliable experiment to measure color discriminability, and also identified 15 colors and 10 symbols each of which is easily differentiated from the others. While alternate sets of colors might be found which are also highly discriminable, the 15 present colors should prove extremely useful to the equipment designer.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
A COMPARISON OF ONE-, TWO-, AND THREE-MAN CONTROL UNITS UNDER VARIOUS CONDITIONS OF TRAFFIC INPUT RATE, by J. S. Kidd. Rept. on Contract AF 33(616)3612. June 59, 22p. 20 refs. WADC Technical rept. 59-104; AD-225 965.
Order from OTS $0.75 PB 161 045

The performance of various sized pattern-feeder approach control teams was compared under three conditions of input load in a simulated air traffic control situation. Conditions in which either one, two, or three men operated the system were compared. Input loads were 90 sec, 60 sec, or 30 sec average interval between aircraft arrivals. Nine laboratory-trained controllers participated in a total of 54 problems. Results indicated a consistent decrement in performance as a function of increased input load. Crew augmentation led to only moderate facilitation of performance when the input load to the system was held constant and the number of controllers was increased. When input load was increased proportionately to the size of the control unit, there was a marked decline in system performance. It was concluded that simple crew augmentation imposes coordination demands that interfere with primary task activities. Maximum autonomy of system operators was recommended.

Personnel and Training

Harvard Graduate School of Education, Cambridge, Mass.
POSITION CHOICES AND CAREERS: ELEMENTS OF A THEORY, by David V. Tiedeman, Robert P. O'Hara (Boston Coll.) and Esther Matthews (Newton High School). Rept. no. 8 on Harvard Studies in Career Development, Technical rept. no. 4 on Contract Nonr-1866(31). 12 Dec 58, 53p. 61 refs. AD-217 191.
Order from LC mi$3.60, ph$9.30 PB 144 464

An attempt is made to organize, in a preliminary manner, previous writing in the field of vocational psychology relating to perceptions of self and of work as variables intervening between prior circumstances and career decisions.

Human Resources Research Office, George Washington U., Washington, D. C.
SOME PROBLEMS IN THE ANALYSIS OF TROUBLE SHOOTING BEHAVIOR, by Paul G. Whitmore (Army Air Defense Human Research Unit) Research rept. 2 on Contract DA 49-106-qm-1. Oct 59, 27p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 144 234

Data from three previous HumRRO studies (RADAR IV, RADAR VI, and ACHILLES) were pooled and analyzed to identify problems of maintenance and maintenance training. The data consisted of (1) observations of maintenance activities made during the administration of job-sample proficiency tests to M33 and NIKE AJAX fire control system maintenance technicians, and (2) responses to multiple-choice items on a written test given to NIKE AJAX fire control system maintenance technicians. The set of coded categories used in recording activities did not meet the requirements for describing the technician's trouble shooting procedures; consequently, the technician's knowledges and skills could not be clearly inferred. It was not possible to isolate "knowledge" classes for the written test items related to over-all proficiency. The generalization of modifications introduced into the M33 FCS experimental training programs to NIKE AJAX IFC training was supported at a very gross level of analysis.

Human Resources Research Office, George Washington U., Washington, D. C.
WHAT HumRRO IS DOING, JANUARY 1956-JUNE 1957. Dec 57, 56p. 19 refs. Research Bulletin 4; AD-158 174.
Order from LC mi$3.60, ph$9.30 PB 138 229

Psychology

Army Medical Research Lab., Fort Knox, Ky.
PERCEPTION OF RELATIVE FREQUENCY AS A FUNCTION OF THE NUMBER OF STIMULUS AND RESPONSE CATEGORIES, by R. A. Gardner, J. B. Forsythe and others. Rept. on Psychophysiological Studies. 7 Apr 58, 18p. 7 refs. Rept. no. 328.
Order from LC mi$2.40, ph$3.30 PB 144 221

A prediction response was used to study the perception of relative frequencies of serially presented stimulus-events when the only predictable property was relative frequency. The number of stimulus-event categories was varied from two to eight. Each stimulus-event category was associated with a different response category. The relative frequency of the response to the most frequently presented category was a function of the number of categories. Asymptotic response levels were reached, if at all, only very late in the series of 420 trials. For the last 140 trials all groups with more than three categories were responding at frequencies significantly different from those of the presented stimulus-event categories.

[Behavior Research Lab., Washington U., St. Louis, Mo.]
THE EFFECT OF ELECTROCONVULSIVE SHOCK ON MALE ALBINO RATS WITH EXPERIMENTALLY INDUCED SENSORY DEFICITS, by John A. Stern and David McDonald. Progress rept. on Contract Nonr-816(06). 31 Dec 58, 17p. 41 refs.
Order from LC mi$2.40, ph$3.30 PB 144 182

The major hypothesis of this experiment is that if ECS animals are more reactive to environmental stimuli, then if one makes them blind, deaf, or anosmic, they will behave more like normal controls. The experimental design constitutes, in the opinion of the author, a clear-cut test of this hypothesis.

Bureau of Applied Social Research, Columbia U., New York.
GROUP AND INDIVIDUAL PERFORMANCE IN PROBLEM SOLVING RELATED TO PREVIOUS EXPOSURE TO PROBLEM, LEVEL OF ASPIRATION, AND GROUP SIZE, by Irving Lorge and Herbert Solomon. Technical rept. no. 3 on Contract Nonr-266(43). 15 Dec 58, 32p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 144 179

The experiment reported here was designed to test the hypothesis that previous exposure with the problem would significantly affect the proportion of individual solutions and, hence, the proportion of group solutions. Perhaps the variance of proportions of group solutions developed in this paper under the assumption that the ability model is operating may be helpful in choosing among several explanations of group performance.

Institute of Educational Research, Indiana U., Bloomington.
A CATALOG OF TROUBLE SHOOTING TESTS (SURVEY OF TESTS DEVELOPED TO DECEMBER 1956) by Nicholas A. Fattu. Research rept. no. 1 on Contract Nonr-908(07). Dec 56. 136p. 148 refs. AD-153 754.
Order from LC mi$6.90, ph$21.30 PB 144 377

The trouble-shooting tests include (1) on-the-job measures, (2) performance tests, (3) mockup or simulator tests, (4) automatic recording of checks (ARC) or tab-type tests, and (5) pencil-paper and oral-interview tests. The first section considers the measures that were taken on the job under normal operating conditions. Those measures differ from the trouble-shooting performance tests in that the latter structure and control both the tasks and the situations in which they occur. The simulator tests tend to have the same kinds of tasks as those used in the performance tests. The ARC type tests attempt to translate some of the features of the simulator tests into pencil-paper form. The examples of the trouble-shooting tests were located mainly in bibliographic sources and publications by the Department of Defense.

Institute of Psychiatry, Maudsley Hospital, London (Gt. Brit.)
RATE OF TEMPORAL AND SPATIAL INHIBITION IN HYSTERIA AND BRAIN DAMAGE IN NORMAL, NEUROTIC AND BRAIN-DAMAGE SUBJECTS. Final technical rept. for 1 May 58-30 Apr 59 on Contract DA 91-508-EUC-311. [1959] 35p. 36 refs.
Order from LC mi$3.00, ph$6.30 PB 143 837

Section 1. Introduction; Section 2. Selection and description of subjects; Section 3, A detailed consideration of the tasks used.

Laboratory for Research in Social Relations, U. of Minnesota, Minneapolis.
THE EFFECT OF STATUS ON ABILITY TO INFLUENCE GROUP SOLUTIONS OF PROBLEMS, by Henry W. Riecken. Technical rept. no. 1 on Research Studies on the Relation Between Cognition and Behavior, Contract N8onr-662(16). Jan 58, 16p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 138 292

An experiment in which 32 four-man groups discussed "human relations problems" provided an opportunity to test a finding of Bales and others that the discussant who talked the most contributed most to the solution of the problem. By providing a hint about a uniquely good, insight solution to one problem, and by differentially locating that hint in the hands of either the highest or the lowest talker in the group, an opportunity was afforded to assess both the perceived and the actual contribution of the "top man" compared to the "bottom man." The results show that top men are almost uniformly perceived as contributing more, and that they are in fact more influential in getting the "elegant solution" (contained in the hint) accepted by the group. Further data suggest that the differential ability of top men to exert influence is related more to their ability to win attention and support from the group than it is to their ability to reduce opposition. Personal characteristics of top men that may lead to their achieving that position are only suggested by our data, but there is some reason to believe that clarity and fluency of expression are important factors, but that measured intelligence is not.

[Laboratory for Research in Social Relations] U. of Minnesota, Minneapolis.
RESEARCH ON COHESIVE AND DISRUPTIVE TENDENCIES IN COALITION TYPE GROUPS, by Ben Willerman. Final technical rept. on Contract N8onr-662(16). 1957, 7p. 6 refs.
Order from LC mi$1.80, ph$1.80 PB 138 288

This final report is a summary of some aspects of cohesive and disruptive tendencies in coalition-type groups which have emerged from our research. The conclusions of studies of individual attraction to group activity relative to individual activity are presented. Some by-products of the research are briefly described.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE EFFECT OF TEAM SIZE AND INTERMEMBER COMMUNICATION ON DECISION-MAKING PERFORMANCE, by Robert G. Kinkade and J. S. Kidd. Rept. on Contract AF 33(616)3612. Apr 59, 16p. 10 refs. WADC Technical rept. 58-474.
Order from OTS $0.50 PB 151 967

The performance of single individuals, two-man teams without intercommunication, and two-man teams with intercommunication was compared in a complex decision-making task. The task was an operational "game" derived from radar approach control. Forty-eight students participated. The experimental design utilized a subject x conditions balanced Latin square having six independent replications. Two-man team performance was superior to that of single individuals, but not proportionately so. Interpretation of the data in terms of productivity per person showed the person working alone to be significantly superior to the person working in a two-man team. Teams with communication were slightly superior to teams having no communication. The explanation of the results of the individual vs. individuals in a team comparison is hypothesized to lie in the diversion of time and productive capacity in the team situation away from the prime task and into integrative and coordinative behavior.

Princeton U., N. J.
THE ROLE OF THREE PROCESSES IN DETERMINING RESPONSES TO INTERPERSONAL DISAGREEMENT, by Harold M. Schroder and David E. Hunt (Yale U.). Technical rept. no. 5 on Contract Nonr-[1858(12)] and Public Health Grant M-955. Jan 59, 127p. 52 refs.
Order from LC mi$6.30, ph$19.80 PB 144 273

The present report will propose three conceptual processes as units for mediating dispositional and situational effects. The general characteristics of a process will be described in Section II. Although our major consideration in developing these processes was the coordination of dispositional and situational factors, we also believe that such processes should be congruent with developmental determinants. Therefore in addition to describing the specific processes in Section III, we will also discuss the relationship of each process to a specific set of child-rearing antecedent conditions. The remaining sections are then given over to several studies aimed at evaluating the construct validity of the viewpoint.

School of Aviation Medicine, Brooks AFB, Tex.
FACT AND FANCY IN SENSORY DEPRIVATION STUDIES, by Jerrold L. Wheaton. Aug 59, 62p. 211 refs. Aeromedical Review no. 5-59.
Order from LC mi$3.90, ph$10.80 PB 144 225

This discussion is not intended to be exhaustive, and more detailed information can be obtained from the cited references (202, 203, 206, 208). The broader issues, in which the problem has been studied, are outlined in chapter III, entitled "The Nature of Isolation." Chapters IV and V consist of summaries of published reports, first, of the autobiographic, anecdotal, and clinical literature, and then, of the experimental literature. The final chapters consist of a summary of the present knowledge of isolation effects on human behavior and a discussion of probable military implications.

Yale U., New Haven, Conn.
AN EXPLORATION OF THE INTERRELATIONS AMONG SOME NON-INTELLECTUAL PREDICTORS OF ACHIEVEMENT IN PROBLEM SOLVING, by Paul C. Berry. Technical rept. no. 4 on Contract Nonr-609(20). Dec 58, 50p. 19 refs. AD-218 598.
Order from LC mi$3.30, ph$7.80 PB 143 856

In considering the interrelations among non-intellectual variables and achievement in problem solving, particularly the sex role, the following hypotheses were tested: (1) compared to women, men are more favorable in attitude toward analytic thinking, less likely to conform, less field dependent, less anxious, and more masculine; (2) each of these nonintellectual variables is correlated with achievement in problem solving among men and women; (3) each of these correlations between a nonintellectual variable and problem solving remains significant even though the effects of mathematical and verbal aptitudes are partialled out; (4) whatever variance these non-intellectual variables have in common with problem solving but not in common with verbal and mathematical aptitude, they have in common with each other; (5) the concept of sex role may be used to account for the variance which is common to problem solving and to these other non-intellectual variables, but not to verbal and mathematical aptitude; and (6) to significant sex differences in problem solving remain when the effects of differences in sex-role identification are controlled. Analysis of data from 20 problems together with 8 different tests administered to 55 men and 49 women confirmed the first, second and sixth hypotheses (except with respect to tendency to conform), rejected the fourth and fifth hypothesis, and gave partial confirmation to the third.

BIOLOGICAL SCIENCES

Detroit Arsenal, Center Line, Mich.
AN INVESTIGATION OF THE PAPER CHROMATOGRAPHY TECHNIQUE FOR DETERMINING THE UTILIZATION OF SACCHARIDES BY FUNGI, by C. Bruce Lee. 1 May 58, 54p. 9 refs. Rept. no. 4135 (Final).
Order from LC mi$3.60, ph$9.30 PB 143 912

Object was to determine the applicability of paper chromatography as a research technique in the utilization of certain saccharides by selected species of fungi. Investigations were conducted on representative examples of monosaccharides, disaccharides and trisaccharides. Estimations of fungus utilization of saccharides were accomplished by changes in the rf values of the saccharides on filter paper strips compared with rf values of the saccharides with the standards also on filter paper strips. Conclusions regarding saccharide utilization were derived using standardized solvents, developing agents and standard testing conditions and

equipment. Paper chromatography techniques revealed that many of the more complex saccharides were altered by exposure to fungus action.

Maryland U., College Park.
STUDIES ON PARASITIC ACARINA AT NAMRU NO. 3, by G. W. Wharton and Conrad E. Yunker. Final rept. for 1 Sep 55-31 Dec 57 on Contract Nonr-1809(00). 31 Dec 57, 3p. 7 refs. AD-150 762.
Order from LC mi$1.80, ph$1.80 PB 138 203

Descriptions were found in the literature for over 350 species of parasitic mites of Egypt. Over 700 collections of parasites from hosts in various Egyptian localities were obtained. Nine cultures of endemic laelapid and dermanyssid mites were initiated and successfully maintained in the laboratory. The natural host of Ophionyssus natricis was found. An investigation of the nasal mites of Egyptian amphibians showed that over 95% of the toads were infected. Over 800 specimens of East African animals were examined. Among the parasitic mites which were collected were chiggers in the nasal cavities of a number of genera of rodents, and a new genus and species of ewingid mite from pagurid crabs. On the basis of material collected in East Africa, the sequence of infection and pathological picture of knemidokoptic mange in parakeets was determined. Results of an ecological study of rodent-mite population in the deserts and semidesert areas near Cairo indicated that: (1) the great daily extremes of the general climate are not reflected in the climate of the burrows, this microclimate being vastly more stable and essentially different than that of the exterior: (2) the burrow and host represent the entire effective environment of the mite populations, while the ticks are subject to the excesses of the external environment as well; (3) no seasonal variations in mite populations, which could be separated from the influence of other factors, could be demonstrated, while the ticks exhibit a definite seasonal variation reflecting the influence of the environment external to the burrows; (4) the host is probably the most important environmental factor in the abundance and distribution of mite populations; (5) area (desert of semidesert) plays a determining role in the variability of these populations.

Pittsburgh U., Pa.
BIOPHYSICAL INVESTIGATIONS ON BACTERIOPHAGES, by Irwin J. Bendet and Max A. Lauffer. Technical rept. no. 6, 1 Jan-31 Dec 58, on Contract Nonr-624(03). [1958] 4p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 144 259

During the past year this laboratory has continued to work on the following problems: (1) explanation of the dual sedimentation phenomenon manifested by T2 bacteriophage; (2) determination of the hydration of Escherichia coli, Southern bean mosaic virus, and a few other representative viruses. (See also PB 138 645)

Anatomy and Physiology

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SUSTAINED OPERANT BEHAVIOR IN MICE; A MODEL FOR BEHAVORIAL RESEARCH IN BIOSATELLITES, by Frederick H. Rohles, Jr. and Marvin E. Grunzke. Rept. on Human Performance in Advanced Systems; figures drawn by U. of Dayton on Contract AF 33(616)6264. Aug 59, 14p. 3 refs. WADC Technical note 59-299.
Order from OTS $0.50 PB 161 298

A male C-57 BL mouse was trained to respond on a fixed-ratio-100 operant reinforcement schedule for 20 minutes out of every 6 hours. The subject was isolated and performed on this schedule for food reward for 96 hours. The feeder in the operant chamber was disconnected and performance was observed under extinction conditions without food for an additional 96 hours. The results of the study showed that the response rate during the 96-hour reinforced session was high and consistent from work period to work period. Meaningful performance data were also obtained under extinction conditions. The study illustrates a potential method of obtaining meaningful behavioral information from animals in orbital flight.

Army Chemical Warfare Labs., Army Chemical Center, Md.
CONFERENCE ON ENVIRONMENTAL PHYSIOLOGY 10 AND 11 APRIL 1958, by F. N. Craig. Oct 58, 29p. CWL Special Pub. 2-11; AD-219 200.
Order from LC mi$2.70, ph$4.80 PB 138 259

Author abstracts of papers presented at the conference.

Army Medical Research Lab., Fort Knox, Ky.
DERIVATION OF 'SUBJECTIVE VELOCITY' FROM ANGULAR-DISPLACEMENT ESTIMATES MADE DURING PROLONGED ANGULAR ACCELERATIONS: ADAPTATION EFFECTS, by S. J. Ceran and F. E. Guedry, Jr. Rept. on Psychophysiological Studies. 20 Feb 59, 24p. 20 refs. Rept. no. 376.
Order from LC mi$2.70, ph$4.80 PB 144 222

Subjective estimates of angular displacement of a target light fixed with respect to the observer were made during prolonged constant angular acceleration of the entire body in a dark room. These estimates provided an indication of subjective velocity throughout the course of the vestibular reaction. Results obtained from 10 subjects indicated that subjective velocity rises and then declines during the course of a constant angular acceleration. Within the range of stimuli applied (0.5 deg/sec^2 to 2.0 deg/sec^2) 'rise' time to maximum subjective velocity appears constant regardless of stimulus magnitude. The maximum attained and the rate of change of subjective velocity up to this maximum are directly related to the magnitude of the angular acceleration. However, after about thirty seconds of constant angular acceleration, the subjective velocity declines even though the angular acceleration remains constant. Implications of

certain characteristics of the results for the torsion pendulum theory are discussed.

Army Medical Research Lab., Fort Knox, Ky.
EFFECT OF CHANGES IN RENAL BLOOD FLOW RATE AND VASCULAR INTRALUMINAL PRESSURE UPON RENAL VASCULAR RESISTANCE, URINE AND LYMPH FLOW RATES, by F. Haddy, J. Scott and others. 27 Jan 58, 74p. 24 refs. Rept. no. 323; AD-151 369.
Order from LC mi$4.50, ph$12.30 PB 138 333

Renal artery pressure change above 80 mm Hg results in active change in vessel geometry due to a direct effect of variation in transmural pressure upon vascular smooth muscle. Vein pressure change is followed by active vasomotion invoked reflexly over nonlocal sympathetic nerves and passive vasomotion induced by variation in transmural pressure dependent upon stromal rigidity. The peculiar changes in urine flow and glomerular filtration rates which follow variation of veni and artery pressures likely are related to these resistance controlling mechanisms.

Hofstra Coll., Hempstead, N. Y.
AUDITORY PAIN THRESHOLDS FOR INTERMITTENT, "BEAT", AND STEADY TONES, by Robert Plutchik. Rept. on Contract Nonr-2252(01). Dec 58, 31p. 21 refs.
Order from LC mi$3.00, ph$6.30 PB 143 926

The major findings were as follows: (1) Individual pain thresholds varied from about 100 db to over 130 db. Unpleasantness thresholds averaged about 8 to 10 db below pain thresholds. This difference turns out to be the same as that required for a half-loudness judgement as reported in the literature. (2) The 2500 cps tone, irrespective of whether it is presented as a series of pulses, a series of beats, or as a steady tone, is reacted to as "unpleasant" or as "painful" at a slightly, but consistently lower intensity level than the corresponding 1000 cps tone. (3) At each frequency used, intermittent tones are judged as "unpleasant" or "painful" at lower intensity levels than steady tones. The differences are slight but consistent. (4) Repetition rates of 3 pulses or beats per second are fairly consistently found to have a lower unpleasantness and pain threshold than either 6 or 15 per second. Each of these findings was found to be consistent with various reports in the literature.

Institut für Animalische Physiologie der J. W. Goethe Universität (West Germany).
INVESTIGATIONS ON THE FLOW OF BLOOD IN CAPILLARIES, by Rudolf K. Zahn. Final technical status rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-921. [1959] 22p. 20 refs.
Order from LC mi$2.70, ph$4.80 PB 144 253

A method for simultaneous recordings of (1) heart rate, (2) ECG amplitude, (3) speed of blood flow and (4) haematocrit has been developed for the tranquilised frog. Different tranquilisation pharmaca have been investigated. MS 222 and Curarine proved to be of limited value, whereas Succinylic choline seems to be by far the best. The better the oxygen supply the shorter the tranquillisation time. There is a slow steady drop with time in heart rate and ECG amplitude, in tranquilised animals. No direct dependance of capillary flow on temperature change and/or heart action could be established. Ultra violet (UV) irradiation of small areas of the swimming skin does not influence heart action.

International Research Associates, New York.
EXPECTATIONS AND PERCEPTIONS WITH RESPECT TO THE MARINE CORPS RESERVE (GROUND). Technical rept. no. 7 on Training Problems on the Marine Corps Reserve, Contract Nonr-1654(00). July 57, 23p. AD-135 458.
Order from LC mi$2.70, ph$4.80 PB 138 233

An inquiry is made into the reservists' motivations to participate in the Marine Corps Reserve. A questionnaire was administered to 1048 reservists in the metropolitan New York area divided into a low-ranking group of privates, privates-first class, and corporals, and a high-ranking group of the higher noncommissioned officers and commissioned officers. The respondents were given a list of 22 positive and negative qualities which they were to attribute to the Army, Navy, Air Force, and Marine Corps as they believed applicable. The term "undemocratic" was applied very few times to any of the reserves. The Marine Corps Reserve was credited with each of the positive attributes more often than the other reserves except that "modern" was applied more often to the Air Force Reserve. The dominant distinguishing elements of the Marine Corps Reserve image were "tough discipline" "makes a man out of you"; and "very traditional." The negative attributes which distinguish the other Reserves from the Marine Reserve are that the others "don't know how to wear uniforms"; "have no discipline"; and "for just ordinary guys." "Good military training" was attributed most often to the Marines and "very democratic" least. Of the 10 attributes most frequently applied to the Air Force Reserve, 5 were positive. The Navy Reserve is the second most favored; 7 out of the 10 attributes most frequently applied were positive. The Army is at the lowest end of the spectrum of esteem; 9 of the 10 attributes most frequently applied were negative. The one positive attribute was "patriotic." The criticisms recorded for the Marine Corps Reserve were chiefly lax discipline, poor work organization, and low caliber of reserve training. None of the reservists were so dissatisfied that they would drop out.

Iowa State U., Iowa City.
PULMONARY BLOOD VOLUME AND CIRCULATORY ALTERATIONS IN DOGS EXPOSED TO COMPENSATED HIGH INTRAPULMONARY PRESSURES, by Jack Williams and Steven M. Horvath. Rept. on High Altitude Physiology, Contract AF 33(616)5173. Apr 59, 18p. 34 refs. WADC Technical rept. 58-471; AD-215 622.
Order from OTS $0.50 PB 151 966

Dogs were placed in full pressure suits and helmets and exposed to pressures from 4 to 230 mm. Hg for periods ranging from 2 to 300 minutes. The measured cardiovascular alterations increased with prolonged exposure times. Pulmonary blood volume increased while the animal was breathing 100% oxygen at 4 to 8 mm. Hg pressure. The pulmonary blood volume began to decrease at a pressure of 140 mm. Hg. All increased pressures caused a decreased cardiac index and increased systemic resistance. The pressure suit used in these studies does not offer complete and prolonged protection to the animal exposed to compensated high breathing pressures.

Minnesota U., Minneapolis.
A DISCRIMINANT ANALYSIS OF THE APTITUDES AND INTERESTS OF ENLISTED MEN IN ELEVEN NAVAL AVIATION GROUPS, by Diane R. Albitz. Technical rept. no. 9 on Contract Nonr-710(17). Dec 58, 103p. 60 refs.
Order from LC mi$5.70, ph$16.80 PB 144 480

The present study carried out a complete discriminant analysis of the aptitudes and interests of enlisted men in eleven Naval aviation groups. Three questions were considered: 1) what are the distances that separate any two of the groups under study; 2) what are the directions in which these groups differ; and 3) can an individual known to be a member of one of these groups be assigned to that group. Thus, both the problem of testing significance and the problem of estimation were investigated. The results of this study indicate the usefulness of including measured interests with aptitude test scores in a discriminant analysis of occupational groups. The contribution of the interest scales in the linear discriminant scores used for classifying individuals into their group of cluster of membership provides evidence of the predictive validity of measured interests. Increased confidence in the utility of interest scales has been generated by the evidence this study presents for their predictive validity.

Quartermaster Research and Engineering Center, Natick, Mass.
SOUTHWEST ASIA: ENVIRONMENT AND ITS RELATIONSHIP TO MILITARY ACTIVITIES, by Austin Henschel. July 59, 85p. 9 refs. Technical rept. EP-118.
Order from LC mi$4.80, ph$13.80 PB 144 176

The environment of Southwest Asia, relationships between the environment and the soldier, and relationships between the environment and materiel are shown on maps and graphs. Most of the military problems of the region are caused by excessive heat and aridity, although the combination of heat and high humidity near the Persian Gulf and the Red Sea cause extreme discomfort at times in these particular areas. In much of the region, summer heat causes impairment of man's ability to work and increases his water requirements. The environment also causes storage and operating difficulties.

School of Aviation Medicine, Brooks AFB, Tex.
HUMAN EXPERIMENTATION IN THE SPACE CABIN SIMULATOR. DEVELOPMENT OF LIFE SUPPORT SYSTEMS AND RESULTS OF INITIAL SEVEN-DAY FLIGHTS, by George R. Steinkamp, Willard R. Hawkins and others. Aug 59, 89p. 5 refs. Rept. 59-101.
Order from LC mi$4.80, ph$13.80 PB 144 171

The evolvement of the simulator, as currently used, is described. The protocol of the design of the experiments is discussed, and pretesting and posttesting methods are presented. Results of a study of five subjects committed to 7-day periods in this small cabin and on a 4:4 work-rest schedule are shown and discussed from the standpoint of the physical, physiologic, psychophysiologic, and nutritional implications.

Tufts [U.] Medford, Mass.
A CHEMICAL AND PHYSIOLOGICAL STUDY OF THE GROWTH HORMONE OF THE ANTERIOR PITUITARY, by E. B. Astwood and M. S. Raben. Final rept for 1 May 52-31 July 58 on Contracts Nonr 789(00) and 1292(00). 22 Dec 58, 5p. 22 refs.
Order from LC mi$1.80, ph$1.80 PB 144 178

In summary, it might be stated that the work carried out on Growth Hormone under this contract has materially extended our knowledge of this important subject and has set the stage for extensive work, now being actively pursued in many laboratories, on the effects of growth hormone in man, work which heretofore was impossible and only now made feasible by the recognition of species differences, and by the availability of methods for the preparation of the primate hormone.

Biochemistry

Army Medical Research Lab., Fort Knox, Ky.
BLOOD COAGULATION: A CONCEPT OF THROMBIN FORMATION, by H. Jensen. Rept. on Environmental Physiology, Proj. 6-64-12-028. 22 Dec 58, 35p. 65 refs. Rept. no. 370.
Order from LC mi$3.00, ph$6.30 PB 144 032

A review of experimental data supports the concept of a four-stage mechanism of thrombin formation. The first stage involves the formation of a prothrombin activator from various precursory factors either by means of an intrinsic or an extrinsic mechanism or possibly by both. The second stage is the conversion of prothrombin to thrombin by the prothrombin activator in the presence of calcium ions. This represents the slow phase of thrombin elaboration. The third stage consists of the conversion of plasma accelerator-globulin by thrombin to the more active serum accelerator-globulin. The fourth stage of thrombin elaboration involves acceleration of prothrombin conversion by the prothrombin activator in the presence of serum accelerator-globulin and calcium ions; this represents the fast phase of thrombin elaboration. It is assumed that the final prothrombin-converting complex, thrombokinase, consists of a prothrombin activator and serum accelerator-globulin.

Columbia U., New York.
IMMUNOCHEMICAL CRITERIA OF PURITY OF PROTEINS AND POLYSACCHARIDES, by Elvin A. Kabat and Peter Z. Allen. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-266(13).

5 Jan 59, 4p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 144 258

(See also PB 124 619)

Edinburgh U. (Gt. Brit.)
POST-OPERATIVE METABOLIC RESPONSE. Final technical rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-920. [1959] 11p.
Order from LC mi$2.40, ph$3.30 PB 144 252

Animal experiments have been with the object of determining how far the changes in nitrogen, sodium and potassium excretion classically associated with injury are due to (a) purely local changes consisting of cell damage and/or presence of extravasated blood, (b) more general metabolic changes initiated by local damage. The picture emerging suggests that some of the sodium and potassium lost after trauma comes from extravasated blood, some comes from other tissues, and that oligaemia is an important factor. Continued work in human subjects suggests that the major metabolic changes following trauma can occur without alteration in the secretion of adrenal hormones, which are merely permissive. Further light on the movements of water (and electrolytes) after trauma will be given by studies of the excretion of "free" water. Preliminary survey work for this is now almost completed. As a by-product important observations have been made on the water, bicarbonate, sodium and potassium excretion in hyperparathyroidism and after administration of parathyroid hormone. Further work in this field may be expected to help in clarifying the mechanism of the parathyroid hormones.

New York Psychiatric Inst.
METABOLISM OF GLUTATHIONE, GLUTAMINE, AND ASPARAGINE, by Heinrich Waelsch. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-369(00). 24 Dec 58, 4p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 144 232

(See also PB 125 642)

Oklahoma State U., Stillwater.
KINETICS AND MECHANISM OF HYDROLYSIS OF AMMONIUM CARBAMATE, by George Gorin. Technical note no. 3 on Studies on Urease, Contract AF 18(603)135. July 59, 13p. 7 refs. AFOSR-TN-59-775.
Order from LC mi$2.40, ph$3.30 PB 144 018

This note presents some results which were obtained in the course of a brief investigation of the rate of hydrolysis of ammonium carbamate in sodium hydroxide solution. The investigation was pursued only to a limited extent, and the results are not precise. Approximate rate constants have been determined for the hydrolysis of ammonium carbamate in 0.05, 0.10, and 0.25 M sodium hydroxide at 25°, and on the basis of these data, some conclusions regarding the mechanism have been drawn. In addition, some measurements have been made in dilute aqueous solution.

Pittsburgh U., Pa.
A STUDY OF THE MECHANISM OF PHOTOSENSITIZATION IN PHOTOSYNTHESIS, by Jerome L. Rosenberg. Annual progress rept. for 1 May-31 Dec 58 on Contract Nonr-624(08). 28 Jan 59, 3p.
Order from LC mi$1.80, ph$1.80 PB 144 236

School of Aviation Medicine, Randolph AFB, Tex.
SEASONAL VARIATION IN HUMAN AMINO ACID EXCRETION, by Henry B. Hale, James P. Ellis and Donald D. Van Fossan. June 59, 9p. 26 refs. Rept. 59-80.
Order from LC mi$1.80, ph$1.80 PB 144 218

Amino acid excretion was studied in young, healthy men during summer, fall, and winter months in a location in southwestern United States. Both random and timed urine samples were employed. The amino acids determined were alanine, arginine, cysteine, glutamic acid, glutamine, glycine, histidine, lysine, methyl histidine, serine, threonine, and valine. Supplemental determinations included urine volume, creatinine, uric acid, urea, sodium, and potassium. Using random samples, and expressing values as ratios with creatinine, significant seasonal variation was found for alanine, arginine, cysteine, glutamic acid, glycine, lysine, serine, urea, and uric acid. Although there was no significant variation in urine volume, both creatinine excretion and the urinary Na/K ratio varied significantly with season. These effects are interpreted as the result of changes in glomerular filtration and tubular reabsorption rates.

Washington U., Seattle.
ENZYMATIC DEGRADATION AND MODIFICATION OF PROTEOLYTIC ENZYMES, by Hans Neurath. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-477(04). [1959] 4p. 3 refs.
Order from LC mi$1.80, ph$1.80 PB 144 231

The nature of the molecular changes accompanying the activation of trypsinogen and chymotrypsinogen has been investigated by chemical, physical and enzymatic methods. A study of the reaction of trypsin with diisopropylphosphofluoridate (DFP) with trypsin has been carried out in order to determine the nature of the peptide sequence involved in the combination between the enzyme and this organic phosphate. Kinetic and spectrophotometric measurements of the reaction between chymotrypsin and trypsin, respectively, and p-nitrophenylphosphate (NPA) and related compounds have suggested the formation of an acetyl-N-imidazole intermediate in the reaction of these proteolytic enzymes with acylating agents.

Medical Specialties and Equipment

Army Medical Research Lab., Fort Knox, Ky.
A CINEFLUOROGRAPHIC UNIT, by Lyle B. Deem, Olavi Weir and others. 5 Mar 58, 14p. 12 refs. Rept. no. 333; AD-153 647.
Order from LC mi$2.40, ph$3.30 PB 138 341

A unit for use in cinefluorographic studies is described. Pulsed x-rays are obtained by the controlled firing of two thyratron tubes (placed in primary circuit of x-ray generator) by an electronic triggering circuit incorporated between camera and primary circuit. Synchronization between camera and triggering mechanism was required to obtain good quality cinefluorographs.

Ohio State U. Research Foundation, Columbus.
RESEARCH ON THE PRODUCTION OF CLINICAL RADIOGRAPHS BY MEANS OF COMPACT, LOW-ENERGY AND HIGH-INTENSITY RADIOACTIVE SOURCES, by H. D. Spangenberg and M. L. Pool. Technical rept. no. 1, 1 June-31 Dec 58, on Contract Nonr-495(17). Jan 59, 37p.
Order from LC mi$3.00, ph$6.30 PB 144 198

On the evaluation of the properties characteristic to various possible radioactive sources that may be suitable for clinical dental radiography. Two parallel and independent approaches are made to improve the sensitivity of radiation measurements. One is the slow but gradual increase in photographic film sensitivity and the other is the new and promising light amplifiers. Many sources that cannot be made sufficiently intense for film work may be very satisfactory if light amplifiers become perfected.

School of Aviation Medicine, Randolph AFB, Tex.
THE EFFECTIVENESS OF A TOPICAL APPLICATION OF STANNOUS FLUORIDE IN A PREVENTIVE DENTISTRY PROGRAM: A REVIEW OF THE LITERATURE, by Norman O. Harris and Warren R. Hester. Sep 58, 19p. 72 refs. Aeromedical Reviews 2-59; AD-205 618.
Order from LC mi$2.40, ph$3.30 PB 138 432

Contents:
Requirements for a successful preventive dentistry program
Efforts of research to reduce caries incidence
Therapeutic effect of sodium fluoride mouthwashes, troches, and pastes
Beneficial effects of fluoridation of communal water supplies
Effects following topical application of sodium fluoride to teeth of juveniles and adults
Effectiveness of stannous fluoride in laboratory experimentation
Reduction of carious lesions following use of stannous fluoride toothpastes
Superiority of topically applied stannous fluoride over sodium fluoride in reducing caries among children
Effectiveness of topical applications of stannous fluoride in reducing caries in adults
Method of topical application of stannous fluoride
Possible contraindications for the use of topically applied stannous fluoride

Pathology

Army Chemical Warfare Labs., Army Chemical Center, Md.
AIR BLAST STUDIES WITH ANIMALS, by R. S. Anderson, Fred W. Stemler and others. July 59, 23p. 6 refs. CWLR-2288; AFSWP-1110.
Order from LC mi$2.70, ph$4.80 PB 144 036

Goats, rabbits, and mice have been exposed to air blasts in a shock tube. Translation seemed to be the major cause of injury except for damage in the ears. Correlations have been made between the air pressure, velocity, and distance traversed by the animals.

Army Chemical Warfare Labs., Army Chemical Center, Md.
A COMPARISON OF THE BURN-PRODUCING EFFECTIVENESS OF TWO INCENDIARY AGENTS, 4.2% M1 AND 4% E10, by Matthew J. Wargovich. Aug 59, 40p. 3 refs. CWLR 2298; AD-225 614.
Order from LC mi$3.00, ph$6.30 PB 143 913

The burn-producing effectiveness of two incendiary agents, 4.2% M1 and 4% E10, was tested on rabbits using the triple response as a criterion for determining the extent of skin damage produced by fires lasting from 5 to 60 seconds (in 5-second intervals). All burns were classified as subthreshold, threshold, or suprathreshold, depending on the responses elicited. All burns were defined microscopically as well as grossly. Rabbit tissue burned with 4% E10 took from 2 to 8 days longer to heal than did tissue burned with 4.2% M1 under similar conditions. Per given volume and burning time, 4% E10 produces a larger and deeper burn than 4.2% M1 under similar conditions.

Connecticut Coll., New London.
A COMPARISON OF DISCRIMINATION THRESHOLDS FOR BRIGHTNESS AND SATURATION IN DEUTERANOPIC, DEUTERANOMALOUS, AND NORMAL OBSERVERS, by Jane W. Torrey. Final project rept. on Evaluation of Color Vision Test, Contract Nonr-996(03). Dec 58, 38p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 144 181

Chromaticity discrimination was measured along two dimensions on the I. C. I Diagram, both passing through the neutral center of the diagram so that differences on either side of the center were differences of saturation. One line approximated the dimension of maximum confusion for deutans, bluish red and bluish green; the other was nearly perpendicular to it and should represent minimum confusion, blue and yellow. The more severe the color defect, the higher were the discrimination thresholds. The trend was most striking on the red-green dimension, where it was fully expected. On blue-yellow and brightness discrimination the differences according to degree of color defect were not as clear but it seemed possible from these results that they may exist. Tests of reliability of the measurements from day to day indicate that there are uncontrolled sources of variability in the apparatus which are too large to permit any more exact calibration of the system of classifying color defect. While the differences between sessions were not enough to vitiate entirely the differences between observers, it is clear that the next step in this research would have to be a redesigning of the apparatus to permit more consistent measurements.

School of Aviation Medicine [Brooks] AFB, Tex.
AN INTRODUCTION TO THE STOCHASTIC THEORY OF EPIDEMICS AND SOME RELATED STATISTICAL PROBLEMS, by A. T. Bharucha-Reid (Columbia U.). Dec 57, 81p. 55 refs. Rept. 58-40; AD-153 786.
Order from LC mi$4.80, ph$13.80 PB 144 172

In this monograph an attempt is made to give an account of the stochastic theory of epidemics and related statistical problems that will be useful to the epidemiologist, medical statistician, and applied probability theorist who may be interested in problems of this nature. Chapters I and II are intended to serve as an introduction to the theory of discrete and continuous branching stochastic processes. In Chapter II a review and discussion of stochastic models in epidemic theory is presented. In Chapters IV and V some statistical problems associated with branching stochastic processes, and their applications to epidemic situations are considered.

Wallace, A. B.
STUDIES IN THE POST TRAUMATIC PATIENT: SODIUM BALANCE STUDIES, NITROGEN UTILISATION, FAT ABSORPTION, ASCORBIC ACID REQUIREMENT, by Anne B. Sutherland, Christine G. Colver and others. Annual technical status rept. for 1 Sep 58-31 Aug 59 on Contract DA 91-508-EUC-354. 1 Sep 59, 82p.
Order from LC mi$4.80, ph$13.80 PB 144 180

The studies detailed in this report have been performed on patients admitted to Plastic Surgery Service. With one exception, the patients have been under the age of twelve years, and all patients had sustained moderate to severe burning injury. Techniques have been adapted, or improved, in the light of experience. A broad picture emerges of the response of children to this type of injury.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center.
AN ESTIMATION OF THE PER CENT MILITARY EFFECTIVENESS OF SOLDIERS WITH VARIOUS DEGREES OF INCAPACITATION FROM GB VAPOR IN VARIOUS TACTICAL SITUATIONS, by Charles H. Trask, Milton K. Christenson and others. Aug 59, 11p. 7 refs. Technical rept. CWLR-2294; AD-225 136.
Order from LC mi$2.40, ph$3.30 PB 144 033

Estimates of the frequency of poisoning by various Ct exposures to GB vapor in men are presented for mild, moderate, severe, very severe, and lethal effects. The per cent military effectiveness in four tactical situations is estimated for soldiers with these degrees of poisoning.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE INFLUENCE OF BODY WEIGHT ON INHALATION TOXICITY OF GB VAPOR TO DOGS EXPOSED FOR TWO MINUTES, by William S. Koon, Francis P. McGrath, and Fred W. Oberst. Rept. for 24 Sep 53-7 Dec 54 on Toxicology of CW Agent Vapor. Oct 58, 14p. 13 refs. CWLR 2247.
Order from LC mi$2.40, ph$3.30 PB 144 169

No significant differences in LC50 of GB vapor or in times to incapacitation were found between three different weight groups of dogs, where t = 2 minutes. However, a significant difference was noted between the death times of the large and small dogs. The medium-sized dogs exhibited a mean death time which could not be shown to differ significantly from those of either the large or small dogs.

Medical Coll. of Virginia, Richmond.
GASOMETRIC DETERMINATIONS OF HYDRAZINO COMPOUNDS, by Herbert McKennis and Allen Yard. Rept. on Contract DA 18-108-cml-5750. Nov 57, 16p. 18 refs. CWL Special pub. 2-4.
Order from LC mi$2.40, ph$3.30 PB 143 914

Previous reports contain discussion of the nature of the reaction of iodate with hydrazine compounds, and the use of this reaction in investigating the biological effects of hydrazine compounds. In keeping with the increase in emphasis on the study of other materials not related to hydrazine the work on the gasometric determination of hydrazine compounds has been concluded. This report summarizes the results and discusses the general principles which have been delineated.

School of Aviation Medicine, Brooks AFB, Tex.
PAROTID FLUID, SERUM, AND URINE 17-HYDROXYCORTICOSTEROIDS FOLLOWING THE INTRAMUSCULAR ADMINISTRATION OF REPOSITORY CORTICOTROPIN, by Ira L. Shannon, John R. Prigmore and others. Aug 59, 4p. 11 refs. Rept. 59-92.
Order from LC mi$1.80, ph$1.80 PB 144 173

In healthy young adult males, the intramuscular administration of 40 I.U. of corticotropin produced the expected alterations in serum and urine 17-hydroxycorticosteroids. The parotid steroid pattern very closely paralleled that of the serum. The results of the present study strengthen the premise that free 17-OHCS levels in parotid fluid may well be utilized in evaluating adrenocortical status. The use of this method makes possible continuous sampling of a completely nonstressful nature, and, even in extremely close quarters where blood sampling is impossible, the subject can be easily taught to carry out the sampling procedure upon himself.

Sterling Labs., Arlington, Va.
DIPROPARGYL ETHER: ORAL LD_{50} - MALE RATS; PRIMARY SKIN IRRITATION - RABBITS; EYE IRRITATION - RABBITS. 1.6 HEPTADIYNE: PRIMARY SKIN IRRITATION - RABBITS; EYE IRRITATION - RABBITS. Rept. on Contract Nonr-2727(00). [1958] 12p.
Order from LC mi$2.40, ph$3.30 PB 144 271

Report consists of tabulated results.

Radiobiology

Army Medical Research Lab., Fort Knox, Ky.
THE PROPHYLACTIC INFLUENCE OF CYSTEINE ON THE SPLEEN OF RATS EXPOSED TO WHOLE BODY X-IRRADIATION, by W. H. Parr, T. A. O'Neill, and R. Korson. 23 Jan 58, 23p. 22 refs. Rept. no. 281; AD-151 366.
Order from LC mi$2.70, ph$4.80 PB 138 332

A sequential comparative study of spleen weights was made from rats exposed to 600 r, 720 r, 880 r, and 720 r pretreated with cysteine. In the group pretreated with cysteine, the results suggested a possibility of cysteine-influenced protective action. However, statistically significant differences between the spleen weights of the 720 groups were found only on the 3rd, 6th, and 8th days. Histological studies of these spleens (720 r and 720 r pretreated with cysteine) also show little differences in cellular response.

Michael Reese Hospital of Chicago, Ill.
STUDY OF SOME PHYSICAL AND BIOLOGICAL ASPECTS OF THE ACTION OF HIGH ENERGY ELECTRONS ON MICROORGANISMS, by E. M. Uhlmann and J. Ovadia. Rept. no. 2 (Final) 29 Mar 57-31 Jan 58, on Contract DA 19-129-qm-916. [1958] 74p. 37 refs. QFCIAF File no. S-565.
Order from LC mi$4.50, ph$12.30 PB 143 835

Various factors affecting dose distributions produced by 25 Mev electrons in unit density material have been investigated and are discussed. Depth dose curves for a 10 x 10 cm beam at energies varying from 10 to 40 Mev are presented. The variation of penetration of 25 Mev electrons for different beam sizes is also reported. Satisfactory methods of obtaining a uniform distribution throughout a volume 8 inches thick are described. Serious difficulties in adequately monitoring an electron beam scanning a food package after the large magnetic deflection required to irradiate it from opposite side are discussed in the light of experience obtained with the accelerator at this installation. The health hazards at the irradiation site arising chiefly from the 20 minute Carbon 11 activity was calculated for assumed irradiation schedules. The health hazard arising from ingestion of radioactive food is also calculated and discussed. Only preliminary phases of the biological program were completed. Experience in synchronization of bacterial cells is discussed.

School of Aviation Medicine, Randolph AFB, Tex.
OBSERVATION OF LATENT EFFECTS FOLLOWING TOTAL-BODY GAMMA RADIATION IN THE BURRO, by U. S. G. Kuhn, III, Roy E. Kyner and others. June 59, 9p. 2 refs. Rept. 59-76.
Order from LC mi$1.80, ph$1.80 PB 144 465

The results of continued observation of burro survivors of sublethal doses of total-body gamma-ray irradiation are reported. Five deaths occurred during the observation period of this project, 3.6 years from November 1954 to May 1958. In four decedents cause of death was associated with irradiation experience. The survivors seemed to make an early clinical and hematologic recovery and now appear to enjoy normal health and condition. Within two years after irradiation blood elements and weights were observed to be within values exhibited by nonirradiated controls.

CHEMISTRY

Army Engineer Research and Development Labs., Fort Belvoir, Va.
HYDRAZOIC ACID AND THE METAL AZIDES (A LITERATURE SURVEY), by Hyman Rosenwasser. 28 Oct 58, 77p. 437 refs. Rept. 1551-TR; AD-208 892.
Order from LC mi$4.50, ph$12.30 PB 144 106

This report covers a literature survey of unclassified literature published since 1934 on HN_3 and the metal azides. The report is divided into 9 chapters: Hydrazoic acid; Alkali metal azides; Emission and absorption of ultraviolet radiation; Ammonium azide and the alkaline earth azides; Lead azides; Silver, thallium, and gold azides; Copper azides and complex azide compounds; Azides of Be, Mg, B, Al, Ga, Si, P, and Cd; and Thermochemistry and microchemistry.

Purdue Research Foundation, Lafayette, Ind.
SYMPOSIUM ON THE CHEMISTRY OF THE LESS FAMILIAR ELEMENTS, by James W. Cobble. Final rept. on Contract AF 49(638)233. Aug 59, 44p. 1 ref. AFOSR-TR-59-101; AD-226 190.
Order from LC mi$3.30, ph$7.80 PB 143 887

On April 14 - 16, the Air Force Office of Scientific Research and the American Chemical Society Division of Inorganic Chemistry held a joint symposium on the "Chemistry of the Less Familiar Elements at the National American Chemical Society Meeting in San Francisco, California. Twenty-nine papers, including those by eight foreign speakers from five countries were presented. This report includes a program, list of speakers, list of foreign participants, and copies of the abstracts of the papers. Titles of the papers follow Recent advances in inorganic chemistry and metallurgy of the rare earth elements; The properties of the actinide metals; Absorption and fluorescence spectra of actinide elements; Absorption spectra of actinide compounds in solution; Thermodynamic and kinetic properties of some rare earth oxide-oxygen systems; Hydrocarbon derivatives of the transition metals; Advances in aromatic-metal compounds; Recent advances in organo-metallic chemistry; Light scattering studies on aqueous gallium perchlorate solutions; The polymerization of chromic ion in aqueous solution; Hydrolytic polymerization of metal alkoxides, Equilibrium ultracentrifugations of hydrolytic polymers; On the formation of polynuclear complexes in aqueous solutions; The phosphinic nitrides - a family of inorganic polymers; Preparation of metastable and low-stability inorganic solids by high temperature techniques; Chemical reactions of free radicals at low temperature; Application of the floating zone technique for growing GaAs single crystals; Recent developments in the alkali metal hydride synthesis of diborane and borohydrides, Synthesis and reactions

of organo-boron halides and oxides; The preparation and properties of some binary borides; The ammonia addition compounds of diborane and tetraborane. Diboron tetrachloride; Bonding problems in the molecular addition compounds of boron; Addition compounds formed by the trihalides of boron and gallium. The determination of the formulas of aqueous ruthenium (III) species by means of ion exchange resin: Ru^{+3}, $RuCl^{+2}$ and $RuCl_2^{+}$. The chlorides of niobium and tantalum. Results of the last ten years; Spectrophotometric examination of certain oxidation states of rhenium and technetium; Acceptor pi-bonding in transition metal compounds; The nature of Ru(IV) in dilute perchloric acid.

Analytical Chemistry

Belcher, R.
SUBMICRO METHODS FOR THE ANALYSIS OF ORGANIC COMPOUNDS: DETERMINATION OF CHLORINE AND HYDROGEN. Annual technical rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-902. 30 Oct 59, 15p. 17 refs.
Order from LC mi$2.40, ph$3.30 PB 144 470

The main objective of this programme is to provide a complete system of analysis for organic compounds in the submicro-scale. There remained two common organic elements (chlorine and hydrogen) for which methods had to be developed.

Ledoux and Co., Teaneck, N. J.
ION EXCHANGE AND OTHER CHEMICAL METHODS FOR BERYLLIUM BASE ALLOYS, by Silve Kallman, Robert Liu, and Hans Oberthin. Rept. for May 58-May 59 on Contract AF 33(616)5743. Sep 59, 41p. 6 refs. WADC Technical rept. 59-325.
Order from OTS $1.25 PB 161 295

While individual elements in association with beryllium can be determined by conventional chemical methods, ion exchange procedures are extremely useful when beryllium is combined with a number of alloying constituents. Procedures are described in this report involving both cation and anion exchange resins which allow the determination of all elements in successive steps using one sample portion. The elements covered in the range of 0.1 to 10% are copper, aluminum, iron, nickel, cobalt, cerium, silver, gold and palladium.

Naval Ordnance Test Station, China Lake, Calif.
A THERMISTORIZED APPARATUS FOR DIFFERENTIAL THERMAL ANALYSIS, by Jack M. Pakulak, Jr. and Guy William Leonard. 19 June 58, 20p. 4 refs. NOTS 1920; NAVORD rept. 5829; AD-203 260.
Order from LC mi$2.40, ph$3.30 PB 144 157

The application of differential thermal analysis for the study of organic compounds is becoming increasingly important. Since the characteristic portions of the thermograms for most organic compounds lie in the 20 - 300°C range, a simple and very sensitive apparatus, using thermistors in place of thermocouples, is described which has proved to be reliable and accurate in the temperature range covered. The applicability of this apparatus is shown by the determination of thermograms for certain inorganic and organic compounds.

Organic Chemistry

California U., Los Angeles.
MOLECULAR ORBITAL STUDY OF IONIZATION POTENTIALS OF ORGANIC COMPOUNDS, by Andrew Streitwieser, Jr. Rept. on Contract AF 49(638)1212. 27 Aug 59, 109p. 123 refs. AFOSR [TN] 59-893, 59-(912-915).
Order from LC mi$5.70, ph$16.80 PB 144 168

Contents:
Part I. Radicals and Non-Alternant Hydrocarbons, AFOSR-TN-59-893
Part II. Methyl Compounds, AFOSR-TN-59-912
Part III. Saturated Hydrocarbons, AFOSR-TN-59-913
Part IV. Acetylenes and Allenes, AFOSR-TN-59-914
Part V. Chlorine, Oxygen and Nitrogen Compounds, AFOSR-TN-59-915

Diamond Ordnance Fuze Labs., Washington, D.C.
HEAT OF POLYMERIZATION OF PHENYL GLYCIDYL ETHER AND OF AN EPOXY RESIN, by C. H. Klute and W. Viehmann. 28 Aug 59, 33p. 12 refs. TR-758; AD-226 590.
Order from LC mi$3.00, ph$6.30 PB 143 948

A differential thermal analysis apparatus was designed and constructed for the accurate measurement of heats of polymerization. With this apparatus the mean value for three determinations of the heats of polymerization of epoxy resins or of phenyl glycidyl ether could be measured to within a standard error of 0.37 kcal per mole. Primary amine curing agents released about 26 kcal per mole, tertiary amines and boron trifluoride-ether complex each released about 22 kcal per mole and mixed type curing agents which could react in part as tertiary amines and in part as primary amines released intermediate amounts of heat.

North Dakota U. [Grand Forks].
ORGANOMETALLIC COMPOUNDS OF TRANSITION METALS, by Lawrence Summers, David C. Hampton, and David Y. L. Liu. Technical rept. no. 6 (Final), 1 June 57-31 Mar 58, on Contract Nonr-582(00). 30 Jan 59, 22p.
Order from LC mi$2.70, ph$4.80 PB 144 141

The last previous report described the continuation of investigations on bis(cyclopentadienyl) compounds of titanium, and the extension of this investigation to zirconium and chromium compounds. Of the transition metals of the 3d series, the remaining one of interest was vanadium. Studies were made of reactions of vanadium chlorides with active cyclopentadienyl-metal derivatives.

Queen's U., Belfast (North Ireland)
MECHANISMS OF THE OXIDATION OF ORGANIC AMINES BY OXYGEN AND BY FREE RADICAL OXIDIZING AGENTS, by H. B. Henbest. Annual technical rept. for 5 July-30 Sep 59 on Contract DA 91-508-EUC-389. [1959] 46p. 25 refs.
Order from LC mi$3.30, ph$7.80 PB 144 250

Covers the following subjects: Oxidation of Amines with Oxygen, Oxidation of Amines with Alkoxyl Radicals, Reactions of Amines in Aqueous Solution with Oxidants undergoing One-Electron Transfer.

Texas U., Austin.
DECOMPOSITION OF VINYLACETYLENE AND DIACETYLENE AND THEIR INTERACTION WITH ACETYLENE, by J. D. Frazee and R. C. Anderson. Technical note 6 on Contract AF 18(603)142. Aug 59, 44p. 26 refs. AFOSR-TN-59-934.
Order from LC mi$3.30, ph$7.80 PB 144 384

Vinylacetylene and diacetylene are possible intermediates in the thermal decomposition of acetylene. The present experiments were, therefore, undertaken to study the decomposition of these and their interaction with other gases such as acetylene or hydrogen. The reactions were studied in a flow system at temperatures of 400-900°, using vapor-liquid chromatography to analyze the gaseous products. Reaction is rapid enough so that experiments were limited to mixtures containing 20% or less or the reagent in an inert diluent.

Physical Chemistry

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
THE EFFECTS OF ELECTRODE CONTAMINATION ON THE PROPERTIES OF AIR-ARC PLASMAS, by Harold Y. Wachman, Milton J. Linevsky and John H. McGinn. Rept. on [Contract AF 04(647)269]. 21 Sep 59, 26p. 11 refs. Technical Information Series R59SD427.
Order from LC mi$2.70, ph$4.80 PB 144 133

The plasma test environments originating from arcs are usually contaminated with material from the arc electrodes. Carbon electrodes contribute appreciable quantities of vapor which alter the chemical composition and thermodynamic properties of the jet and cooled copper electrodes contribute trace quantities of vapor which, as expected, alter the character of the electrical discharge. In this work, the chemical composition and thermodynamic properties of air are compared to those of air-carbon gaseous mixtures containing 1-30% carbon by weight. The comparison of the different environments is made over the temperature range 4000-10,000°K and pressures between 0.1 and 100 atmospheres. The effects of trace amounts of copper on the electrical conductivity and power dissipated in the air arc column are calculated.

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 1, 1 Mar - 31 May 57, on Research on Aqueous Solutions at or above Critical Temperature of Water, Contract DA 36-039-sc-73211. [1957] 83p. 48 refs. AD-139 823
Order from LC mi$4.80, ph$13.80 PB 138 089

Contents:
Factual data on conductivity of solutions above the critical temperature; reaction of alkaline earth metal compounds with silica; program for studying the effect of fluoride ion on the hydrothermal formation of quartz; studies of the hydrothermal reactions of germanium dioxide; geological and crystallographic investigations
Hydrothermal reactions under supercritical conditions. IV. The reaction between strontium hydroxide and silica
Hydrothermal reactions under supercritical conditions. III. The effect of pH on the crystallization of silicon
Data on some crystalline compounds in the system Na_2O-GeO_2-H_2O

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 2, 1 June - 31 Aug 57, on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-73211. [1957] 41p. 19 refs. AD-146 491.
Order from LC mi$3.30, ph$7.80 PB 138 090

Contents:
Factual data on conductivity of solutions above the critical temperature; reactions of alkaline earth metal compounds with silica; hydrothermal reactions of germanium dioxide; geological and crystallographic investigations
Germanium chalcedony
A proposal for the hydrothermal study of the alumina-water system.
(See also PB 138 089)

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 3, 1 Sep-30 Nov 57, on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-73211. [1957] 39p. 23 refs.
Order from LC mi$3.00, ph$6.30 PB 138 088

Contents:
Factual data on conductivity of solutions above the critical temperature; reactions of alkaline earth metal compounds with silica; hydrothermal reactions of Al_2O_3; hydrothermal reactions of germanium dioxide; geological and crystallographic investigations
Hydrothermal reactions in the Na_2O-GeO_2 system
(See also PB 138 090)

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. no. 4, 1 Nov 57-28 Feb 58, on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-73211. [1958] 39p. 12 refs.
Order from LC mi$3.00, ph$6.30 PB 138 091

Contents:
Factual data on conductivity of solutions above the critical temperature; hydrothermal studies on aluminum oxides; geological and crystallographic investigations
Hydrothermal reactions under supercritical conditions. V. Reactions between silica and alkaline earth metal salts
Sodium tetragermanate, $Na_2Ge_4O_9$, tetragonal form
Report on durability of AC spark plugs no. 448 JKD Part no. 062157 and no. 062157-1
(See also PB 138 088)

Atlantic Research Corp., Alexandria, Va.
FLAME STABILIZATION, by Arch C. Scurlock and John H. Grover. Rept. on Contract Nonr-1858(25). Jan 59, 62p. 8 refs. Proj. Squid Technical rept. ARC-5-R; AD-226 180.
Order from LC mi$3.90, ph$10.80 PB 144 332

An investigation was made of the mechanism of flame stabilization behind bluff bodies in high-velocity gas streams. Blow-off velocity data were obtained by using (1) rod-shaped flameholders in a rectangular combustion chamber which, in effect, produced a 2-dimensional flame, and (2) spherical flameholders in a circular chamber which produced a 3-dimensional flame. The fuels used were natural gas, propane, and hydrogen. The results showed that such variables as the molecular diffusivity of the fuel, flow Reynolds number, and laminar flame velocity and quenching distance of the gas had a large effect on stability. Two-dimensional stabilizer (rods) had better stability than did 3-dimensional stabilizers (spheres) of the same characteristic dimension. However, neither the rod nor sphere data were completely free of the influence of the apparatus. Hydrogen had the best stability of the 3 fuels studied; propane had better stability than natural gas (88% methane). Measurements of pressure distribution in the chamber indicated that the presence of the flame greatly alters the flow pattern in the vicinity of the flame.

California U., Berkeley.
THE PERTURBATION OF MOLECULAR DISTRIBUTION FUNCTIONS BY CHEMICAL REACTION, by Bruce H. Mahan. Rept. on Contract AF 49(638)01. 21 Sep 59, 12p. 9 refs. AFOSR-TN-59-990.
Order from LC mi$2.40, ph$3.30 PB 144 017

A collision cross-section for radial combination reactions is derived which indicates that translationally hot free radicals combine faster than the average thermal radicals. The cross-section is used to calculate the disturbance of the equilibrium distribution of velocities by radical combination reactions. It is concluded that the equilibrium assumption of chemical kinetics is justified for photochemical systems where the radical concentrations are low, but may be violated in systems where free radical concentrations approach 0.1 mole fraction.

California U., Berkeley.
SPECTROSCOPIC STUDY OF THE PHOTOLYSIS OF DIAZOMETHANE IN SOLID NITROGEN, by Theodore D. Goldfarb and George C. Pimentel. Rept. on Contract AF 49(638)01. 25 Sep 59, 13p. 7 refs. AFOSR-TN-59-991.
Order from LC mi$2.40, ph$3.30 PB 144 016

Diazomethane or partially deuterated diazomethane was suspended in solid nitrogen at 20° K and photolyzed with filtered light and a spectroscopic study was extended from the ultraviolet (2300 A) through the infrared (to 650 cm^{-1}). An unstable substance is stored which produces ethylene after diffusion is permitted. This ethylene precursor is lost, as are visible-ultraviolet absorptions at 4182, 3968, and 3050-3300 A, when the photolyzing radiation includes only wavelengths longer than 3400 A. Absorption at 2620 A was detected only in experiments at high concentrations (low M/R), making it extremely unlikely that this absorption is caused by CH_2. Finally, an absorption at 2470 A not caused by diazomethane was present before photolysis. This could be the tautomeric compound, isodiazomethane.

[Chicago U., Ill.].
REVIEW OF WORK. Final rept. on Contract N6ori-02026. [1958] 12p. 23 refs.
Order from LC mi$2.40, ph$3.30 PB 144 444

The final report will take the form of a review of the principal results of the research done under contract. The work can conveniently be discussed under three general subject headings: (1) Mechanisms of Redox Reactions (2) Constitution of Complex Ions (3) Mechanisms of Substitution Reactions of Complex Ions. Research done under the contract and published in the chemical literature is cited in footnotes; related work, not done under the contract but relevant to this review, is cited in the body of the report. Not all the papers published under contract auspices are included in the references.

Cornell U., Ithaca, N. Y.
A STUDY OF EVAPORATED ALUMINUM FILMS BY X-RAY TOTAL REFLECTION, by R. C. Duncan and L. G. Parratt. Technical rept. no. 13 on Contract AF 18(600)300. 21 Aug 58, 108p. 45 refs. AFOSR-TN-58-680; AD-162 212.
Order from LC mi$5.70, ph$16.80 PB 137 433

Films freshly deposited, then heat treated in successive steps up to 400°C or anodized in successive steps up to an oxide thickness of about 625A, have been studied. The theory of reflection based on homogeneous media accounts reasonably satisfactorily for the shape of the reflection curves near the critical angle for total reflection, but it seems necessary for the heat treated and anodized films to introduce a surface model which contains inhomogeneities in order to account for the shapes of the curves at smaller glancing angles.

Florida U. Engineering and Industrial Experiment Station, Gainesville.
FLUOROCARBON N-F COMPOUNDS, by J. A. Young and R. D. Dresdner. Quarterly technical rept. no. 1, 1 Aug-30 Sep 59, on Contract DA 01-009-ORD-772. [1959] 13p.
Order from LC mi$2.40, ph$3.30 PB 144 131

Fluorocarbon NF compounds have been made by three methods: addition of fluorine across C-N unsaturation, fluorination of NH groups, and replacement of acyl groups on nitrogen by fluorine. Formation of the NF group is competitive with N-N coupling or with rearrangement of the free radical first formed. The following group reactions have been found: $R_FCN \longrightarrow R_FCF_2N{=}NCF_2R_F$, $(R_F)_2NH \longrightarrow (R_F)_2NF + (R_F)_2N\text{-}N(R_F)_2$, $(R_F)_2NCOF \longrightarrow (R_F)_2NF + (R_F)_2N\text{-}N(R_F)_2$, $R_FCONH_2 \longrightarrow R_FNCO$, $R_FNCO \longrightarrow R_FN{=}NR_F$, and $R_FNHCOF \longrightarrow (R_FNCOF)_2$. Present production of NF_3 is by the electrochemical method using pyridine in anhydrous HF. The by-products are C_5F_{12} and cyclo-$C_5F_{10}NF$.

Frick Chemical Lab., Princeton U., N. J.
A GENERAL TREATMENT OF EQUILIBRIUM POLYMERIZATION, by A. V. Tobolsky and A. Eisenberg [Technical rept. on Research in High Polymer Chemistry Rates of Initiation in Vinyl Polymerization, Contract DA 36-034-ORD-2190]. [1959] 19p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 144 389

A general theory of equilibrium polymerization is presented. Three chemical categories are discussed: equilibrium polymerization in the presence of an initiator, e.g., caprolactam, and two categories that do not involve an initiator, represented by sulfur and by vinyl monomers, respectively. Two mathematical approximations are considered. In certain cases the chemical facts and the experimental results allow a treatment based on a single equilibrium constant. In very many cases, however, a two constant treatment is necessary, e.g., caprolactam initiated by water and the polymerization of sulfur. It is suggested that a two constant treatment is also necessary for describing the equilibrium polymerization of vinyl monomers.

Frick Chemical Lab., Princeton U., N. J.
THE THERMAL OZONE-HYDROGEN REACTION, by Theodore P. Williams and David Garvin. Technical note no. 6 on Contract AF 18(603)134. 15 Sep 59, 36p. 18 refs. AFOSR-TN-59-979.
Order from LC mi$3.00, ph$6.30 PB 144 019

The kinetics of the reaction between dilute ozone and molecular hydrogen has been studied in the temperature range 400-500° K using a flow technique. Water is the principal product, small amounts of hydrogen peroxide also are formed. The reaction competes with the thermal decomposition of ozone. It is concluded that the oxidation of hydrogen is initiated by oxygen atoms formed in the thermal decomposition of ozone, and that a short chain sequence occurs. Mechanisms involving either OH or both OH and HO_2 are presented.

General Electric Co., Schenectady, N. Y.
VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, INVESTIGATION OF, by J. H. Affleck. Scientific rept. no. 5 on Contract AF 19(604)4093. 22 Sep 59, 15p. 2 refs. AFCRC-TN-59-757.
Order from LC mi$2.40, ph$3.30 PB 144 187

Thermionic properties of cesium on various refractory materials. Dispenser cathodes have been fabricated using a barium activator. (See also PB 142 346)

Grinnell Coll., Iowa.
CRACKING REACTIONS CATALYZED BY THE SILICA-ALUMINA CRACKING CATALYST, by Joseph D. Danforth. Final rept. for 1948-1957 on Contract N8onr-67100. [1957] 5p. 8 refs. AD-142 932.
Order from LC mi$1.80, ph$1.80 PB 137 704

Harvard U., Cambridge, Mass.
THE MICROWAVE SPECTRUM, BARRIER TO INTERNAL ROTATION, AND STRUCTURE OF METHYL FORMATE, by R. F. Curl, Jr. Rept. on Contract N5ori-1866(14). [1958] 25p. 19 refs.
Order from LC mi$2.70, ph$4.80 PB 143 935

Rotational constants have been assigned to the following isotopic species of methyl formate by investigation of their microwave spectra: $HCOOCH_3$, $DCOOCH_3$, $HCOOCH_2D$, $HCOOCD_3$, $HC^{13}OOCH_3$, $HCOOC^{13}H_3$, $HCO^{18}OCH_3$, and $HCOO^{18}CH_3$. Structural parameters were obtained from these rotational constants. The barrier to internal rotation of the methyl group was calculated from the splittings observed in the rotational transitions of the ground torsional state for several isotopic species. The dipole moment was calculated from the observed Stark effect.

Illinois Inst. of Tech., Chicago.
KINETICS AND MECHANISMS IN IONIC MELTS, by A. G. Kennan. Final rept. for 1 Sep 54-1 Sep 57 on Contract AF 18(600)1148. [1957] 13p. 15 refs. AFOSR TR-57-48; AD-132 478.
Order from LC mi$2.40, ph$3.30 PB 138 490

A spectrophotometric investigation was made of fused NH_4NO_3 with UV spectra. Several successful spectra were obtained for pure fused NH_4NO_3 in repeated trials; the best spectra were measured at 175°. The sample thickness was about 0.2 mm. The data show the manner in which the resolution deteriorated in other samples, and the way in which the total absorbance was decreased where the mounting was less successful. The film was shown to be heterogeneous because of bubbles. The addition of HNO_3 to NH_4NO_3 did not improve the spectra. The data substantiated the conclusion from cryoscopic data that pure fused NH_4NO_3 is a simple ionic system when approaching its melting point.

Instituto de Quimica Fisica (Spain).
KINETICS AND MECHANISMS OF THE THERMAL DECOMPOSITION OF ACETALS, by M. J. Molera, J. Morcillo and others. Annual technical rept. no. 1, 1 Sep 58-31 Aug 59, on Contract DA 91-508-EUC-360, [1959] 65p. 34 refs.
Order from LC mi$3.90, ph$10.80 PB 144 239

As a contribution to basic research on the kinetics of thermal decomposition of organic compounds, four acetals have been selected for study:

formaldehyde dimethyl acetal
formaldehyde diethyl acetal
acetaldehyde dimethyl acetal
acetaldehyde diethyl acetal

The reactions have been studied in a high vacuum apparatus by the static method. It has been proved that the pressure increase inside the reaction vessel may be considered as a reasonable measure of the acetal consumed; consequently, the kinetic constants have been determined from the pressure increase-time curves.

Metcalf Research Lab., Brown U., Providence, R. I.
THE DISSOCIATION ENERGY OF FLUORINE FROM SHOCK WAVE MEASUREMENTS, by Kurt L. Wray and Donald F. Hornig. Technical rept. no. 5 on Contract Nonr-562(06). 1 Feb 58, 31p. 10 refs. AD-154 578.
Order from LC mi$3.00, ph$6.30 PB 138 329

In general, the heat of dissociation of fluorine determined by various workers falls into one of two ranges, the one from 60 to 70 kcal/mole, the other from 30 to 40 kcal/mole. The results of this research indicate that the lower range of values is correct.

Minnesota U., Minneapolis.
Be-C EQUILIBRIA, by R. L. Dowdell. Progress rept. no. 6 on NEPA Proj. AC-2017. 15 Oct 48, declassified 12 Nov 58, 19p. NEPA 794-UM-6; AD-204 967.
Order from LC mi$2.40, ph$3.30 PB 138 462

The study of the system Be-C has been continued with emphasis on the stability of the carbide Be_2C and also its lattice dimensions. Other carbides with Be have not been found, and it now appears certain that Be_2C is the only carbide in the system which is in equilibrium with either excess Be or graphite from room temperature to 2500°F. The new Picker Diffraction X-ray Machine is operating very well and is giving precision measurements by back reflection technic which are very consistent and accurate.

Minnesota U., Minneapolis.
Be-C EQUILIBRIA, by R. L. Dowdell. Progress rept. no. 7 on NEPA Proj. SC-2017. 29 Nov 48, declassified 12 Nov 58, 13p. NEPA 833-UM-7; AD-204 966.
Order from LC mi$2.40, ph$3.30 PB 138 458

The study of the system Be-C is being continued with emphasis on the Be end of the diagram, with the idea that it would be well to find some liquidus and solidus points for alloys containing mechanical mixtures of phases which appear to be Be and Be_2C. (See also PB 138 462)

Minnesota U., Minneapolis.
Be-C EQUILIBRIA, by R. L. Dowdell. Progress rept. no. 8 on NEPA Proj. SC-2017. 15 Dec 48, declassified 12 Nov 58, 18p. NEPA 859-UM-8; AD-204 965.
Order from LC mi$2.40, ph$3.30 PB 138 459

Most of the work has been with hot pressed compacts of Be_2C and graphite prepared by other workers in the field. This staff is endeavoring to determine the structure and the nature of the bond in these compacts. The specimens received from Nepa were labeled "Runs 77 and 80" and were made from mixtures of 20% Be_2C plus 80% graphite. These hot compacts were made at 2300°C for 30 minutes. (See also PB 138 458)

North Carolina U., Chapel Hill.
ADSORPTION IN POLAROGRAPHY, by Charles N. Reilly and Werner Stumm. Technical note UNC Chem no. 3 on Contract AF 49(638)333. 19 Oct 59, 44p. 91 refs. AFOSR-TN-59-1113.
Order from LC mi$3.30, ph$7.80 PB 144 383

Surface active substances, even in trace quantities, can exert a marked and often insidious effect on electrode processes. In polarography, adsorption of such substances at the electrode may decrease the limiting current, shift the half wave potential and in some cases obliterate the entire wave! In addition, they can cause minima or deceiving split waves. The characterization of the mode by which these effects arise and how one may detect their origin constitutes the purpose of this discussion.

North Carolina U., Chapel Hill.
ELECTRICAL METHODS OF ANALYSIS, by Charles N. Reilley. Final rept. for 1 June 54-30 June 58 on Contract AF 18(600)1160. 29 Aug 59, 8p. 22 refs. AFOSR-TR-59-128.
Order from LC mi$1.80, ph$1.80 PB 144 349

During the nearly four years of research under this contract, important progress has been made toward understanding of the mechanism of electrode processes and a number of electrochemical methods -- especially those involving chelate reactions -- were developed. Also, several new procedures of analytical value have been discovered. Some of the results are briefly tabulated and summaries of all published papers covering the research are given.

North Carolina U., Chapel Hill.
METAL CHELATE STABILITY CONSTANTS OF AMINOPOLYCARBOXYLATE LIGANDS, by James H. Holloway and Charles N. Reilley. UNC rept. no. 2 on Contract AF 49(638)333. 11 Sep 59, 30p. 15 refs. AFOSR-TN-59-748.
Order from LC mi$2.70, ph$4.80 PB 144 499

The stability constants for the reaction between a series of divalent metal ions with cyclohexanediaminetetraacetic acid (CyDTA), diethylenetriaminepentaacetic acid (DTPA), ethyleneglycol bis-(β-aminoethyl ether)-N, N'-tetraacetic acid (EGTA), ethylenetherdiaminetetraacetic acid (EEDTA), and N-hydroxethylethylene-diaminetriacetic acid (HEDTA) have been determined potentiometrically with a mercury electrode. The stability constants for the reaction between lanthanum and diethylenetriaminepentaacetic acid has also been determined by the same method.

Noyes Chemical Lab., U. of Illinois, Urbana.
TEMPERATURE DEPENDENCE OF PROTON RELAXATION TIMES IN AQUEOUS SOLUTIONS OF PARAMAGNETIC IONS, by Robert A. Bernheim, Thomas H. Brown and others. Technical rept. no. 15 on Contract Nonr-1834(13). 9 Oct 58, 26p. 19 refs. AD-205 747.
Order from LC mi$2.70, ph$4.80 PB 144 432

The nuclear magnetic relaxation times of protons in aqueous solutions of paramagnetic ions were measured as a function of temperature. For Mn^{++} ions, the proton T_1 and T_2 were measured at 10, 20, and 28 Mc/sec, and for Co^{++}, Cu^{++}, and Gd^{+++} ions, 20 Mc/sec. The temperature effects observed can be explained by incorporating the proper temperature dependences of the several correlation times into the general Bloembergen-Solomon relaxation expressions. Analysis of the data by means of the equations developed provides information concerning the chemical exchange of solvent protons with those in the hydrated Mn^{++} ion. An activation energy of 5.2 kcal/mole and other parameters for this process are evaluated. The temperature dependence of T_1 and T_2 in the Co^{++}, Cu^{++}, and Gd^{+++} solutions can be explained by the temperature dependence of the dipolar interaction alone. Varying the anion in Cu^{++} solutions had little effect on the T_1 or its temperature dependence; also, T_1 for Cu^{++} solutions was found to vary inversely with concentration over the whole temperature range studied.

Oklahoma State U., Stillwater.
RESEARCH IN PHOTOCHEMICAL AND PHOTOEMISSION PROCESSES IN NITROAROMATICS AND IN OTHER COMPOUNDS, by Earl H. Gilmore. Final rept. for 15 Sep 55-31 Aug 58 on Contract DA 23-072-ORD-581. Sep 58, 72p. 45 refs. AD-209 626.
Order from LC mi$4.50, ph$12.30 PB 144 331

None of the results of a complete analysis requiring seven different emission data from the system esculin in glucose glass indicates that the Jablonski model is invalid for the system. A large fraction of the quenching occurring in the system studied occurs from the singlet level. Nonradiative processes can occur from either the excited singlet or the excited triplet level of a molecule. The rate constant for the excited singlet to triplet level transition must be in the order of magnitude of the values of the rate constants for the singlet to ground level transitions if phosphorescence is appreciable.

Pennsylvania State U., University Park.
SIGMA VALUES AND THE EFFECTS OF STRUCTURE ON REACTIVITY. A REVIEW OF DEVELOPMENTS FOR 1957, by Robert W. Taft, Jr. Technical rept. no. 18 on Contract Nonr-656(05). Feb 58, 45p. 123 refs. AD-153 774.
Order from LC mi$3.30, ph$7.80 PB 138 337

Consideration is given to the evaluation of resonance effects, hyperconjugative and conjugative, in both the aromatic and aliphatic series; the determination of the extent of steric inhibition of resonance; the determination of steric inhibition of solvation; the evaluation and correlation of kinetic and potential energy intramolecular steric effects; and the evaluation of driving forces involved in anchimeric assistance (neighboring group participation).

Rensselaer Polytechnic Inst., Troy, N. Y.
FUSED SALT CHEMISTRY, by George J. Janz. Technical note no. 11 on Contract AF 49(638)50. Aug 59, 31p. 27 refs. AFOSR-TN-59-880; AD-226 418.
Order from LC mi$3.00, ph$6.30 PB 143 924

To be published as part of the proceedings of this meeting by the Stamford Research Institute, Menlo Park, Calif. Molten salts from systems which are liquid at temperatures up to 3000°C at atmospheric pressure. They form the largest class of non-aqueous inorganic solvents. The present communication develops some aspects of the structure of molten salts which are of current interest among both theoretical and experimental research workers. The models for molten salts based on liquid state theories and on the electro-chemical properties of these systems are considered. Experimental methods, the information to be gained, and current problems in the fields of pure molten salts, and mixtures are surveyed.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
BLUFF-BODY FLAME STABILIZATION AT LOW PRESSURES, by C. C. Chang, G. Engholm, and L. H. Zacho. Rept. on Contract AF 18(600)1553. July 59, 61p. 24 refs. Research rept. no. 161; AFOSR-TR-59-111.
Order from LC mi$3.90, ph$10.80 PB 144 346

Blowoff velocities of butane-air flames stabilized on a 3/16 inch diameter cylindrical flameholder were measured as a function of pressure (1/10 to 1 atm) and equivalence ratio for Reynolds numbers ranging from 1945 to 4685. Within this laminar range it was found that blowoff velocity was directly proportional to pressure for equivalence ratios from 0.9 to 1.5 and inversely proportional to pressure for equivalence ratios less than 0.9 or greater than 1.5.

Ultrasonics Research Lab., Western Reserve U., Cleveland, Ohio.
QUANTITATIVE MEASUREMENTS OF COLLOIDAL VIBRATION POTENTIALS, by Joseph Dereska, Ernest Yeager, and Frank Hovorka. Technical rept. no. 20 on Contract Nonr-1439(04). 1 Dec 58, 30p. 16 refs.
Order from LC mi$2.70, ph$4.80 PB 143 858

When ultrasonic waves are transmitted through a colloidal suspension in an aqueous medium, alternating potential differences are produced between points separated by a phase distance other than an even multiple of the wavelength. Quantitative measurements of this effect have been made in colloidal silica suspensions. Light scattering, electron microscopy, electrophoresis, and conductivity measurements have been made on the various silica suspensions to determine particle size and charge. Experimental results are in relatively good agreement with theory for measurements in suspensions of moderately high conductance. Agreement is less favorable for solutions of low conductivity.

EARTH SCIENCES

Geochronometric Lab., Yale U. [New Haven, Conn.]
RADIOCARBON DATING. Final rept. on Contract Nonr-609(05). Jan 58, 16p. 13 refs. AD-154 472.
Order from LC mi$2.40, ph$3.30 PB 138 258

Consideration is given to the instrumental, geochemical, and dating problems in radiocarbon dating. The advantages and use of the CO_2 proportional-counting method are discussed.

Climatology and Meteorology

Electrical Engineering Research Lab., U. of Texas, Austin.
THE USE OF POTENTIAL REFRACTIVE INDEX IN SYNOPTIC-SCALE RADIO METEOROLOGY, by K. H. Jehn. Rept. on Contract AF 19(604)2249. 15 Sep 59, 22p. 3 refs. Rept. 6-29; AFCRC-TN-59-598.
Order from LC mi$2.70, ph$3.80 PB 144 279

The concept of potential refractive index is examined in the light of earlier work and of the present emphasis on synoptic-scale radio meteorology. A new potential refractive index is defined and illustrated. It is concluded that the new parameter has operational utility in long range microwave radio and radar transmission, as well as in refractive index mapping.

Florida State U., Tallahassee.
THE EFFECT OF THE VERTICAL VARIATION OF WIND AND STABILITY ON MOUNTAIN WAVES, by Bo R. Döös. Technical rept. no. 13 on Contract Nonr-1600(00). 30 Dec 58, 36p. 19 refs.
Order from LC mi$3.00, ph$6.30 PB 144 230

The motion over an infinitely long mountain ridge has been studied. The scale of the motion is assumed to be so small that the influence of the earth's rotation can be neglected. It is further assumed that the motion is non-viscous, laminar, steady, and isentropic. The resulting wave equation is solved for certain types of realistic wind and temperature distributions. The wave lengths and the amplitudes have been evaluated for seven different cases which have been selected so that the effect of variation on the wind profile and the temperature distribution can be studied separately.

Florida State U., Tallahassee.
SOME EFFECTS OF THE WESTERN CORDILLERA OF NORTH AMERICA ON CYCLONIC ACTIVITY IN THE UNITED STATES AND SOUTHERN CANADA, by E. Paul McClain. Technical rept. no. 12 on Contract Nonr-1600(00). 15 Dec 58, 64p. 28 refs.
Order from LC mi$3.90, ph$10.80 PB 143 857

This report presents the results of an investigation which sought more satisfactory physical explanations for the observed behavior of cyclonic storm systems over and in the vicinity of the Western Cordillera of North America. Smoothed terrain contours were constructed and then used to estimate where and under what synoptic conditions orographically induced vertical motions might systematically alter the vorticity tendency field. Two general hypotheses evolved from the analysis: (1) Lee cyclogenesis. --A low-level lee-side trough is established and positive vorticity tendencies are generated in this region by the nature of the orographic vertical velocities. Whether or not major cyclonic storms develop from this trough is dependent upon the subsequent superposition of high-level divergence. (2) Windward retardation and cyclolysis. --Mature cyclones approaching the windward slopes decelerate, recurve northward and weaken due to the combined action of low-level orographic vertical velocities, friction, and the relatively unimpeded progression of the high-level portion of the system. A detailed case study is presented to illustrate and, to some extent, to verify the hypotheses outlined above as well as some other synoptic-scale mountain effects.

Institute for Advanced Study, Princeton, N. J.
ATMOSPHERIC RADIATION PROJECT, by Lewis D. Kaplan. Final interim rept. for 1 Feb 54-31 Aug 57 on Contract Nonr-1358(01). [1957] 6p. 5 refs. AD-143 331.
Order from LC mi$1.80, ph$1.80 PB 138 231

The spectral characteristics of the 3 principal absorbing gases in the atmosphere (carbon dioxide, ozone, and water vapor) that would be necessary to investigate radiative heat transfer were studied. New measurements by Eggers were used to determine the 15-μ band intensity and mean line width for CO_2 (J. Chem. Phys. 25:876-883, 1956). Intensities for 3 satellite bands of CO_2 were calculated (J. Chem. Phys. 26:1252-1253, 1957). The O_3 spectra of the 9.6 μ band were successfully analyzed for rotational structure. Line widths were calculated for all water vapor lines; an intensity analysis should produce the basic data necessary for the calculation of the heat transfer. The heat balance of the lower stratosphere was investigated.

McGill U. (Canada).
A SYNOPTIC CLIMATOLOGY FOR LABRADOR-UNGAVA, by Roger G. Barry. Scientific rept. no. 4 on Contract AF 19(604)3865. Aug 59, 256p. 89 refs. Arctic Meteorology Research Group Pub. in Meteorology Research Group Pub. in Meteorology no. 17; McGill Sub-Arctic Research Papers no. 8; AFCRC-TN-59-602.
Order from LC mi$11.10, ph$39.60 PB 144 275

A classification of airflow pattern types is formulated for the region on the basis of synoptic weather maps for November, 1956 to March, 1958. Regional indices of the zonal and meridional flow at mean sea level and the 500 mb level are examined in relation to the airflow types. The spatial and temporal variations of weather phenomena associated with the types are analyzed by quantitative weather parameters and the significance of the results is assessed with reference to local weather forecasting and palaeoclimatic reconstruction. (See also PB 142 028)

Marine Lab., U. of Miami, Coral Gables, Fla.
RADAR METEOROLOGICAL STUDIES, by H. W. Hiser and P. R. Ray. Final rept. for 1 Feb 58-31 Jan 59 on Contract NOas-58-388-d. [1959] 116p. 22 refs. Rept. no. 8904-4.
Order from LC mi$6.00, ph$18.30 PB 144 255

A range corrected logarithmic radar receiver, a master power supply, and an I. F. pulse generator, which were developed under the contract, are described and schematics are presented. Research on anomalous propagation and "thin bands" is described. A comparison of observations on the CPS-9, SP-1M, and MPS-4 radars and a summary of radar observations of 1958 hurricanes that approached South Florida are also included.

Marine Lab., U. of Miami, Coral Gables, Fla.
STUDIES OF THE EVOLUTION AND MOTION OF HURRICANE SPIRAL BANDS AND THE RADAR ECHOES WHICH FORM THEM, by H. V. Senn, H. W. Hiser, and E. F. Low. Final rept. for 1 July 58-30 June 59 on Contract Cwb-9480. Aug 59, 68p. 28 refs. ML-59169; AD-227 258.
Order from LC mi$3.90, ph$10.80 PB 144 247

Studies of radar echo vector motion in relation to a stationary hurricane center have been made for 1573 echo trajectories from hurricanes Edna 1954, Connie, Diane, and Ione 1955, Audrey 1957, and Daisy and Helene 1958. The data indicate that echo trajectories, while generally down spiral bands, have crossing angles which are smaller than those found for spiral bands in previous studies. Furthermore, the radius of a point on a spiral band (not an individual echo) in a given quadrant increases with time, resulting in an outward motion of the band. Preliminary results of several attempts to derive a mathematical model of echo-spiral band motion under various assumptions are also presented.

Naval Ordnance Test Station, China Lake, Calif.
OBJECTIVE FORECASTING OF CIRRUS CLOUDINESS AT THE NAVAL ORDNANCE TEST STATION, by D. L. Farnham. May 59, 18p. 6 refs. NOTS TP 2249; NAVORD rept. 6550.
Order from LC mi$2.40, ph$3.30 PB 144 177

The development of a rapid and relatively simple objective method of forecasting cirrus cloudiness at the Naval Ordnance Test Station, China Lake, California, is presented. Results of its use from March through May 1959 are shown. Conclusions that the method has forecasting advantages are reached.

New York U. Coll. of Engineering, N. Y.
AN ANALYSIS OF UPPER-AIR OBSERVATIONS AT McMURDO SOUND, ANTARCTICA, by James Demetrios Kangos. Scientific rept. no. 7 on Contract AF 19(604)1755. July 59, 33p. 19 refs. AFCRC-TN-59-451.
Order from LC mi$3.00, ph$6.30 PB 144 166

The height of the tropopause is determined at McMurdo Sound for January 1957 and July 1957 using three methods. The tropopause was found to be lower in summer than in winter. Mean temperature soundings for January 1957, July 1957, and October 1957 were determined to study the effect of the sun's rays on the heating of the Antarctic atmosphere. It was found that radiational heating of the atmosphere by the sun seemed to be the predominant process. Mean vertical wind profiles for July 1957 at McMurdo Sound reveal that the wind increases to the top of the sounding, whereas during January 1957 a wind maximum is present in the vicinity of the tropopause.

New York U. Coll. of Engineering, N. Y.
THE SPECTRA OF LARGE-SCALE TURBULENT TRANSFER OF MOMENTUM AND HEAT, by Wan-cheng Chiu. Scientific rept. no. 8 on Contract AF 19(604)1755. July 59, 29p. 11 refs. AFCRC-TN-59-452.
Order from LC mi$2.70, ph$4.80 PB 143 892

The spectra of large scale eddy transfer of angular momentum and heat were constructed for seven levels, ranging from 700 mb to 50 mb over Belmar, N. J., and at the 300 mb and 200 mb levels over Cocoa, Florida.

Woods Hole Oceanographic Institution, Mass.
CLOUD STRUCTURE AND DISTRIBUTIONS OVER THE TROPICAL PACIFIC, PART I, by Herbert Riehl, William S. Gray (U. of Chicago) and others. Technical rept. no. 5 on Contracts [Nonr] 1731(00), N6ori-02036, and Cwb 9509. Jan 59, 131p. Reference no. 58-62.
Order from LC mi$6.90, ph$21.30 PB 144 191

This report contains, in addition to description of purpose and method of the inquiry, the preliminary results of the first flight. Subsequent reports will be issued on the two remaining flights and containing an overall summary and comparison. It is intended that all three will be combined finally in a single publication.

Frost Science

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
A THERMALLY CONTROLLED SOIL FREEZING CABINET, by J. H. Schmertmann. May 58, 39p. Technical rept. 50; AD-208 955.
Order from LC mi$3.00, ph$6.30 PB 144 195

A cabinet providing good thermal control for one-dimensional heat-transfer experiments, control of water access to the sample, proper instrumentation, and adequate utility is described together with theoretical studies and tests conducted during its developemnt.

Institute of Engineering Research, U. of California, Berkeley.
PROGRESS REPORT FOR THE YEAR ENDING JUNE 27, 1953, by R. V. Dunkle and J. T. Gier. Rept. for 27 June 52-27 June 53 on Contract DA-11-190-eng-3. 27 June 53, 74p. 12 refs. Series no. 62,

issue no. 1.
Order from LC mi$4.50, ph$12.30 PB 144 463

The basic activities are: (1) a study of the spectral characteristics of wet and dry snow and the total emissivities and absorptivities of wet and dry snow for temperatures between 0°C and -60°C; (2) the study of the radiant characteristics of various types of paints and materials which might be used in arctic conditions; and (3) determination of criteria for the selection of materials, coatings and clothing for arctic camouflage and for identification under arctic whiteout conditions.

Institute of Engineering Research, U. of California, Berkeley.
RADIATION IN A DIFFUSING MEDIUM WITH APPLICATION TO SNOW, by R. V. Dunkle and J. T. Gier. Rept. on Contract DA 11-190-eng-3. 15 Nov 53, 16p. 3 refs. Series no. 62, issue no. 2.
Order from LC mi$2.40, ph$3.30 PB 144 462

The transmission through an idealized snow cover has been shown to be directly related to the albedo and to be an exponentially decreasing function. Two parameters have been proposed as possible correlating factors for transmission and albedo measurements. The first factor is a characteristic of the surface condition of the cover and the second is a characteristic of the snow beneath the surface. (See also PB 144 463)

Geography

California U., Berkeley.
NOTES ON THE CHIRIQUI LAGOON DISTRICT AND ADJACENT REGIONS OF PANAMA, by Burton Leroy Gordon. Rept. on Contract Nonr-222(11). 1957, 30p. 16 refs. AD-143 127.
Order from LC mi$2.70, ph$4.80 PB 138 226

A report is given of the observations made on a trip from Santa Fe to Calovebora, Panama. The terrain, the flora, the population, and the animals found in the area are described with special details about the Almirante Bay and Chiriqui Lagoon given. The Guaymi Indians cultivate a wax-producing scale insect, the Llaveia axin. A discussion is presented of the people engaged in the work, the habits of the insect, the uses and preparation of the wax, and the general industrial culture of the insect.

California U., Berkeley.
NOTES ON THE GEOGRAPHY OF BARBADOS, by Edward T. Price. Rept. on Contract Nonr-222(11). 1958, 62p. 41 refs.
Order from LC mi$3.90, ph$10.80 PB 144 257

Contents:
Man in Barbados
Shorelines, present and past
Earth movements in the Scotland District

California U., Berkeley.
QUINTANA ROO: MEXICO'S EMPTY QUARTER, by Clinton R. Edwards. Rept. on Contract Nonr-222(11). 1957, 189p. 62 refs. AD-143 122.
Order from LC mi$8.40, ph$28.80 PB 137 549

An investigation is made to find an explanation for the abandoment of Quintana Roo's agricultural lands. A geographic description is given of present-day Quintana Roo which includes the geomorphology, climate, vegetation, and soils of the area as well as its population and economic situation. Some similarities and contrasts are pointed out between Yucatan (AD-84 112) and the territory. A discussion is presented on the disparity in population between this territory and Yucatan, which in a smaller area harbors almost 20 times as many people. Besides the general bibliography, references are included at the end of every main subtopic.

Sacramento State Coll., Calif.
GEOGRAPHY OF INDIAN COASTS, by David E. Sopher. Annual summary rept. on Contract Nonr-2329(00). 1958, 18p.
Order from LC mi$2.40, ph$3.30 PB 144 270

This report is confined to observations and conclusions concerning historical and contemporary cultural interrelationships among the strand communities of these areas.

Oceanography

Johns Hopkins U. School of Engineering, Baltimore, Md.
AN ADVECTIVE MODEL OF THE OCEAN THERMOCLINE, by Pierre Welander. Technical rept. no. 7 on Contracts Nonr-248(31) and CWB-9504. Dec 58, 31p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 143 983

A theoretical study is made of the density field and the associated velocity field produced in an unlimited ocean by a prescribed density distribution at the surface. It is assumed that all motions take place under geostrophic and hydrostatic balance, and that the density is simply advected by the motion. The computation is carried out for a spherical earth.

Oregon State Coll., Corvallis.
BIOCHEMISTRY OF MARINE ORGANISMS, by Vernon H. Cheldelin. Rept. for 1 Jan-31 Dec 58 on Contract Nonr-1286(06). 10 Jan 59, 2p.
Order from LC mi$1.80, ph$1.80 PB 144 256

A summary.

Scripps Inst. of Oceanography, U. of California, La Jolla.
MARINE MICROBIOLOGY, by Claude E. ZoBell and

Leslie Ralph Berger Progress rept. no. 12 (Annual), 1 Jan-31 Dec 58, on Physiological Activities of Marine Bacteria, Contract Nonr-2216(00). 31 Dec 58, 13p. 11 refs. Reference 59-1.
Order from LC mi$2.40, ph$3.30 PB 144 197

Suitable apparatus and procedures have been developed to permit the study of microbial activities at hydrostatic pressures up to 2000 atm. Although some cultures of marine and terrestrial bacteria can grow at pressures as high as 800 atm, prolonged incubation at these pressures is lethal to most organisms. Some deep sea forms, termed barophiles, appear to reproduce only under increased pressure. The morphology of growing cells in pure culture at different pressures has been observed. At increased hydrostatic pressure, protoplasmic synthesis appears to be less inhibited by pressure than is cell-wall formation and cell division. The result is the formation of abnormally large cells, chains of cells, and snake forms. In some cases the cells appear to lyse from "over-growth" The microbial populations in marine sediments have been carefully screened both for the physiological types of bacteria and for their numbers. A number of enzyme systems have been studied under increased pressure. Several cultures of marine bacteria appear to exhibit an unusual growth response to temperatures. When total growth of a culture or its growth rate was plotted against the temperature of the culture, a bimodal curve was obtained. (See also PB 127 188)

Texas A. and M. Research Foundation, College Station.
DIAGENETIC MODIFICATION OF CLAY MINERAL TYPES IN ARTIFICIAL SEA WATER, by U. Grant Whitehouse and Ronald S. McCarter. Technical rept. on Oceanographic Survey of the Gulf of Mexico, Contract N7onr-48702. Mar 57, 65p. 33 refs. Reference 57-5T; AD-134 148.
Order from LC mi$3.90, ph$10.80 PB 137 559

Electron diffraction, electron miscroscopy, X-ray diffraction, and chemical analysis were used for detecting and measuring the extent of modification of clay materials at selected time intervals during a 5-yr period. Relative weight percents of 18.2 for chloritic-clay separates and 4.4 for illitic-clay separates were obtained after more than 4 yr of treatment. Chemical-analysis and electron-microscopy data suggested that latticular alteration preceded the development of 40 to 70% of the chloritic and illitic materials separated. The modification of montmorillonitic clay was more dependent upon the Mg-K ratio in sea water than upon the total salt-concentration levels. The limiting Mg-K ratio was approximately 9.4 with a limiting low K concentration of 0.005 mol/l for montmorillonitic material of less than a 0.5-μ settling diameter. The alteration of the montmorillonitic material was noted only for material that was initially settled through the artificial sea water columns. As the K concentration level of sea water dropped by extraction below 0.005 M, a bulk effect of the settling clay material became operative, and the relative percentage of altered clay material decreased. Further, the relative amounts of modified clay material detected were decreased by the introduction of carbohydrate material into the sea water media. The amounts present after a definite time interval were dependent upon the distributive tendencies of the source clay materials and the physical disturbance of the clay sea water systems. Resuspension of the clay material by reagitation of the systems decreased and significantly governed the rate of diagenetic modification.

Physics of the Atmosphere

Air Force Cambridge Research Center, Bedford, Mass.
THE ARDC MODEL ATMOSPHERE, 1959, by R. A. Minzner, K. S. W. Champion and H. L. Pond. Aug 59, 151p. 141 refs. Air Force Surveys in Geophysics no. 115; AFCRC-TR-59-267.
Order from OTS $2.75 PB 161 305

A model of the earth's atmosphere to 700 kilometers is given. Below 53 kilometers the present model is the same as The ARDC Model Atmosphere 1956. Above this height, changes have been made based on data deduced from rocket flights and from the rate of change of the orbital period of satellites. At approximately 600 kilometers the new model gives densities that are 20 times higher than the 1956 model. Below 600 kilometers the two models gradually come closer together and finally cross at about 150 kilometers. Between 90 and 150 kilometers the density for the 1959 model is lower, being about one half that of the 1956 model at 120 kilometers. At the present time, the maximum altitude at which density data from satellites has been obtained is just below 700 kilometers. For this reason, the tables end at 700 kilometers. Dashed lines in the plots present a tentative extrapolation of the data to 1000 kilometers. The value of the molecular weight, like other atomspheric properties, probably depends on both location and time. The 1959 model curve probably represents the molecular weight at high latitudes, such as Fort Churchill, where the experimental data were obtained. At lower latitudes the molecular weight may be nearer the curve given in the 1956 model.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
INTERNATIONAL SYMPOSIUM ON ATMOSPHERIC DIFFUSION AND AIR POLLUTION, 24-29 AUGUST 1958, OXFORD, ENGLAND, by H. G. Booker. Technical rept. no. 48 on Studies on Propagation in the Atmosphere, Contract DA 36-039-sc-74903. 23 Sep 58, 76p. 26 refs. Research rept. EE 388.
Order from LC mi$4.50, ph$12.30 PB 144 174

Papers on the following topics were given at this symposium: (1) General survey of atmospheric diffusion and pollution; (2) recent findings on atmospheric turbulence; (3) theory of turbulent diffusion; (4) diffusion of heavy or finite particles; (5) vertical transfer through the troposphere and stratosphere; (6) effects of thermal stratification on diffusion; and (7) pollution patterns from point and area sources.

Ionosphere Research Lab., Pennsylvania State U., University Park.
A COMPUTER PROGRAM FOR OBTAINING REFRAC-

TIVE INDICES AND POLARIZATIONS FROM THE APPLETON-HARTREE EQUATIONS AND MAGNETO-IONIC TABLES FOR CAPE CANAVERAL, by E. A. Mechtly. Scientific rept. no. 116 on Ionospheric Research, Contract DA 36-061-ORD-577. 15 Feb 59, 69p. 3 refs.
Order from LC mi$3.90, ph$10.80 PB 144 242

Program Cc 126 for the Pennsylvania State University's digital computer PENNSTAC is given. This program has been prepared for the computation from the Appleton-Hartree equations of magneto-ionic refractive indices and polarizations for both modes of propagation. Instructions for using this program are given. Magneto-ionic tables for Cape Canaveral, Florida are presented. These tables have been compiled for use in conjunction with the Ionosphere Research Laboratory's project for the determination of electron densities in the ionosphere by means of rockets.

Ionosphere Research Lab., Pennsylvania State U., University Park.
IONOSPHERIC ELECTRON DENSITIES FOR WASHINGTON D. C., PANAMA, TALARA, AND HUANCAYO FOR JANUARY-FEBRUARY-MARCH, 1958, by E. R. Schmerling. Scientific rept. no. 122 on Ionospheric Research, Contract AF 19(604)3875. 15 Aug 59, 245p. 3 refs. AFCRC-TN-59-603.
Order from LC mi$11.10, ph$37.80 PB 144 164

These tables have been computed from routine ionograms by the matrix method of Budden (1955). The details of the method as used here are more fully discussed by Schmerling (1957). 40x40 matrices were used, two matrices being computed for each station, to cover the ranges 1.6(0.2)9.6 mc/s. and 2.0(0.5)22 mc/s. For F2 critical frequencies below 10 mc/s. the former matrices were used, and for F2 criticals above 10 mc/s, the latter. In addition, if significant structural details were seen on ionograms with F2 criticals above 10 mc/s. the former matrices were used to determine the profiles in greater detail below 10 mc/s. The method takes full account of the earth's magnetic field, but ignores electronic collisions. No assumptions are made as to profile shape other than a monotonic variation of electron density with height.

Minnesota U., Minneapolis.
WINDS AND WIND STRUCTURE AT 100,000 FEET FROM CONSTANT ALTITUDE BALLOON TRAJECTORIES, by Homer T. Mantis. Final scientific technical rept. on Atmospheric Physics, Contract AF 19(604)2207. Apr 59, 255p. 4 refs. AFCRC-TR-59-243; AD-214 594.
Order from LC mi$11.10, ph$39.60 PB 144 323

The wind data from constant altitude balloon trajectories were analyzed by 2 methods. The structure of the winds on what might be called a conventional meteorological scale was made by measuring 3-hr average winds (some slightly longer or shorter if the fixes were irregular in time), from the trajectories plotted on the maps at 1:500,000 scale. By using a 3-hr period, the accuracy of the velocities is quite high and most of the remaining variation is comparable to the scale of motion analyzed on synoptic maps. The second type of analysis of the wind structure was an investigation of motions of smaller scale. The existence of smaller scale motions is quite evident in the trajectories at low wind speeds. Several of the flights show complete closed loops in the trajectories. To systematize the observations of wind structure at smaller scale, a type of spectral analysis of the wind measurements was made for higher level flights with camera trajectories.

New York U. Coll. of Engineering, N. Y.
THE SEMIDIURNAL PRESSURE OSCILLATION IN THE STRATOSPHERE, by B. Haurwitz. Scientific rept. no. 7 on Contract AF 19(604)1738. Oct 58, 18p. 3 refs. AFCRC-TN-58-603; AD-206 331.
Order from LC mi$2.40, ph$3.30 PB 137 889

The semidiurnal pressure oscillation was computed for one station pair in the southern U. S. at the 250- and 175-mb level, and for another in the tropical Pacific at the 200-mb level. The accuracy of these values of S_2 is not very great because of the lack of sufficient data. Values show that the pressure maximum is retarded aloft by about 1.5 hr, and that the amplitude increases upwards, in agreement with earlier conclusions based on data from the Caribbean.

ENGINEERING

Bureau of Yards and Docks, Washington, D. C.
WATER SUPPLY FOR ADVANCED BASES. 1 Nov 52, 62p. 7 refs. Technical pub. NAVDOCKS TP-PL-6.
Order from LC mi$3.90, ph$10.80 PB 144 110

This publication is developed as a guide to the selection of equipment that is available for the collection, treatment, and distribution of water (primarily for potable purposes) at advanced bases. It should prove very useful to the officer who is responsible for selecting the proper type and size of equipment for each set of circumstances and for making up allowance lists for various requirements, also to the officer in the field who has charge of water supply systems. This publication contains adequate descriptions of available equipment recommended for both temporary and semipermanent advanced bases, and establishes the criteria that govern the selection of particular systems and equipment for specific cases.

Institute of Tech., U. of Minnesota, Minneapolis.
SURVEY AND EVALUATION OF POWER SOURCES SYSTEMS. PART III. MECHANICAL COMPONENTS, by Adolph O. Lee, M. M. El-Wakil, and William A. Kleinhenz. Rept. for 15 Sep 53-1 Dec 55 on Contract DA 36-039-sc-56649. 1955,131p. 127 refs.
Order from LC mi$6.90, ph$21.30 PB 144 505

Mechanical components of power source systems are limited to those devices or means of transmitting power from a driving unit or prime mover to an electrical generator. Elastic energy storage has been investigated in two forms - solid material elasticity and liquid compressibility. At the present time solid material elasticity in the form of springs is the more practical. Springs serve well as a form of storage energy in limited amounts. Liquid compressibility will need further development before its use will become practical. Wind power has had the benefit of years of experimentation, but has not developed into a major means of providing power. Neither atmospheric pressure variations nor atmospheric temperature variations was found to contribute significantly as a potential energy source. An estimate of the potential availability of the energy consumed by man is provided in the report.

Aeronautical Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EMERGENCY ESCAPE CAPSULE STUDIES. PHASE I. PRELIMINARY LABORATORY FLOTATION STUDIES, by Allan P. Kearney, Billy J. Mills, and Ronald S. Huey. Rept. on Integration of Personal Equipment. June 59, 21p. WADC Technical rept. 59-247(I); AD-226 055.
Order from OTS $0.75 PB 161 042

Preliminary studies using aircraft canopy escape-type capsules are described. Design of capsule clothing, donning of clothing in confined space, stowage of emergency survival items, air exchange requirements, flotation, inhabitation and communication studies were conducted as individual facets of the program. The studies were culminated with a test in which a human subject remained in a closed capsule for 72 hours. Findings from these preliminary studies are presented. The capsule with an air exchange system successfully served as a temporary shelter while floating in a test pool for a period of 72 hours. Throughout the test, the hatch was closed to simulate a situation which might be necessary operationally only as a result of the most severe environmental conditions.

American Brake Shoe Co. [New York]
DEVELOPMENT OF LOW ALLOY STEEL COMPOSITIONS SUITABLE FOR HIGH STRENGTH STEEL CASTINGS, by Hugo R. Larson, Ronald C. Campbell, and Herbert W. Lloyd. Rept. for July 58-Jan 59 on Metallic Materials, Contract AF 33(616)5299. June 59, 116p. WADC Technical rept. 59-63.
Order from OTS $2.50 PB 161 044

Cast high strength alloy steels were investigated to develop compositions which had 12% elongation, 30% reduction of area and 15 ft. lb. impact strength when heat treated to 180,000 psi tensile strength. In addition the ultra high strength level was studied to determine the tensile strength at which a reduction of area in exceas of 10% could be maintained. A series of alloys based primarily on 4340 were poured. The optimum carbon content was established at approximately 0.35%. High purity raw materials had a definite beneficial effect on ductility both at the 180,000 psi and the ultra high strength level. Two vacuum melted heats met all of the above requirements quite easily. Air hardening die type steels were also inveatigated. Exceptionally good properties were obtained with high purity raw materials and a base analysis of about .30% carbon, 5% chromium, 1.50% molybdenum and 0.50% vanadium. Simple plate castings of varying thickness and length were poured to investigate the feeding characteristics of the 8740 type steel. Tensile bars cut from the castings had properties which correlated well with radiographic soundness of thin slices cut adjacent to the tensile specimens. Both the 8740 and the 5% chromium steels were poured in three typical airframe castings. Tensile properties in the castings were not as good as from test bars.

Army Chemical Warfare Labs., Army Chemical Center, Md.
CONDENSATION TRAIL ELIMINATION, by Bernard E. Simonson and Robert H. Frickel. Sep 59, 33p. 19 refs. CWLR 2304.
Order from LC mi$3.00, ph$6.30 PB 144 107

A theoretical and experimental study was conducted on the elimination of aircraft condensation trails. Various materials were added to the exhaust stream of a laboratory model pulse jet generator which burned JP-4 jet fuel. The exhaust products were conducted into a cold chamber maintained at -50°F where nuclei produced from (1) sublimating silver iodide, (2) a solution containing silver iodide, (3) a hydrophilic colloid, (4) a household detergent, and (5) reacting metallic silver with iodine were added to the exhaust. Most promise was shown when a solution containing silver iodide was injected into the exhaust stream. The optical density of the condensed cloud was decreased by 38.9% when compared to an untreated cloud.

Army Transportation Research and Engineering Command, Fort Eustis, Va.
HELICOPTER WEIGHT AND LOAD COMPUTER, by Gene C. Moen. June 59, 36p. Proj. 9-38-01-000, House Task 12.90.
Order from LC mi$3.00, ph$6.30 PB 144 128

This report contains an evaluation of the design and arrangement of a helicopter weight and load computer and a discussion of the development of optimum features for a computer. Results of the engineering and performance evaluation reveal that additional development of the computer body is required and that the optimum means of presenting the computer scale should be determined. It was concluded that a computer based on the technical characteristics, included in the report, will satisfy the Army's requirement for a helicopter weight and load computer. A contract has been let for the development of an optimum configuration of the computer.

Bureau Technique Zborowski (France).
THEORETICAL INVESTIGATION AND EXAMINATION BY MEASURING TESTS OF THE THRUST CONTROL BY RUDDERS UNIFORMLY FITTED AT THE OUTLET OF A DUCT. Final technical rept. for 1 July 58-30 Sep 59 on Contract DA 91-508-EUC-394. 10 Oct 59, 86p. 9 refs.
Order from LC mi$4.80, ph$13.80 PB 144 249

It is of great importance for VTOL aircraft to dispose at any moment of its ascensional or, at hovering flight, of the full thrust of the motor aggregate. In the case of COLEOPTERS, the ring airfoil permits fitting rudders at the outlet which can assume the role of control surfaces not only for changes of direction, but also for modification of the thrust. A computation method is given which is based on potential-flow theory, permitting the calculation of the thrust reduction in function of the rudder configuration (relative depth and deflection angle) and the flight speed. The method cannot take due account of viscosity influences, necessarily occurring for higher flight speeds at greater rudder deflections. Indeed, flow separation on the back of the rudders seriously changes the computed values, restricting by the perturbations due to its action, even the domain of rudder depths and deflection angles to be admitted. Moreover, the zone occupied by the detached flow reduces in a large extent the control possibilities of the rudder, necessitating special devices to avoid this, as e. g. tangential blowing at the rudder hinge. It seems to follow from calculations as well as from tests that the most favorable results can be expected for rudder depths of approximately 20% of the total wing length and within a range of deflections bounded to 60°. More investigations on boundary-layer behavior and on questions of boundary-layer control in threedimensional flow seem absolutely indispensable for a more pertinent theory than that proposed here.

David Taylor Model Basin, Washington, D. C.
THE PLANING CHARACTERISTICS OF A V-SHAPED PRISMATIC SURFACE WITH 70 DEGREES DEAD RISE, by James D. Pope. Dec 58, 18p. 11 refs. Rept. 1285.
Order from LC mi$2. 40, ph$3. 30 PB 144 217

This report is one of a series on the experimental investigation of the planing characteristics of a series of related prismatic surfaces. The principal planing characteristics have been obtained for a V-shaped prismatic surface having an angle of dead rise of 70 degrees. Wetted lengths, resistance, and center-of-pressure location were determined at speed coefficients from 2. 17 to 36. 85, and trims up to 30 degrees. Keel-wetted-length-beam ratios were extended to approximately 8. 0 in all cases where excessive loads or excessive spray conditions were not encountered.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
FUTURE APPLICATION TRENDS FOR TITANIUM AND STEEL IN MILITARY AIRCRAFT, by W. Stuart Lyman and Fred L. Bagby. 8 May 59. 7p. DMIC-M-17 memo. 17.
Order from OTS $0. 50 PB 161 167

deFlorez Co., Inc., Englewood Cliffs, N. J.
EVALUATION OF EXPERIMENTAL POINT SOURCES AND TRANSPARENCIES FOR HELICOPTER HOVERING FLIGHT SIMULATION DEVICE 2FH2. Rept. on Contract Nonr-1628(00). Feb 59, 72p. Technical rept. NAVTRADEVCEN 1628-11.
Order from LC mi$4.50, ph$12.30 PB 144 272

The visual display produced by the point light source and transparency originally furnished for Device 2-FH-2, an experimental helicopter hovering flight simulation device, and the visual display produced by a new light source and transparency for that device were evaluated by pilots. These evaluations were then compared to determine the relative merits of the original set and the new set of components. An appraisal of the usefulness of such a device for training was obtained also. The improved resolution obtained with the new light source is preferable to the greater brightness of the original one. The photographic techniques used in preparing the new transparancy result in a more realistic display than that obtained with the wholly hand-decorated original transparency. The dished shape of the new transparency is much more rigid than the old one but detracts somewhat from the realism. Three-dimensional objects give the most important cues in the display with horizon and earth texture next in importance. The distortion known as "bowl effect" is the most objectionable distraction. Simulation of all sorts of ambient weather conditions is greatly to be desired for training purposes. Some cockpit motion, even though limited, will add significantly to the effectiveness of the display.

Douglas Aircraft Co., Inc., Long Beach, Calif.
A DESIGN STUDY OF AN AIRCRAFT CARGO-HANDLING SYSTEM FOR HIGH-FLOOR AIRCRAFT. Rept. for 29 July 58-24 Apr 59 on High Floor Study, Contract AF 33(600)37569. 5 June 59, 118p. Engineering rept. LB-30108; WADC Technical rept. 59-264; AD-216 085.
Order from OTS $2. 50 PB 161 294

The purpose of this study is to investigate and design a cargo handling system for the following high-floor aircraft (C-54, C-97, C-118, C-121, KC-135, and the 1920 which is representative of the swing-tail jet transports). This cargo handling system would reduce the loading and off-loading time, thus effectively increasing the utilization of the aircraft. The wide variety of cargo compartment configuration represented by the high floor aircraft were thoroughly analyzed in order to derive a single pallet size which would provide the best utilization of the compartment space. The cargo handling system recommended as a result of the study utilizes rigid, flat pallets, 5 feet by 7 feet in size equipped with web cages for the consolidation and unitization of loads. Ball conveyors at aircraft door entrance provides omni-directional movement of the pallets for proper alignment between the guide rails in the aircraft. Roller conveyors on the floor permit moving the pallet to the proper location in the cargo compartment where quick action locking pins provide the restraint for flight. A self-contained loading capability, jettisoning problems, and application of the system to the Civil Reserve Air Fleet were also studied.

Giravions Dorand (France).
DESIGN STUDY OF THE FEASIBILITY OF FLYING-CRANE TYPE HELICOPTERS INCORPORATING THE JET-FLAP CONTROL SYSTEM. VOLUME I: TEXT, by R. Dorand and S. Tararine. Rept. on Contract DA 91-591-EUC-987, 30 Apr 59, 315p. 87 refs. Rept. no. 1088.
Order from LC mi$11. 10, ph$48. 60 PB 144 460

The object of this report is to study the feasibility of flying-crane-type helicopters incorporating the new and promising concept of the jet-flap control system, to determine the optimum crane helicopter configuration for carrying 20 to 30 tons of cargo a distance of 10 to 100 nautical miles and to estimate the operational costs of such a machine. The flying-crane helicopter program considered here is as follows: - Payload: 20 to 30 tons at sea level, under standard conditions, 10 to 20 tons under tropical conditions - Range: 10 to 100 nautical miles - Ferry range: 500 to 1500 nautical miles - Cruising speed: not less than 60 Kts - Hovering ceiling: 6000 ft at 95° F. Study of this program leads to the consideration of several design studies each including the jet flap control system.

Giravions Dorand (France).
DESIGN STUDY OF THE FEASIBILITY OF FLYING-CRANE TYPE HELICOPTERS INCORPORATING THE JET-FLAP CONTROL SYSTEM. VOLUME II: FIGURES AND CHARTS, [by R. Dorand and S. Tararine] Rept. on Contract DA 91-591-EUC-987. 30 Apr 59, 122p. Rept. no. 1088.
Order from LC mi$6. 30, ph$19. 80 PB 144 461

See PB 144 460

Hiller Aircraft Corp., Palo Alto, Calif.
INVESTIGATION OF A RESONANT BURNER CONCEPT, PHASE I, by R. M. Lockwood. Summary rept. on Contract Nonr-2458(00). 1 Dec 58, 50p. 5 refs. Rept. no. ARD-219.
Order from LC mi$3. 30, ph$7. 80 PB 144 289

A new resonant combustor concept has proceeded to the point of initial evaluation. A shrouded resonant combustor with multiple ejector-type air inlets has been constructed and demonstrated. The main purpose of this research has been to achieve a combustion that can take advantage of the qualities of resonant combustion (a combination of high combustion efficiency with a pressure rise during combustion) without suffering from the air inflow losses characteristic of resonant combustion with increasing airspeed.

Hiller Helicopters, Palo Alto, Calif.
TWO-PLACE OBSERVATION HELICOPTER: PRELIMINARY DESIGN STUDY, by John F. Straubel, ed. Rept. on Contract DA 44-177-tc-421. Aug 57, 136p. Rept. no. 57-76.
Order from LC mi$6. 90, ph$21. 30 PB 138 540

It is the purpose of this report to provide design and operational suitability evaluations of various specimen configurations and individual components within the Army two-place helicopter concept. The study scope has been limited to consideration of single main rotor --anti-torque rotor, mechanically driven helicopters. It has been the intention in compiling this report that it be usable not only as a supplement to the other study reports, but also as a handbook to which the Army can refer in establishing new configurations which may seem worthy of consideration.

Hiller Helicopters, Palo Alto, Calif.
TWO-PLACE OBSERVATION HELICOPTER: PRELIMINARY DESIGN STUDY. RECOMMENDATIONS. Rept. on Contract DA 44-177-tc-421. Aug 57. 28p. 1 ref. Rept. no. 57-77.
Order from LC mi$2. 70, ph$4. 80 PB 138 541

The following report provides Hiller Helicopters' recommendation to the Army for a lightweight, two-place helicopter for operations in the 1960-1970 decade. This material is supplementary to the Two-Place Helicopter Preliminary Design Study, which is presented separately in Report 57-76.

Kellett Aircraft Corp., Willow Grove, Pa.
DESIGN STUDY, ARMY TWO-PLACE HELICOPTER, by Arthur Jennings, J. A. Gaidelis and others. Rept. on Contract DA 44-177-tc-416. Aug 57, declassified 28 Apr 58, 216p. KAC rept. no. 124X90-1.
Order from LC mi$9. 60, ph$33. 30 PB 138 542

Presented in this report are the results of a design study of an Army Two-Place Helicopter which is designed for low-cost, reliability, ease of maintenance, and of smaller configuration size than present reconnaissance helicopters.

Nagler Helicopter Co., Glen Cove, N. Y.
PRELIMINARY DESIGN STUDY OF ARMY TWO-PLACE HELICOPTER, by Eugene K. Liberatore. Final summary rept. on Contract DA 44-177-tc-418. 6 Sep 57, 278p. 16 refs. Nagler rept. 190-F-1.
Order from LC mi$11. 10, ph$42. 60 PB 138 545

Submitted here is the preliminary study of a two place observation helicopter suitable for Army operations. The principle feature of the configuration is the powerplant and drive system in which the engine and crankcase are free to turn in opposite directions. The performance given in the Statement of Work is substantially satisfied with a helicopter of 1750 lbs. gross weight using a 180 HP Lycoming 0-360 Engine. A turbine driven version would have a normal gross weight of about 1500 lbs.

Chemical Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE PREPARATION OF FAR INFRARED FILTERS POTENTIALLY USEFUL FOR THE DETECTION AND ANALYSIS OF COMPOUNDS CONTAINING THE PHOSPHORUS-OXYGEN-ALKYL LINKAGE, by Arnold Prostak. 1 Oct 58, 10p. 10 refs. CWL Technical memo. 32-35.
Order from LC mi$1. 80, ph$1. 80 PB 144 035

Stable transmission filters have been prepared from talc and Fluorothene for the 10 micron infrared region with a half bandwidth of 0. 9 micron and a peak transmission of 77%. These filters are applicable to a

LOPAIR device for detecting compounds containing the phosphorus-oxygen-alkyl linkage. Replacing the present monochromator with filters should result in greater simplicity, reduction of cost and weight, and perhaps longer range.

Badger, W. L., Associates, Inc., Ann Arbor, Mich.
OPERATION OF PILOT PLANT LTV EVAPORATOR AT WRIGHTSVILLE BEACH, NORTH CAROLINA. Rept. for Nov 57-31 May 59. 30 July 59, 98p. 6 refs. Rept. no. 452; Office of Saline Water Research and Development Progress rept. no. 26.
Order from OTS $2.75 PB 161 290

The primary objective in the development of the W. L. Badger Long Tube Vertical Multiple Effect Evaporator for saline water conversion is to minimize the ultimate cost of producing potable water. To accomplish the primary objective, it is necessary to (1) prevent formation of scale on heating surfaces, and (2) minimize corrosion to permit use of inexpensive materials of construction. The work done leading to this report was guided in the direction of accomplishing the two secondary objectives. The pilot plant was built as a single effect Long Tube Vertical Evaporator supplemented by two Forced Circulation Evaporators. To insure results which could be translated to commercial installations, the system was built with sufficient flexibility to permit operation under the conditions which would exist in any effect of a twelve effect system including one stage of thermocompression. The experimental work was divided into four major classifications: (1) Rising film heat transfer, (2) Falling film heat transfer studies, (3) Scale prevention experiments, (4) Corrosion investigation.

[Massachusetts Inst. of Tech., Cambridge].
FILTRATION OF AEROSOLS, by D. F. Jergensen and R. P. Whitney. 9 Oct 42, declassified 27 Sep 58, 52p. 3 refs. Memorandum rept. M. I. T. - M. R. no. 11.
Order from LC mi$3.60, ph$9.30 PB 143 906

Some of the fundamental factors involved in aerosol filtration have been investigated; principally air velocity, size of fiber, degree of compression of filter pad, type of material, and charge on the smoke particles.

Polytechnic Inst. of Brooklyn, N. Y.
DEVELOPMENT OF EMERGENCY DESALTING KIT, by H. P. Gregor, H. Jacobson and R. Dogan. Final rept. on Contract NObsr-65586. 26 Feb 57, 43p. AD-140 611.
Order from LC mi$3.30, ph$7.80 PB 138 487

Work was undertaken to design, develop, and furnish 2 prototype models of portable desalting unit capable of producing potable water from live sea water by a single pass through an ion-exchange film. Sulfonic cation-exchange membranes were prepared by the interpolymer solution technique. Concentration potentials were 15.5 mv in 0.2 M solutions, compared to a theoretical maximum of 16.1 mv; resistances ranged upwards from about 5 ohm sq cm. Films were incorporated onto microfilter porcelain disks. To prevent the membranes from swelling, several techniques designed to cross-link the matrix were investigated; physical and electrochemical properties were not improved. Interpolymer membranes were subjected to aqueous solutions under a pressure head of about 2000 psi; the films were essentially impervious to water. Water-transport and salt-rejection studies as a function of time were performed. Salt solutions of varying concentrations were opposed to sugar solutions of varying concentrations, and significant desalting was found. Interpolymer membranes were used to separate dry fructose from 0.59 M (3.45%) NaCl solutions. Resulting fructose solutions (via osmosis) of 60-70% H_2O (by weight and of 0.4-0.8% NaCl were obtained. Prototype desalting bags for demonstration purposes were fabricated. This method for desalting sea water will not only provide potable water, but also a food substance. Assuming a 65% water solution of fructose and water, a volume ratio (volume of H_2O/volume of fructose) of 3.97 and an analogous weight ratio of 2.47 is obtainable.

Civil Engineering

Bureau of Yards and Docks, Washington, D. C.
HOUSING AND SUBSISTENCE FACILITIES. 15 May 54, 85p. 12 refs. Technical Pub. NAVDOCKS TP-Pw-23.
Order from LC mi$4.80, ph$13.80 PB 144 109

This publication is intended primarily as a guide for civilian and military personnel responsible for planning, designing, and constructing housing and subsistence facilities at naval shore activities. Reference is occasionally made to maintenance features. Part A presents the general authority under which this Bureau provides public works and public utilities, including housing and subsistence facilities. Part B deals with family quarters, including married officers' quarters, married enlisted men's quarters, and married civilian personnel quarters. Part C data cover planning and architectural requirements for bachelor officers' quarters, male and female. Part D gives data for enlisted men's barracks, enlisted women's barracks, and subsistence facilities. Part E describes commissary stores, including organization and architectural requirements. Part F presents the planning and layout of bread and pastry bakeries, also bread-baking and bread-handling equipment. Part G describes the location and design of laundries, including functional planning and equipment.

Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
PREDICTION OF "WES CONE INDEX" BY MEANS OF A STRESS-STRAIN FUNCTION OF SOILS, by Zoltan Janosi. Feb 59, 28p. 2 refs. Rept. no. 46.
Order from LC mi$2.70, ph$4.80 PB 144 410

The "cone index" developed by the Waterways Experiment Station (WES) of the Corps of Engineers for the purpose of estimating soil trafficability may be calculated with acceptable accuracy from the appropriate empirically defined stress-strain function of the given terrain. Methods for the determination of that function and the equations which express it were developed by the Land Locomotion Laboratory and successfully used in the prediction of the "cone index."

Stanford U., Calif.
INVESTIGATION OF SHEAR WALLS. PART 12: STUDIES OF REINFORCED CONCRETE SHEAR WALL ASSEMBLIES, by Jack R. Benjamin and Harry A. Williams. Technical rept. no. 10 on Contract DA DA 49-129-eng-193. Dec 56, 224p. 11 refs. AFSWP 891; AD-145 422.
Order from LC mi$9.90, ph$34.80 PB 138 121

Models tested were one and two story assemblies containing two or three shear walls connected by diaphragms in all cases. Some assemblies contained front and back face walls also. The distribution of load in three wall structures is largely dependent on the rigidity of the foundation structure and the supporting soil.

Stanford U., Calif.
INVESTIGATION OF SHEAR WALLS. PART 13: FINAL REPORT-SUMMARY OF RESULTS OF STUDY OF REINFORCED CONCRETE AND BRICK WALLED BENTS UNDER STATIC SHEAR LOADING, by Jack R. Benjamin and Harry A. Williams. Technical rept. no. 11, 31 Mar 51-31 Dec 56, on Contract DA 49-129-eng-193. Dec 56, 40p. 12 refs. AFSWP 892; AD-145 423.
Order from LC mi$3.00, ph$6.30 PB 138 115

Methods of predicting the behavior of one-story reinforced concrete and brick shear walls are given. Various parameters affecting the problem are reviewed briefly. The investigation was restricted to static loading. (See also PB 138 121)

Electrical and Electronic Engineering

Aero Geo Astro Corp., Alexandria, Va.
AN INVESTIGATION OF POLARIZATION RESPONSE FOR RADIATION OVER A FINITE CONDUCTING PLANE, by Duncan M. Bowie. Scientific rept. no. 1 on Contract AF 19(604)5481. 19 Oct 59, 49p. 5 refs. AFCRC-TN-59-772.
Order from LC mi$3.30, ph$7.80 PB 143 996

This report describes an investigation of the radiation patterns obtained from a feed located close to a ground plane. It considers a new technique for increasing the available power in a plane containing the finite ground plane. In particular, the well-known limitations of the horizontally polarized signal were investigated and a technique was developed for enhancing this signal. Improved horizontal polarization response was obtained by using a grounded dielectric foam structure with thickness of the order of a few wavelengths. This structure was extended over the ground plane to provide improvement in horizontal polarization response. Data is given in terms of beam position for a variety of foam dielectric configurations. With a sufficient amount of foam, pattern characteristics are obtained approximately equal to those of the feed in free space. Vertical polarization data regarding beam position is also provided and an Appendix contains the detailed radiation patterns for both polarizations.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
DESIGN CONSIDERATIONS OF A STEADY DC MAGNETOHYDRODYNAMIC ELECTRICAL POWER GENERATOR, by George W. Sutton. Rept. on Contract AF 04(647)269. 15 Sep 59, 50p. 8 refs. Technical Information Series R59SD432.
Order from LC mi$3.30, ph$7.80 PB 144 200

The design of an mhd generator has been considered, including the length, pressure, magnetic field strength and losses. The geometry chosen is a straight channel of variable cross-section. Only DC power generation is considered utilizing temperatures which may be obtained from conventional thermal sources. Losses due to high exhaust temperature, ohmic heating, wall cooling, magnet power and end effects are amenable to control. As far as magnet power is concerned, indications are that these losses are approximately constant. The implication is that the mhd generator should be large, and formulae are given to determine the various losses for different size units. Since the exhaust gases from the mhd generator are very hot, these gases must be utilized further to obtain a reasonable overall thermal effeciency.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
ELECTRICAL AND PRESSURE LOSSES IN A MAGNETOHYDRODYNAMIC CHANNEL DUE TO END CURRENT LOOPS, by George W. Sutton. Rept. on Contract AF 04(647)269. 22 July 59, 47p. Technical Information Series R59SD431.
Order from LC mi$3.30, ph$7.80 PB 144 189

The problem of end losses in a magnetohydrodynamic flow has been studied for incompressible inviscid flow in a rectangular channel. Termination of the magnetic field at the ends of the electrodes leads to electrical losses which increase with decreasing aspect ratio of the electrode section of the channel. The losses are also increased with increasing values of the generator coefficient. These electrical losses can be corrected by extensions of the magnetic field beyond the electrode region, but these corrections adversely affect the net pressure change through the device.

Air Force Cambridge Research Center, Bedford, Mass.
SURVEY OF RECENT GEOMETRIC-ANALYTIC WORK ON IMPEDANCE, POWER, AND NOISE TRANSFORMATIONS, by E. Folke Bolinder. May 59, 22p. 50 refs. AFCRC-TR-59-146; AD-215 821.
Order from LC mi$2.70, ph$4.80 PB 144 431

A survey is made of recent geometric-analytic work on impedance, power, and noise transformations. Three basic research publications treating impedance, power, and noise transformations through bilateral 2-port networks are briefly outlined. Analytically, the transformations consist in conformal, projective, and affine transformations. Geometrically, they are performed in the complex plane, in the Cayley-Klein models of 2- and 3-dimensional hyperbolic space, and in the Minkowski model of 4-dimensional Lorentz space.

Air Force Missile Test Center, Patrick AFB, Fla.
MAGNETIC TAPE COPY STATION, by C. R. Scott and W. H. Bulter. 12 Aug 58, 15p. AFMTC-TR-58-18; AD-157 101.
Order from LC mi$2.40, ph$3.30 PB 144 318

This paper outlines in a detailed manner the operation of the Magnetic Tape Copy Station presently operational at the Air Force Missile Test Center.

American Electronic Labs., Inc., Philadelphia, Pa.
OMNIDIRECTIONAL ANTENNA SYSTEM AS-631 (XE-2)/U, by Milton Nussbaum. Final rept. for 1 July 55-1 Nov 56 on Contract DA 36-039-sc-64679. [1956] 91p. 5 refs. AD-133 954.
Order from LC mi$5.40, ph$15.30 PB 137 518

Efforts to develop a transportable antenna system capable of receiving vertically polarized electromagnetic energy throughout the 20- to 120-mc range resulted in the development and construction of the AS-631(XE-2)/U system. A rod-type discone antenna, mounted on a telescoping mast, was developed to meet the electrical and mechanical requirements. The frequency coverage was accomplished by splitting the range into low (20 to 62 mc) and high (62 to 120 mc) bands for correlation with the TLR-1 receiving system. Each band requires a separate disk, but both bands have common cone rods. The high-band discone will operate on top of the telescoping mast (24 ft above the ground), but the optimum operating position for the low-band antenna is as close to the ground as possible. The high-band antenna is useful up to 180 mc. The telescoping mast is adaptable for mounting the discone antenna.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J
DESIGN FOR EASE OF MAINTENANCE, by Samuel J. Lanzalotti. 17 July 57, 25p. Technical memo. no. M-1905; AD-144 088.
Order from LC mi$2.70, ph$4.80 PB 138 095

The problems associated with the maintenance of electronic equipment are discussed to indicate some of the difficulties correctable by proper design. Design for ease of maintenance is concerned with keeping the equipment in operation with a minimum down time alloted per malfunction and with designing equipment capable of being maintained by personnel with training equal to that normally required to operate the equipment. Discussions are included on the designers responsibility, specification and designing for maintainability, and the principles of design for ease of maintenance.

Bell Telephone Labs., Inc., Whippany, N. J.
AN ULTRA-PRECISE STANDARD OF FREQUENCY, by A. W. Warner. Interim rept. no. 9, 13 July 58-9 Jan 59, on Contract DA 36-039-sc-73078. 23 Jan 59, 29p. 2 refs. Rept. no. 27480-H.
Order from LC mi$2.70, ph$4.80 PB 144 300

This report includes a discussion of a new phase of the work, the development of a ruggedized high-precision crystal unit capable of maintaining 1 pp 10^9 in an environment incumbent to missile-borne use, and the continuation of work leading to an improved ground station oscillator. One preliminary model of the 5-mc missile crystal unit has been made to obtain dimensional data. Two models of the 2.5-mc ground station crystal unit have been made using thermo-compression bonding, and testing has begun. Vibration equipment, and a centrifuge and oven have been obtained to test the missile crystal unit. A welder and an ultrasonic cleaner have been obtained for use in crystal unit fabrication. An experimental 5-mc transistor oscillator has been designed and built. An improved 2.5-mc three-stage oscillator has been constructed. (See also PB 142 641)

Birmingham U. (Gt. Brit.).
CHARACTER RECOGNITION. Annual rept. for period ending 30 Sep 59 on Contract DA 91-508-EUC-361. [1959] 23p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 144 238

The five-unit telegraph code is a non redundant code, in as far as all the possible combinations of mark and space digits, except five spaces, are used, and further consideration of the question of correlation detection applied to the recognition of the characters of a non-redundant code showed that there was no advantage over 'digit-by-digit' recognition. Tests were carried out on the recognition of signals from an 'alphabet' of the ten numerals 0 to 9 in a double difference (i.e. redundant) five-unit code using both correlation detection and normal teleprinter recognition. The former showed a considerable improvement in error rate. The amount of extra noise which can be tolerated using the correlation system varied from about 3db at low error rate to 6db at an error rate of about 30%. In the double difference code used each character is different from any other character in at least two and sometimes in four digits. Obviously the probability of a character being received as one different in four digits is less than that of it being received as one different in only two digits and the frequencies of occurrence of both these types of error were noted. The ratio of double difference to quadruple difference error was 263 to 1.

Collins Radio Co., Cedar Rapids, Iowa.
TEST SET, RADIO AN/ARM-22(XN-1) by K. L. Fletcher. Rept. on Contract NOas-52-623-c. 1 Feb 57, 27p. Rept. no. CER-526; AD-127 239.
Order from LC mi$2.70, ph$4.80 PB 144 378

The purpose of work on Radio Test Set AN/ARM-22(XN-1) was to design and develop suitable test equipment for maintenance of Radio Set AN/ARN-21 and associated equipment. The equipment includes six major units as shown in figure 1. Together these units provide complete test facilities for airborne

TACAN equipment. Included are provisions for simulating either the r-f signals received from an AN/URN-3 surface beacon or the corresponding video signals. Also included are channel selection facilities, complete instrumentation, r-f power-measuring circuitry, and other functions necessary for testing of all military airborne TACAN equipment.

Courtney and Co., Philadelphia, Pa.
THE CONTROL OF SPECULAR REFLECTIONS FROM BRIGHT TUBE RADAR DISPLAYS, by Kenneth W. Colman, Douglas Courtney and others. Technical rept. on Contract Nonr-2346(00). 15 Nov 58, 25p. 13 refs. Rept. no 23.
Order from LC mi$2.70, ph$4.80 PB 144 316

Diamond Ordnance Fuze Labs., Washington, D. C.
ANALYSIS OF POWER DISSIPATION IN A TWO-TRANSISTOR FLIP-FLOP, by Philip Emile, Jr. 14 Aug 59, 11p. 2 refs. DOFL rept. TR-746; AD-226 075.
Order from LC mi$2.40, ph$3.30 PB 144 227

The design of an Eccles-Jordan 2-transistor flip-flop is completely determined if one specifies: the output power, V_O^2/R_{EXT}, required in each of 2 symmetrical loads (R_{EXT}); the ratio, K of the output voltage to the collector supply voltage ($K = V_O/V_{CC}$); and the minimum β, β/S, of the transistor. An expression for the power dissipation in the collector resistors of the flip-flop is derived in terms of the above parameters. It is found that the power dissipation varies inversely with β/S. It is further shown that even for $\beta/S \rightarrow$ and K taken at its optimum value that the minimum power dissipated in the circuit is at least 4.8 times the power dissipated in the load ($4.8\ V_O^2R_{EXT}$). This gives a maximum efficiency (Power Out/Power In $= 1/5.8 \times 100$ percent) of 17.3 percent. Curves of maximum efficiency, optimum K and power dissipation versus β/S are included.

Diamond Ordnance Fuze Labs., Washington, D. C.
FLAT ARCHIMEDEAN SPIRAL ANTENNA: PRINCIPLES AND APPLICATIONS, by J. A. Kaiser. 15 Aug 59, 38p. 14 refs. TR-726.
Order from LC mi$3.00, ph$6.30 PB 144 228

A pair of equally excited but oppositely sensed Archimedean two-wire spirals situated close to one another in the same plane - a doublet - is used to generate a linearly polarized field in which the direction of polarization and phase are controlled or varied independently by rotation of the spiral radiators. An array of these doublets can be made to scan by rotation of the several spiral elements; an eight-doublet array which was made to scan over an 83-degree sector with small amplitude variation is discussed. A doublet fed from a ring network can be employed as a polarization diversity circuit. A virtual doublet is achieved by placing a single spiral in a right-angle trough. A preliminary scanning array comprising four spirals in a trough was made to scan ± 36 degrees. The possibility of using a parasitic spiral in conjunction with a driven spiral for obtaining linear polarization of variable direction and phase is indicated. Also, a brief simplified analysis of the two-wire Archimedean spiral is presented, which leads to the concept of higher-order modes of radiation.

Diamond Ordnance Fuze Labs., Washington, D. C.
FURTHER EXTENSIONS OF LOOP ANTENNA THEORY, by J. Herman. 15 July 59, 52p. 12 refs. TR-756.
Order from LC mi$3.60, ph$9.30 PB 144 226

A complete mathematical solution for the thin wire loop antenna, and the subsequent development of the principle of "mode selection and suppression" using inserted distributed and/or lumped internal impedances have been previously reported in DOFL Reports TR-462 and TR-600. The original solution was expressed in the form of wave families, consisting of one TE family and two TM families. In the present report, the two TM families are consolidated into one, and the general solutions for currents, impedances and fields revised accordingly. The solutions are then extended to incorporate the effect of multiple feed points with or without arbitrary phase delays. The problem of a loop with a solid dielectric core is then reformulated, and extended to the case of a hollow spherical dielectric core inclosing a spherical conducting core. It is shown that the basic loop element theory can be used to form the solution to an array of parallel, coaxial, unequally spaced, and unequal size loops, driven or parasitic. The results lead to a high degree of control over radiation coverage, and indicate further possible advantages, such as electronic beam scanning. The use of the theory developed can aid in antenna design to a great extent. The possibilities have not been completely explored. Further work will probably prove quite profitable.

Diamond Ordnance Fuze Labs., Washington, D. C.
LOW-ALTITUDE FM ALTIMETER, by Philip W. Boesch and Kermit E. Hardinger. 10 Aug 59, 23p. 5 refs. Technical rept. TR-740; AD-225 570.
Order from LC mi$2.70, ph$4.80 PB 144 170

With the recent emphasis on aircraft navigation safety, effort has been directed toward developing an altimeter capable of providing adequate altitude information for blind landings. Application of fuzing principles invented at DOFL has led to a radio altimeter which accurately (5 percent) measures distances from 5 ft to several thousand. This altimeter has been designed to furnish the pilot altitude information accurate enough throughout flareout and landing to enable him to make a safe instrument landing. The altimeter could also be adapted to supply this information to a computer for an automatic landing system. This is a signal-seeking altimeter that searches in frequency until a signal is found, then locks on and tracks it. If the signal fades out or is otherwise lost, the system will resume searching until recaptured by the signal. A warning device indicates loss of signal. The basic FM system uses jittered (nonperiodic) triangular modulation of a reflex klystron. This produces a jittered FM transmitted signal, which, when mixed with the return signal, produces an instantaneous difference frequency proportional to the distance from the ground. The aperiodicity eliminates critical distance and range ambiguities. The altimeter has been tested with a moving corner-reflector target out to several hundred

feet and flight tested in a helicopter to 1000 ft. with good results.

Eagle-Picher Co., Joplin, Mo.
SERVICES, FACILITIES AND MATERIALS TO CONDUCT INVESTIGATIONS LEADING TO THE DEVELOPMENT OF RESERVE TYPE BATTERIES (LOW TEMPERATURE). Final rept. on Contract DA 36-039-sc-72413. 7 July 57, 25p. AD-145 981.
Order from LC mi$2.70, ph$4.80 PB 138 421

A completely potted, water-activated battery was developed which meets the physical requirements of the BA-2270/U. The capacity of the battery at -40°F under high-wind-velocity conditions is limited to about 2 hr for the A unit and 4 hr on the B batteries. From 4 to 5 hr of life is possible under carefully controlled conditions. The optimum temperature for the battery is 165°F; the system was considered too critical for general usage. Water-activated batteries liberate heat at rates proportional to their internal temperature as well as the current they are delivering. The batteries can fail by spiraling temperatures which finally boil the unit dry or by cooling which causes a degeneration of chemical action and allows the units to freeze. The temperature band in which a successful battery can be built becomes more narrow with a required longer operation.

Electrical Engineering Research Lab., U. of Texas. Austin.
AN INVESTIGATION OF THE FEASIBILITY OF USING THE BROOKS ANTENNA SYSTEM AT L-BAND, by A. P. Deam, F. E. Brooks, Jr. and A. N. McQuown. Rept. on Contract NObsr-64126. 30 Nov 54, declassified 5 July 57, 65p. 2 refs. Rept. no. 8-02; AD-72 760.
Order from LC mi$3.90, ph$10.80 PB 137 808

This report concerns the adaptation of the Brooks Antenna System as a height finding radar in connection with the AN/TPS-1D radar. The first phase of this contract dealt with studying the feasibility of the system in view of the problems involved. Signal strengths versus elevation of a transmitter at a frequency of 1175 mc are reported over various types of terrain. From these height-gain curves estimates of the performance of a double interferometer used as a height finder were made. The results are presented in the form of distribution curves showing the percentage of time a particular accuracy is reached. The results show that with an interfering signal whose magnitude is 14 db below that of the direct ray the measured elevation angle will be in error by less than 0.2° for 25% of the time. A method is proposed, utilizing a balanced modulator principle, for developing frequency shifts that are equivalent to those normally produced by a continuously varying phase shifter. It is felt that the results of this first phase of the program are encouraging and that work should proceed to the second phase, the construction of a working model of the system.

Electronic [Tech. Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TECHNIQUES FOR APPLICATION OF ELECTRON TUBES IN MILITARY EQUIPMENT (TUBE TYPES OTHER THAN RECEIVING TUBES) by Rex S. Whitlock. Compiled into book form by McGraw-Hill Book Co. under Contract AF 33(616)3551. Dec 58, 206p. 13 refs. WADC Technical rept. 58-446, Vol. I; AD-205 363.
Order from OTS $3.50 PB 151 979

This report is part of a series of reports covering the application of electron tubes in military electronic equipment. The information contained in the reports is presented as a guide to the engineer so that he can more fully utilize electron tubes with the greatest degree of reliability. The first report of this series, WADC TR 55-1 (PB 111 644R), dated October 1957, covers receiving type tubes and also gives general information on tube properties, ratings, characteristics, and application. This manual is Volume 1 of the second report, which covers microwave and special purpose tubes. Volume 1 contains general information about pulsed magnetrons, diode rectifiers, thyratrons, transmitting triodes, and transmitting tetrodes. Special data are also given for certain tube types.

Electronic Tech. Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TECHNIQUES FOR APPLICATION OF ELECTRON TUBES IN MILITARY EQUIPMENT (TUBE TYPES OTHER THAN RECEIVING TUBES) by Rex S. Whitlock. Compiled into book form by McGraw-Hill Book Co. under Contract AF 33(616)3551. June 59, 189p. 9 refs. WADC Technical rept. 58-446, Vol. II; AD-215 429.
Order from OTS $3.00 PB 161 088

This manual covers microwave and special purpose tubes. This volume contains general information about twin tetrodes, vacuum rectifiers, grid-controlled rectifiers, transmitting clipper diodes, gas switching tubes, cathode ray tubes, klystrons, and multiplier phototubes. Specific data are also given for certain tube types. (See also PB 151 979)

Electronics Research Lab., U. of California, Berkeley.
ELECTRON AND PLASMA BEAM DYNAMICS, by A. J. Litchenberg, D. H. Sloan and others. Scientific rept. no. 3 (Interim annual rept.) for 1958-1959 on Contract AF 19(604)2270. 15 June 59, 57p. 18 refs. IER Series no. 60, issue no. 238; AFCRC-TN-59-565.
Order from LC mi$3.60, ph$9.30 PB 144 498

Studies cover the following: Vacuum tubes; Cross-field gaseous tubes; Parallel-field gaseous tubes; Semiconductor properties of ionized gas; and Plasma as a means of microwave amplification. (See also PB 137 474)

Erie Resistor Corp., State College, Pa.
ENERGY STORAGE CAPACITATORS, HIGH DIELECTRIC CONSTANT, by Lawrence J. Ruffner. Interim development rept. no. 2, 13 July-13 Oct 59, on Contract NObs-77554. [1959] 102p.
Order from LC mi$5.70, ph$16.80 PB 144 254

Developing a ceramic composition suitable for fabrication of finished capacitors. Barium titanate-magnesium fluoride compositions have been satisfactorily reproduced with some improvement in dielectric constant.

General Electric Microwave Lab., Palo Alto, Calif.
COMPUTER APPLICATIONS, by V. Met and M. P. Forrer. Quarterly progress rept. for 1 Aug-30 Sep 58 on Contract Nonr-2127(00). [1958] 3p. Rept. R58ELM 79-3.
Order from LC mi$1.80, ph$1.80 PB 144 446

Efforts were concentrated on the task of putting the assembled recirculative pulse generator into operation. An automatic gain control could be provided, and a six cavity bandpass filter of 600 mc bandwidth and 0.2 db ripple in the passband has been constructed. The match of components in the circuit was perfected to an excellent standard. External gain modulation was also accomplished from a conventional 10 to 50 mc signal generator, corresponding to the desired pulse repetition rate.

General Electric Microwave Lab., Palo Alto, Calif.
COMPUTER APPLICATIONS, by V. Met and M. P. Forrer. Quarterly progress rept. for 1 Oct-31 Dec 58 on Contract Nonr-2127(00). [1958] 13p. 1 ref. Rept. R 59 ELM 79-4.
Order from LC mi$2.40, ph$3.30 PB 143 986

During the reporting period the regenerative pulse generator with traveling-wave tube expander was put into successful operation. The pulses obtained approach the limits of the resolution of our present test equipment. Thus, having demonstrated the realizability of our suggested scheme, the effort on the contract was temporarily diminished with the contract funds 75 per cent expended. It is felt that a three-month extension of the contract would give us time to evaluate and perfect our present results, which are highly encouraging. (See also PB 139 828)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by James C. Hogg, Jr. Progress rept. no. 1, 15 Mar-15 June 54, on Contract DA 36-039-sc-56730. [1954] 19p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 138 476

Circuit studies indicate that modification of the present C.I. Meter circuit to incorporate a two-stage amplifier should give reliable operation at frequencies above 150 mc with crystals having resonant resistances equal to or less than 200 ohms. An experimental Impedance-Inverting Pierce Oscillator has been constructed and tested for applicability as a high-frequency crystal test set.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by James C. Hogg, Jr. and Douglas W. Robertson. Progress rept. no. 2, 15 June-15 Sep 54, on Contract DA 36-039-sc-56730. [1954] 29p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 477

A two-stage version of the C. I. Meter circuit has been constructed and satisfactory operation obtained at 132 mc with substitution resistors having values well in excess of 200 ohms. Phase-detection system and a bridge system for measuring the resonant frequencies of crystals have been investigated. (See also PB 138 476)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley and Douglas W. Robertson. Progress rept. no. 3, 15 Sep-15 Dec 54, on Contract DA 36-039-sc-56730. [1954] 29p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 138 478

A study of the VHF impedance characteristics of low-value resistors with particular attention to the development of low-phase-angle potentiometers and other components to be utilized in various bridge configurations contemplated for use in future C. I. Meters. A two-stage line-coupled oscillator circuit has been developed. (See also PB 138 477)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley and Douglas W. Robertson. Progress rept. no. 4, 15 Dec 54-15 Mar 55, on Contract DA 36-039-sc-56730. [1955] 36p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 138 479

Development of a VHF rheostat to cover a resistance range of 10 to 200 ohms with an acceptably low phase angle from 75 to 200 mc. The bridge system of crystal parameter measurement is very promising. (See also PB 138 478)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley, Douglas W. Robertson, and Thomas R. Scott, Jr. Progress rept. no. 5, 15 Mar-15 June 55, on Contract DA 36-039-sc-56730. [1955] 28p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 138 480

Preliminary studies have been made to determine the effect of drive on the parameters of high-frequency overtone crystals. The frequency and R_e deviations experienced make evident the necessity of specifying the drive or power dissipation in the proposed high-frequency C. I. Meter. (See also PB 138 479)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley, Douglas W. Robertson, and Thomas R. Scott, Jr. Progress rept. no. 6, 15 June-15 Sep 55, on Contract DA 36-039-sc-56730. [1955] 23p.
Order from LC mi$2.70, ph$4.80 PB 138 481

Several sets of VHF rheostats have been constructed. Metals of the platinum family are undergoing tests as possible substitutes for nickel. An analysis of a practical method for determining all the equivalent electrical parameters of an active quartz crystal. (See also PB 138 480)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by William B. Wrigley, Douglas W. Robertson, and Thomas R. Scott, Jr. Progress rept. no. 7, 15 Sep-15 Dec 55, on Contract DA 36-039-sc-56730. [1955] 23p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 138 482

Additional measurements of the harmonic distortion present in the Two-Tube Developmental C. I. Meter. A study of several methods of eliminating or reducing the harmonic content of the companion oscillator. (See also PB 138 481)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, Thomas R. Scott, and William B. Wrigley. Final rept. on Contract DA 36-039-sc-56730. 31 May 56, 114p. 15 refs.
Order from LC mi$6.00, ph$18.30 PB 138 483

Contains resume of work in seven previous quarterly progress reports. The final model of the developmental VHF crystal consists of a combination of three basic developmental devices which have been designated as the VHF Rheostat, the Crystal Parameter Bridge and the Developmental CI Meter. A VHF rheostat minimizes reactive effects and, being variable, eliminates the necessity of interpolation. Several alternate bridge arrangements and additional VHF oscillator configurations are also included. (See also PB 138 482)

Hughes Aircraft Co., Culver City, Calif.
MAXIMALLY FLAT AND QUASI-SMOOTH SECTOR BEAMS, by A. Ksienski. Scientific rept. no. 3508/2 on Contract AF 19(604)3508. July 59, 38p. AFCRC-TN-59-581.
Order from LC mi$3.00, ph$6.30 PB 143 975

Methods for the synthesis of sector beams are presented and illustrated with examples. First a perfectly smooth and square beam, the equivalent of the maximally flat transfer function of network theory, is discussed. It is then shown that realization of such beams by means of relatively short arrays is feasible when a certain amount of oscillation is permissible. An alternative method of obtaining almost equal ripple sector beams is also presented. In this quite general method, the desired beam shapes are synthesized by derivation from elementary optimum patterns.

[Kuthe Labs., Inc., Newark, N. J.].
INDUSTRIAL PREPAREDNESS STUDY ON HYDROGEN THYRATHRON TUBES TYPE VC1257, by A. E. Gordon. Quarterly progress rept. no. 6, 1 Oct-31 Dec 57 on Contract DA 36-039-sc-70288. [1958] 10p. AD-218 438.
Order from LC mi$1.80, ph$1.80 PB 138 097

Following successful life tests, production of a revised new design tube was initiated. An excellent yield was obtained and additional life tests were satisfactory. Ten tubes were selected for qualification approval tests and delivery on the contract. (See also PB 132 080)

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
THE AUTOMATIC DESIGN OF LOGICAL NETWORKS, by T. C. Bartee. Rept. on Contract AF 19(122)458. 3 Dec 58, 27p. 9 refs. Technical rept. no. 191; AD-207 170.
Order from LC mi$2.70, ph$4.80 PB 143 826

The operation of a logical network can be described by means of a set of Boolean expressions which represent, in symbolic form, the relationship between the inputs and outputs of the network. As the number of inputs and outputs to the network increases, however, the complexity of these equations increases significantly and the amount of calculation required to solve certain problems becomes prohibitive. In order to facilitate the design of large networks, a set of computer programs has been prepared which generates the expressions that describe the input-output relationships for given problems, and then automatically minimizes these expressions, presenting the logical designer with a set of expressions which can be used to design the required network most efficiently. This design technique makes possible the construction of logical networks which perform such functions as sine, arc sine and square root. When these networks are used as a part of the arithmetic element of a digital computer, these functions may be yielded by a single instruction, significantly reducing the time required to solve certain problems. The latter section of this report describes a sine instruction which replaces an angle with the sine of that angle, in less than 10 μsec.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIGITAL RATE SYNTHESIS FOR FREQUENCY MEASUREMENT AND CONTROL, by T. J. Rey. Rept. on Contract AF 19(122)458. 30 Oct 58, 17p. 5 refs. Technical rept. no. 188; AD-205 596.
Order from LC mi$2.40, ph$3.30 PB 144 224

Digital rate synthesis is a transformation of harmonic synthesis (beat methods) from the frequency to the time domain; the synthesis of harmonics is replaced by pulse techniques. The signal whose period is to be measured or controlled is in the form of a pulse train

that has the repetition rate X. A single reference source drives a rate generator which consists of one or more dividing stages in fixed cascade; the output of the generator is a sequence of nonuniformly spaced pulses whose average repetition rate AS is known from the independently controllable connection between the individual stages and their output bus. A rate difference detector compares the rates X and AS. The smoothed detector output has the proper sign and serves to indicate the magnitude of the difference or to reduce the difference in a closed loop, for example, by controlling a tuning motor. The range of direct operation is limited by pulse techniques, but digital and harmonic synthesis can be combined with division and with phase-lock methods to stabilize an oscillator over a practically unlimited band of frequencies, the precision and purity approaching that of the reference source.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFECTS OF THE FILTER IN OSCILLATOR SYNCHRONIZATION, by T. J. Rey. Rept. on Contract AF 19(122)458. 14 May 58, 21p. 13 refs. Technical rept. no. 181; AD-133 854.
Order from LC mi$2.70, ph$4.80 PB 144 301

Automatic phase control (APC) systems with sinusoidal reference are analyzed; expressions are presented for the stability and the noise bandwidth at lock. The limit of the pull-in range is determined, and the result is in good agreement with experiment.

Litton Industries, College Park. Md.
SURFACE WAVE ANTENNA STUDY, by Murray Hoffman. Final rept. on Contract AF 19(604)1551. [1959] 95p. 14 refs. AFCRC-TR-57-188; AD-133 637.
Order from LC mi$5.40, ph$15.30 PB 138 427

The basic array parameters useful to the antenna designer were investigated during the study. These included relative slot excitation, ground plane current distribution, control of phase, a study of the normalized impedance of the slots, the radiation efficiency of the antenna, and the development of production techniques. The various methods for launching the wave onto the ground plane were not covered in the study. Instead, a horn launcher similar to one used by King was employed to couple to the mode and its characteristics were taken into account in the analysis.

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON MAGNESIUM BATTERIES, DRY CELL TYPE BA-270/U-XM, by George H. Schroeder. Quarterly progress rept. no. 10, 8 Mar-7 June 57, on Contract DA 36-039-sc-66081. [1957] 8p. AD-157 210.
Order from LC mi$1.80, ph$1.80 PB 138 105

The basic design of the cell loading machine has been completed. There has been no cell fabrication during this period. (See also PB 129 922)

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON MAGNESIUM BATTERIES, DRY CELL TYPE BA-270/U-XM, by George H. Schroeder. Quarterly progress rept. no. 11, 8 June-7 Sep 57, on Contract DA 36-039-sc-66081. [1957] 8p. AD-157 208.
Order from LC mi$1.80, ph$1.80 PB 138 104

The design of the cell loading equipment has been completed and fabrication is quite well along. (See also PB 138 105)

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON MAGNESIUM BATTERIES, DRY CELL TYPE BA-270/U-XM, by George H. Schroeder. Quarterly progress rept. no. 12, 8 Sep-7 Dec 57, on Contract DA 36-039-sc-66081. [1957] 10p. AD-157 209
Order from LC mi$1.80, ph$1.80 PB 138 106

The machine for loading the lined Mg cups with mix was completed. The machine receives the mix from a hopper, mechanically extrudes it into molds and dies, and subsequently pushes the mix from the mold into a positioned, lined Mg cup. Experiments indicated that the machine will operate satisfactorily with mixes that are too wet to handle on conventional battery fabricating equipment. (See also PB 138 104)

Material Lab., New York Naval Shipyard, Brooklyn.
SPECIFICATION DEVELOPMENT ON "ENAMEL-B" FILM INSULATED HIGH TEMPERATURE MAGNET WIRE, by H. Pinski. Final rept. 19 Mar 59, 17p. Lab. project 4861-F-27, Pt. 8.
Order from LC mi$2.40, ph$3.30 PB 144 124

Evaluation of film insulated magnet wires for information purposes and for further development of specification MIL-W-19583(NAVY).

Michigan U. Research Inst., Ann Arbor.
FINAL REPORT ON CONTRACT AF 19(604)1949, by K. M. Siegel. Rept. for 1 Oct 56-31 July 59. July 59, 7p. 27 refs. Rept. no. 2591-5-F; AFCRC-TR-59-179; AD-225 015.
Order from LC mi$1.80, ph$1.80 PB 144 319

The major effort was the writing of an instruction manual. The purpose of this manual is to tell engineers, mathematicians, and physicists (with only an undergraduate course in electromagnetic theory and the usual undergraduate courses in applied mathematics) how to compute the radar cross sections of aircraft and missiles.

Michigan U. Research Inst., Ann Arbor.
TRANSISTORIZED CIRCUITS FOR USE IN SPACE-RESEARCH INSTRUMENTATION, by L. H. Brace. Instrumentation rept. no. 1 on Contracts DA 20-018-509-ORD-103; AF 19(604)1843; AF 19(604)1948; and DA 36-039-sc-78131. Oct 59, 31p. 5 refs. 2521; 2804; 2597; 2816:1-3-S.
Order from LC mi$3.00, ph$6.30 PB 144 196

The development of various accessory circuits for use in space research instrumentation is described. The

circuits include dc current detectors, voltage-controlled oscillators, voltage generators, timers and dc-dc convertors.

Microwave Associates, Inc., Burlington, Mass.
DEVELOPMENT OF DIODE TYPE 50649B, by R. B. Collins. Quarterly progress rept. no. 3, 1 Dec 58-28 Feb 59, on Contract DA 36-039-sc-78021. [1959] 18p.
Order from LC mi$2.40, ph$3.30 PB 144 154

The final electrical and mechanical design of the diode are discussed. The preparations for the Pilot Production Run are described. (See also PB 142 761)

Microwave Associates, Inc., Burlington, Mass.
VARIABLE CAPACITANCE MICROWAVE DIODE. Quarterly progress rept. no. 1, 1 Nov 58-31 Jan 59, on Contract DA 36-039-sc-78236. [1959] 18p. 1 ref. AD-215 451.
Order from LC mi$2.40, ph$3.30 PB 143 977

Two of the main technical problems to be solved on this contract are electrical evaluation and packaging. In Chapter 1, 9600 Mc impedance measurements are compared with 1000 Mc measurements made at Bell Telephone Laboratories. Agreement is fairly good. The 9600 Mc measurements are generally more sensitive. A hermetically sealed package is required. The soft-glass package used by many manufacturers of low-frequency diodes was tested by fabricating silicon varactors in it. The cutoff frequency of these varactors, measured at 9600 Mc was much lower than for similar varactors made in a ceramic package, according to results given in Chapter 2.

Microwave Engineering Labs., Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts. Quarterly progress rept. no. 4, 10 Mar-9 June 59, on Contract AF 19(604)4071. 9 July 59, 19p. AFCRC-TN-59-551; AD-226 814.
Order from LC mi$2.40, ph$3.30 PB 143 973

Successful masering has been achieved in several slow-wave structures with typical figures of 10 db gross gain over a 60 mc bandwidth. Both grounded (bandpass) and ungrounded (low pass) combs have been used with the ungrounded comb giving the best results. Non-reciprocal operation has been obtained by use of a poly-crystalline yttrium iron garnet slab on the side of the comb opposite from the ruby giving a typical backward attenuation of 15 db. (See also PB 142 347).

Microwave Lab., Stanford U., Calif.
A PROPOSED MILLIMETER-WAVE GENERATOR, by G. S. Kino. Technical note on Contract AF 49(638)415. Sep 59, 20p. 11 refs. M. L. rept. no. 606; AFCRC-TN-59-890.
Order from LC mi$2.40, ph$3.30 PB 143 995

A millimeter-wave generator, using a waveguide filled with a plasma of uniform cross-sectional density, but with an axial density variation of the form $n_0(1+\alpha \sin \gamma z)$, is discussed. It is shown, by solving the wave equation for the system, that slow-wave space harmonics, although usually of small amplitude, can have the property that their electric fields are maximum at the center of the guide and minimum at its walls. The design of a possible 1-mm backward-wave oscillator operating at 2.5 kv with approximately 12 ma starting current is dealt with. This design is postulated on the assumption that the so-called Langmuir "electrostatic sound waves" or similar modes may be used to set up the necessary density variation in the plasma.

Microwave Lab., Stanford U., Calif.
RESEARCH IN MICROWAVE TUBES. Scientific status rept. no. 9 (Final), 1 June 56-30 Sep 58, on Contract Nonr-225(26); Continuation of Contract DA 36-039-sc-63178. Sep 58, 16p. 4 refs. M. L. rept. no. 546.
Order from LC mi$2.40, ph$3.30 PB 144 314

The first project involved development work on vacuum windows for high-power microwave tubes. This is a significant aspect of the development of long-life, sealed-off tubes, and of the development of higher power broadband tubes. At the close of this contract a test facility for high-power windows had been constructed and was in operation. This instrument is called a "Circulator," and is being used for the testing of a number of types of high-power windows. The circulator, after some revision, has proved to be a very satisfactory device. Power gains on the order of 20 may readily be obtained, and it is possible to subject the windows under test to peak powers of 20 megawatts or higher. A number of tests have already been made, using both actual operating windows and also slabs of various experimental materials. These are reported here, and a description of the circulator and its operation is given. Use of this device will undoubtedly contribute significantly to the understanding of the mechanisms of failure in high-power windows.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
MODAL ANALYSIS AND SYNTHESIS OF ELECTROMAGNETIC FIELDS, by L. B. Felsen and N. Marcuvitz. Rept. on Contract AF 19(604)2031. 19 June 59, 85p. 6 refs. Research rept. R-726-59; PIB-654; AFCRC-TN-59-583.
Order from LC mi$4.80, ph$13.80 PB 144 341

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ON THE IDENTIFICATION AND COMMAND PROBLEMS IN COMPUTER-CONTROLLED ADAPTIVE SYSTEMS, by E. Mishkin and R. A. Haddad. Rept. on Contract DA 30-069-ORD-2646. 3 Sep 59, 36p. 6 refs. Research rept. R-767-59; PIB-695; OOR rept. 2268-1-E.
Order from LC mi$3.00, ph$6.30 PB 144 213

In order to satisfy stringent performance requirements in a dynamic process, a computer is incorporated as a central element in the feedback loop. The computer performs the dual task of identifying or measuring the process' dynamics, and thence generating an appropriate command or actuating signal so as to satisfy the overall specifications. The family of singularity functions (steps, ramps, confluent parabolas) is used as the command signal. The process' dynamics is monitored and identified by the computer without recourse to interrupting test signals such as periodic impulses or white noise. The stored energy term inherent in many measurement problems in continuous processes is accounted for in a novel manner.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y
THEORY OF THIN DIELECTRIC COVER ON SLITTED RECTANGULAR WAVEGUIDE ANTENNA, by S. Nishida. Rept. on Contract AF 19(604)2031. 13 July 59, 25p. 3 refs. Research rept. R-754-59; PIB-682; AFCRC-TN-59-593.
Order from LC mi$2.70, ph$4.80 PB 143 989

A thin dielectric sheet or slab which covers the radiating surface of a slitted rectangular waveguide can serve as a radome for this type of leaky wave antenna. Theoretical expressions are derived for the propagation constants of a leaky wave on a slitted rectangular waveguide which is covered by such a dielectric slab. Numerical results are presented in graphical form and show that only the attenuation constant of the leaky wave is significantly affected by the presence of the dielectric slab when its thickness is comparable to or greater than the width of the narrow slit.

Minneapolis-Honeywell Regulator Co., Minn.
INDUSTRIAL PREPAREDNESS STUDY ON GERMANIUM POWER TRANSISTORS, by V. K. Erickson, D. J. Noggle and others. Final rept. for 31 Mar 55-30 Sep 57 on Contract DA 36-039-sc-66044. [1957] 411p. 6 refs.
Order from LC mi$11.10, ph$63.60 PB 138 086

Industrial preparedness studies were undertaken to develop a Ge power transistor, and to develop facilities and equipment to mass reproduce this transistor. Extreme precautions must be observed to avoid contamination of the transistor during fabrication and assembly. Experimentation established that a solid encapsulating fill is detrimental to the electrical characteristics of the transistor. A solder seal was also unsatisfactory in that the solder flux introduces contamination. Some type of mechanical seal, such as welding, must be used. Extremely close control must be maintained over the alloying of the emitter, collector, and base ring to the Ge die during the time-temperature cycle. High temperature conditioning (48 hr at 100°C) tends to stabilize the electrical characteristic of the transistor. To obtain the most efficient dissipation of heat from the transistor junction, the thermal resistance of the conduction path from the collector to the external heat sink must be as low as possible. A good heat flow path from the transistor to the mounting surface is obtained by machining an angle of 0°15' on the bottom surface of the base block assembly. A 64 μin. maximum surface roughness on this surface also insures a low thermal interface resistance. The effect of emitter geometry on the current carrying capacity of the transistor is discussed.

Missouri U., Columbia.
ELECTROCHEMICAL SYSTEMS FOR USE IN LOW TEMPERATURE BATTERIES, by G. V. Lago, J. P. Karnes and others. Final rept. for 17 Dec 58-15 Mar 59 on Contract DA 36-039-sc-74994. [1959] 55p. 2 refs.
Order from LC mi$3.60, ph$9.30 PB 143 899

The conductivities of KSCN-CH_3CN, KSCN-C_2H_5CN and $NaClO_4$-C_2H_5CN systems with and without H_2O have been investigated for both dilute and concentrated solutions. Freezing point measurements for the more concentrated electrolyte solutions were made. In addition the viscosities, dielectric constants, and densities of the solvents have been determined. Load tests have been made on a number of experimental cells employing KSCN-H_2O-CH_3CN electrolyte, MnO_2 Shawinigan Black cathodes and either Mg or Zn anodes. Initial and final "no load" voltages have been measured as well as the anodic voltages. Preliminary tests on cells employing $NaClO_4$-H_2O-C_2H_5CN as electrolyte have been made. The load tests were made at room temperature, -45, -50, and -54°C. The causes and effects of polarization and internal resistance were also studied. (See also PB 142 864)

Naval Avionics Facility, Indianapolis, Ind.
THE NOPI-WURF SUB-AUDIO FREQUENCY NOISE GENERATOR, by Robert E. Harrison. Jan 58, 30p. 3 refs. NAFI-TP-39.
Order from LC mi$2.70, ph$4.80 PB 144 185

This report describes a noise generator particularly suited for use in the simulation and study of noise problems in fire control computers and other types of electromechanical systems operating in the frequency range from zero to thirty cycles per second. This equipment was developed by the Washington University Research Foundation, St. Louis, Missouri, under contracts 163s-577 and 163s-1039 in conjunction with a radar noise study program. This report was written in October 1953, but was not prepared for publication due to termination of the author at that time. It is being published now because the noise generator described is currently in use, and the material herein should prove useful.

Naval Ordnance Test Station, China Lake, Calif.
A REVIEW OF MASER AMPLIFIERS, by Albert J. Jaske. 17 July 58, 21p. 15 refs. NOTS-2031; NAVORD rept. 5889.
Order from LC mi$2.70, ph$4.80 PB 144 077

The theory of operation of both the gas and solid-state maser is presented, and aspects of its use as a microwave amplifier, such as band width and noise, are discussed.

Naval Research Lab., Washington, D. C.
AN INVESTIGATION OF IMPULSE-VOLTAGE BREAKDOWN IN POLYETHYLENE, by C. R. Vail. Final rept. 9 Dec 59, 58p. 17 refs. NRL rept. 5374.
Order from OTS $1.50 PB 151 955

The study of the characteristics of dielectric break-

down in commercial polyethylene, under applied high-voltage impulses, divides naturally into two parts: one concerned with single-impulse breakdown during the period of rise of overvoltage impulses and the other concerned with multiple-impulse breakdown at gradients below the threshold level for single-impulse breakdown. Single-impulse breakdown is shown to be a function of rise rate, and to be characterized by breakdown gradients that exceed the dc breakdown level for very high rise rates but that may fall well below the dc level for lesser rise rates. It appears to be independent of thickness in the range from 1.5 to 26.5 mils. The fact that single-impulse breakdown data fit an extremal distribution suggests the applicability of the weakest-link theory. Although multiple-impulse breakdown data are too few for drawing statistically significant conclusions, there is some evidence that there is an inverse relation between breakdown gradient and number of impulses to breakdown. It is concluded that the process of impulse breakdown in commercial polyethylene involves a mechanism of electron avalanching that is influenced, for the lower rise rates, by partial breakdown associated with foreign matter, imperfections, and voids, while for higher rise rates, it is strongly influenced by "electrode conditioning" due to emission from the cathode. Prestressing is thought to increase the breakdown voltage through the electrode conditioning process and through a process of repairing defects in the material.

New York U. Coll. of Engineering, N. Y.
OPTIMIZATION OF THE ADAPTIVE FUNCTION BY Z-TRANSFORM METHOD, by S. S. L. Chang. Rept. on Contract AF 49(638)586. June 59, 39p. 15 refs. Technical rept. 400-6; AFOSR-TN-59-585; AD-217 032.
Order from LC mi$3.00, ph$6.30 PB 144 276

A study is made on the optimization of the adjustment process in a self-optimizing system under rather general assumptions. The system is designed to keep a performance parameter m either at a prescribed value or at an unknown extremal value. A direct measurement on m is made, and the adjustment is based on measured m only. Factors considered are (1) the finite measuring interval, (2) the necessity of looking ahead one interval, (3) the probable error in measurement, and (4) the changing situation. A set of weighting factors on present and past data, and the proper value of test bias for extremal seeking systems, are determined by a least square optimization process. The criterion of optimization is least reduction in m for peak seeking systems and least square error in m for systems with prescribed value of m. Two types of extremal seeking systems are studied. The alternate biasing systems are found to be superior in performance compared to the derivative sensing systems.

[Oxford U. (Gt. Brit.)]
AN S-BAND FERRITE ISOLATOR FOR USE WITH A LINEAR ACCELERATOR. Technical note no. 1 on Contract AF 61(514)1183. [1958] 5p. 4 refs. AFOSR-TN-58-654; AD-162 185.
Order from LC mi$1.80, ph$1.80 PB 138 108

A ferrite isolator that handles 1 megawatt of S-band is described. Results that show the great advantage of using an isolator when operating a magnetron with a narrow bandwidth load are given. It is pointed out that the use of isolators gives designers of electron accelerators freedom to use very high Q or variable impedance devices.

Pacific Semiconductors, Inc., Culver City, Calif.
TRANSISTOR, JUNCTION, DIFFUSED BASE, R. F. POWER OSCILLATOR, by S. H. Barnes, P. H. Dirnbach and others. Quarterly progress rept. no. 1, 27 June-30 Sep 58, on Contract DA 36-039-sc-78033. 68p. 4 refs.
Order from LC mi$3.90, ph$10.80 PB 144 153

Preliminary processes for the fabrication of a 1 w, 70 mc transistor are described. The transistor structure is discussed and a brief summary of the design equations given. Mechanical environmental tests which have been performed to date are discussed. The electrical characteristics of 100 state of the art samples delivered at the end of this period are tabulated and distributions of the important parameters are plotted and discussed.

Pacific Semiconductors, Inc., Culver City, Calif.
TRANSISTOR, JUNCTION, DIFFUSED BASE, R. F. POWER OSCILLATOR, by S. H. Barnes, L. Brown and others. Quarterly progress rept. no. 2, 30 Sep-30 Dec 58, on Contract DA 36-039-sc-78033. [1959] 43p. 4 refs.
Order from LC mi$3.30, ph$7.80 PB 144 156

The processes for the fabrication of the 1 watt, 70 mc power oscillator transistors have remained basically the same as in the previous report, but improvements in process control and reliability have been stressed. Process control effort has been particularly heavy in the diffusion processes. Environmental tests have been initiated and are providing valuable feed-back information. Progress in the design and development of a new environmentally-secure package capable of handling the required power dissipation and still adhering to the TO-9 dimensions is described. Characterization of the contract transistors is continuing. Oscillator and amplifier circuitry and measurements are discussed. (See also PB 144 153)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON MICROWAVE DIODES, by W. H. Forster. Quarterly rept. no. 1, 1 July-30 Sep 57, on Contract DA 36-039-sc-75943. [1957] 43p. 1 ref.
Order from LC mi$3.30, ph$7.80 PB 138 098

Tools to fabricate 1N26 and 1N78 silicon microwave diodes have been designed and built during this period. Diodes have been assembled in order to check these tools and to develop fabrication techniques. No attempt has been made, as yet, to obtain an hermetic seal in these diodes. Various bead materials have been tried in order to determine the optimum material with respect to electrical requirements and hermetic sealing.

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON MICROWAVE DIODES, by W. H. Forster. Quarterly rept. no. 2, 1 Oct-31 Dec 57, on Contract DA 36-039-sc-75943. [1958] 33p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 138 102

Silicon microwave diodes types 1N26 and 1N78 produced on a pilot production line.

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON MICROWAVE DIODES, by W. H. Forster. Quarterly rept. no. 3, 1 Jan-31 Mar 58, on Contract DA 36-039-sc-75943. [1958] 34p. 3 refs. AD-206 159.
Order from LC mi$3.00, ph$6.30 PB 138 103

Types 1N26 and 1N78 silicon microwave diodes were prepared. (See also PB 138 102)

RCA Service Co., Camden, N. J.
ELECTRONIC DESIGNER'S SHOCK AND VIBRATION GUIDE FOR AIRBORNE APPLICATIONS, by Robert E. Barbiere and Wayne Hall. Rept. on Contract AF AF 33(616)3257. Dec 58, 260p. 126 refs. WADC Technical rept. 58-363; AD-204 095.
Order from OTS $4.00 PB 161 299

Improvements in the mechanical design of airborne electronic equipment have not kept pace with advances in electrical design. The resulting major inadequacy has been the inability of some equipments to resist a shock and vibration environment. This book is a guide for the designer of airborne electronic equipment to aid him in designing resistance to shock and vibration into equipments. Both the theoretical and practical aspects of shock and vibration are covered. The discussion of shock and vibration concepts and the philosophical approaches to shock and vibration problems serve as a foundation for understanding the complete publication. This makes it unnecessary for the electronics designer to have prior shock and vibration knowledge. Environmental data reveal to the designer the levels of shock and vibration excitation to which electronic equipments are subjected. The practical applications of shock and vibration design practices are emphasized. The relative susceptibilities of component parts and the effects of the mounting orientation of component parts in the equipment are presented. Also covered are the design of racks and chassis for best resistance to shock and vibration and the use of auxiliary means, such as damping or isolation, for either resisting or changing the environment. The balance of the design guide considers the test methods and facilities that can give reasonable assurance that the equipment will eventually be able to withstand its operational environment. A thorough discussion is given of shock and vibration simulators and instrumentation as well as the philosophy of performing laboratory tests.

Rome Air Development Center, Griffiss AFB, N. Y.
AUTOMATIC GROUND CONTROL APPROACH SYSTEM AN/MSN-3, by Rainey M. Brooks and William F. Hoy. June 59, 69p. RADC-TR-59-32; AD-228 502, superseded, AD-211 936.
Order from LC mi$3.90, ph$10.80 PB 144 219

This report presents a general description of the AGCA System and the results of evaluation tests on the system. The tests proved that the AGCA System, utilizing the AN/MSN-3 and the AN/ARR-43, will provide USAF with an approach capability it does not now operationally possess. The report also includes the final tests on the modified Serial #2 AGCA System, as accepted by RADC prior to E & ST by Air Proving Ground Center.

Rome Air Development Center, Griffiss AFB, N. Y.
THE EFFECTS OF WIDE-BAND SIGNALS ON RADAR ANTENNA DESIGN, by Lawrence R. Dausin, Kenneth E. Niebuhr, and Nils J. Nilsson. July 59, 20p. 6 refs. RADC-TN-59-178; AD-216 023.
Order from LC mi$2.40, ph$3.30 PB 144 080

The angle of arrival of a plane wave incident on a line aperture depends on the bandwidth of the incident signal as well as on the extent of the aperture. Conventional antenna theory assumes the angular resolution of an antenna depends only on the aperture extent and illumination function. However, by auto-correlation techniques further angular resolution can be obtained. This additional directivity depends on the extent of the signal bandwidth. The obtainable directivity information for line arrays depends on the aperture illumination function and the auto-correlation function of the incident signal. In view of the vast amount of available information concerning conventional antennas, the results of this report have been related to conventional antenna theory. The antenna designer can specify the desired directivity pattern in terms of a conventional single-frequency aperture illumination function. The effects of this single frequency illumination function can then be achieved for wideband signals by a simpler illumination function. Some examples of the theory are given.

Rome Air Development Center, Griffiss AFB, N. Y.
IMPROVED MILITARY BEACON SYSTEM, by Olindo A. Tagliaferri. Sep 59, 31p. RADC-TN-59-235; AD-226 863.
Order from LC mi$3.00, ph$6.30 PB 144 298

The continued development and use of the Mark X SIF Beacon System has generated many problems especially in reference to high density employment areas. The ability of the system to operate in a particular congested area is part of an overall test program conducted in the New York City area. New techniques to suppress side lobe interference and fruit are described. Test results are given and it is concluded that receiver subtraction shows promise of significantly reducing ring around and eliminating fruit on the display.

Rome Air Development Center, Griffiss AFB, N. Y.
SOLID STATE REAL TIME FAULT ALARM FOR TELETYPE EQUIPMENT, by Murray Kesselman. Sep 59, 17p. RADC-TR-59-70.
Order from LC mi$2.40, ph$3.30 PB 144 484

A solid-state real-time fault alarm was developed to alert Communications Center operators to malfunctions in automatic operation of cryptographic equipment. A detailed technical discussion of the equipment is given.

Rome Air Development Center, Griffiss AFB, N. Y.
TRANSISTORIZED, FOUR-CHANNEL RADIO REMOTE CONTROL UNIT (CONTROL, RADIO SET C-2767/MR) by John J. Guba and William E. Wilbur. Aug 59, 29p. RADC-TR-59-108; AD-225 510.
Order from LC mi$2.70, ph$4.80 PB 144 070

This report describes a radio remote control unit (Control, Radio Sec C-2767/MR) developed by the Rome Air Development Center and fabricated by Allen B. DuMont Laboratories, Inc. The unit provides two-wire operational control of from one to four continuous-wave or voice-modulated transmitters and/or receivers (channels) from a central location (up to three miles from the radio equipments). All operating controls for radio equipments are grouped by channel on the front panel of the unit. Three radio remote control units may be interconnected to provide a maximum of 12 channels at one location. Channels may be shared by paralleling up to eight radio remote control units situated at widely separated locations. Lockout circuitry incorporated in the units prevents the use of a shared channel at more than one location at a time, thereby eliminating any interference or confusion. The unit is of compact design, is transistorized, and features plug-in modular construction. Side-tone oscillators enable monitoring of c-w transmissions, and squelch circuits eliminate output noise when receivers are not in use.

Servo Corp. of America, New Hyde Park, N. Y.
DEVELOPMENT OF A DIRECT-READING FREQUENCY METER. Final progress rept. for 1 Nov 53-31 Dec 54 on Contract DA 36-039-sc-15416. 5 Apr 55, 186p. 23 refs. SCA-3700-RQ5.
Order from LC mi$8.40, ph$28.80 PB 144 021

The format of the present report is arranged so that a reader familiar with the preceding quarterly reports can turn directly to Section 2 which describes the work performed in the interval from 18 November 1953 to 31 December 1954. In Section 2 it is shown that a frequency meter based on the simplified instrumentation has been developed as far as the available wide-range tuning-element art permits. An experimental model of limited performance has been constructed. It is concluded that this basic method of frequency measurement is sound and worthy of further development particularly for higher frequency use. Component development is essential in regard to the wide-range tuning element and is desirable in regard to the counter or register element. A reader not familiar with the preceding reports should direct his attention first to Appendix B, which summarizes the total work performed from the initiation of the project in September 1951 to November 1953. Appendix B describes the originally-proposed instrumentation of the basic method of frequency measurement and the greatly simplified instrumentation which was later adopted for development. Operating sequences and the development of the functional elements are also treated in Appendix B.

Stanford Electronics Labs., Stanford U., Calif.
EXPERIMENTS ON A HIGH-PERFORMANCE CAVITY MASER USING RUBY AS S-BAND, by W. S. C. Chang, J. Cromack and A. E. Siegman. Rept. on Contract AF 33(600)27784. 21 July 59, 27p. 4 refs. Technical rept. no. 156-4; AD-226 295.
Order from LC mi$2.70, ph$4.80 PB 144 061

A 3-level solid-state maser using ruby was operated at frequencies near 3000 mc, using a high-efficiency cavity having TEM modes in a rectangular geometry. Two different operating points in the $\theta = 10^{o}$ to $\theta = 30^{o}$ region of the ruby spectrum gave maser operation with a pump frequency near 10,500 mc, although the inversion obtained was a sensitive function of the exact operating point. An operating point at $\theta = 90^{o}$, requiring pumping at 13,500 mc, gave a gain-bandwidth product of better than 50 mc. It was found possible to pump the 1-4 or $\Delta M = 3$ transition at this same operating point, obtaining 3000 mc amplification with a 23,700 mc pump frequency. Although this mode of operation was not fully explored, it is potentially capable of increasing the gain-bandwidth product by a substantial amount.

Stanford Electronics Labs., Stanford U., Calif.
FERRITE ATTENUATORS FOR TRAVELING-WAVE TUBES, by L. C. Bacon. Technical rept. no. 26 on Contract Nonr-225(24). 11 Feb 58, 181p. 26 refs. AD-153 715.
Order from LC mi$8.40, ph$28.80 PB 138 346

Several ways of employing ferrites in traveling-wave-amplifier attenuator systems are evaluated. The properties of conventional attenuators are reviewed with special attention given to the interrupted-circuited type. The phenomena of nonreciprocal absorption in the region of resonance for a gyromagnetic material is considered. In a discussion of the experiments with the use of ferrites in conjunction with TWT's several difficulties are pointed out, including dielectric loading, beam defocusing, and alteration of circuit phase velocity. Suggestions for ameliorating the conditions are given. A modified version of S. E. Miller's coupled-mode theory is employed to study 2 methods of utilizing nonreciprocal coupled helices with ferrites based above resonance. A description is given of the design and operation of a high power circuit for a travelling-wave amplifier circuit that uses a ferrite attenuator. Comparison is made with the performance of a severed circuit attenuator. The general characteristics of the ferrite attenuators are briefly discussed.

Stanford Electronics Labs., Stanford U., Calif.
GAIN, BANDWIDTH AND NOISE CHARACTERISTICS OF THE VARIABLE-PARAMETER AMPLIFIER, by H. Heffner and G. Wade. Technical rept. no. 28 on Contract Nonr-225(24). 26 Feb 58, 35p. 8 refs. AD-153 170.
Order from LC mi$3.00, ph$6.30 PB 138 141

The variable parameter (or parametric) principle of amplification is characterized by a typical arrangement in which a variable energy-storage element, such as an inductor or a capacitor, is suitably coupled to two resonant circuits. If the value of the energy-storage element is made to vary in the proper way, energy is fed from the source which drives the element (that is, the pump) to the fields of both the resonant circuits. This paper describes the behavior relative to gain, bandwidth and noise of this type of amplifier.

Stanford Electronics Labs., Stanford U., Calif.
A SEMICONDUCTOR-DIODE PARAMETRIC AMPLIFIER AT MICROWAVE FREQUENCIES, by K. L. Kotzebue. Technical rept. no. 49 on Contract Nonr-225(24). 4 Nov 58, 78p. 34 refs.
Order from LC mi$4.50, ph$12.30 PB 143 735

Extensive measurements were made of the microwave characteristics of the type of diode used in the experimental parametric amplifier, with emphasis on the measurement of series resistance. For this diode, a welded-contact germanium diode, the series resistance was a function of frequency, decreasing at a rate of nearly 3 db per octave over the frequency range of 500 Mc to 3,500 Mc. These measurements indicate that the germanium diode may be useful in parametric amplifiers at frequencies much higher than those predicted on the basis of low-frequency measurements.

Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF METHODS OF SCANNING THE BEAM OF LARGE ANTENNAS, by J. S. Honda and E. D. Sharp. Scientific rept. 8, 1 Mar-31 May 59, on Contract AF 19(604)2240. June 59, 43p. 5 refs. AFCRC-TN-59-590; AD-226 524.
Order from LC mi$3.30, ph$7.80 PB 144 310

Research continued on the investigation of both mechanical and electrical methods of scanning the beam of large ground-based antennas. The measured performance of an experimental, low-noise up-converter, variable-reactance amplifier, suitable for use with an electronic-scanning receiving array, is presented. The amplifier utilized a back-biased diffused junction diode as the variable-reactance element and was operated both as a two-frequency and as a three-frequency up-converter. An analysis is presented of an array with its antenna elements arranged in a triangular pattern. The reduction in number of antenna elements obtained by arranging them in a triangular pattern over that obtained when they are arranged in the usual rectangular pattern is presented for several ranges of main beam scan angle. It is found that if the main beam is positioned within a constant angle about the normal to the array, the number of antenna elements can always be reduced 13.4 percent by arranging the elements in a pattern of equilateral triangles rather than in the usual square pattern.

Stavid Engineering, Inc., Plainfield, N. J.
INVESTIGATION OF TECHNIQUES FOR DISPLAYING INFORMATION IN AN AIR TRAFFIC CONTROL CENTER, by Richard A. Barker and Robert G. Hertz. Rept. on Contract AF 19(604)1508. May 57, 43p. 9 refs. AFCRC-TR-57-160; AD-117 013.
Order from LC mi$3.30, ph$7.80 PB 138 072

Several types of display were investigated to determine their suitability for use in an enroute ATC center. These devices fall into the categories of (1) large screen projection displays, both photographic and optical-electronic; (2) character writing techniques; (3) third-dimensional presentation; and (4) special (miscellaneous) displays. The problem of displaying radar information on a bright, large-screen display with high accuracy and fine resolution can be solved with the use of a film processor. This entails a major disadvantage: a time lag because of photographic processing time is introduced between the collection of signals by the radar and the presentation of the same information to the controller. The optimum antenna azimuth scan rate of a radar employing photographic projection in its display should be equal to (or less than but never greater than) the film cycling rate.

Sylvania Electric Products, Inc., Mountain View, Calif.
DEVELOPMENT OF LOW-NOISE BACKWARD-WAVE AMPLIFIER TUBE, by Robert E. Vehn. Final rept. on Contract DA 36-039-sc-73181. Apr 59, 138p. 39 refs.
Order from LC mi$6.90, ph$21.30 PB 144 302

The design, construction, and performance of experimental low-noise backward-wave amplifiers electronically tunable over the 12- to 18-kmc frequency range are reported. The design objectives were 50 mc constant bandwidth over the tuning range, and 20 db gain. Both two- and three-helix cascade designs were investigated. The development of the hollow-beam electron gun is described. The performance of the experimental tubes is summarized, and recommendations for further activity are made.

Technical Research Group [Syosset, N. Y.]
TECHNICAL GAIN, by A. F. Kay. Rept. on Contract AF 19(604)5532. Aug 59, 42p. 17 refs. Scientific rept. no. 131-1.
Order from LC mi$3.30, ph$7.80 PB 144 248

Formulas for the ratio ? of received to transmitted power are derived and examined for aperture antennas at any range (a) including supergain and (b) excluding supergain. Only case (b) is considered thereafter. In the far field this formula reduced to the "range equation," which is basic in communications systems design. Some simple illuminations which can be realized practically by defocussed dishes are shown to be sufficiently close to the optimum cases for most practical purposes. A formula for the power density in the near field of a transmitting aperture is also derived and it is shown how to maximize the power flow through any given area of space by design of the transmitting aperture illumination.

Technische Hochschule, Munich (Germany).
INVESTIGATION OF ATMOSPHERICS IN THE FREQUENCY RANGE OF 0-100 CYCLES PER SECOND BY MEANS OF MEASUREMENTS WITH NARROW BAND AMPLIFIERS, by Hans Gunther Jungmeister. Final technical rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-956. [1959] 30p.
Order from LC Mi$2.70, ph$4.80 PB 144 251

A survey is given on the possibilities for realizing narrow band amplifiers for extremely low frequencies. It was found that feed back amplifiers with twin-T RC networks in the feed-back loop are most suitable for lowest frequencies. Such a feedback amplifier filter is theoretically analyzed as to whether it can be used as frequency analyzer. Special methods for measur-

ing and calibrating the Q and the spectral amplitudes are shown. These methods are based on the application of the frequency spectrum of short square pulses.

Transistor Applications, Inc., Boston, Mass.
INVESTIGATION OF THE APPLICATIONS OF NEGATIVE RESISTANCE DIODES FOR SWITCHING CIRCUITS, by A. W. Carlson. Scientific rept. no. 4, 16 Mar-17 June 59, on Contract AF 19(604)3066. [1959] 57p. AFCRC-TN-59-769.
Order from LC mi$3.60, ph$9.30 PB 143 978

This report is concerned with the study and investigation of pulse circuit applications of three-terminal negative resistance devices. The RCA 1832 Thyristor is used as a representative type in the study of the following applications: (1) Capacitive type multivibrators using emitter and collector negative-resistance characteristics. (2) Inductive multivibrator using the base input negative resistance characteristic. (3) Blocking oscillator using transformer feedback. (4) Ring counter. (See also PB 142 804)

Ordnance, Missiles, and Satellite Vehicles

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
THE HEAT PROTECTION POTENTIAL OF SEVERAL ABLATION MATERIALS FOR SATELLITE AND BALLISTIC RE-ENTRY INTO THE EARTH'S ATMOSPHERE, by N. S. Diaconis, J. B. Fanucci, and G. W. Sutton. Rept. on Contract 04(647)269. 11 Sep 59, 65p. 18 refs. Technical information series R59SD423.
Order from LC mi$3.90, ph$10.80 PB 143 901

An evaluation of the relative performance advantage of various ablation materials for the heat protection to a non-lifting vehicle during hypersonic re-entry into the earth's atmosphere has been made based on theoretical ablation models substantiated by experiment. Calculations have also been made of the heat penetration within the material. Typical ablation materials from three categories have been investigated, both theoretically and experimentally in air arc facilities at a hypersonic stagnation point. Stagnation point ablation data for an attractive material in each category was obtained for various local heating rates, stagnation pressures and stagnation enthalpies. Effective heats of ablation have been determined experimentally and compared with the theoretical calculations.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
A STUDY OF HYPERSONIC ABLATION, by Sinclaire M. Scala. Rept. on Contract AF 04(647)269. 30 Sep 59, 64p. 45 refs. Technical Information Series R59SD438.
Order from LC mi$3.90, ph$10.80 PB 143 879

The aerothermochemical response of four broad classes of materials to the severe heating encountered during the hypersonic re-entry of space vehicles is determined theoretically. These materials include quartz-like refractories, graphite, thermosetting plastics and thermoplastics. A unified treatment of the ablation of different classes of materials has been developed. The effective heat of ablation of each material depends critically on the enthalpy level of the flight environment, and increases with increasing flight speed. The effect of an increase in stagnation pressure is to promote a decrease in the effective heat of ablation. The specific area of greatest uncertainty is in the kinetics of condensed phase heterogeneous reactions.

Air Force Missile Development Center, Holloman AFB, N. Mex.
ON SATELLITE ORBITS. IV. SOME NEW METHODS OF SATELLITE ORBIT CALCULATIONS AND STABILITY PROBLEMS, by Herbert Knothe. Sep. 59, 24p. 2 refs. AFMDC-TR-59-37.
Order from LC mi$2.70, ph$4.80 PB 143 992

In Chapter I the equations of motion for a satellite in a rotationally symmetric gravity field are reduced to a system of two ordinary first order differential equations for p and 1/r as functions of the angular polar distance θ by first introducing the arc length s of the spherical image of the orbit on the unit sphere as independent parameter. In Chapter II a system of three ordinary first order differential equations for p, ξ, ϕ_0 as functions of ϕ (ϕ defined by $\cos\theta = \sin i \sin\phi$, ϕ_0 corresponds to the apogee) is derived. A rapidly convergent process of iteration for solving these equations is explained and explicit examples are given. In Chapter III a differential geometrical approach is applied which leads to simple formulae for the calculation of the regression. A vector integral equation is derived for the deviation of the satellite from the plane of the initial osculating ellipse. (See also PB 142 376)

Air Force Missile Development Center, Holloman AFB, N. Mex.
SOME GENERAL CONSIDERATIONS OF THE PROBLEM OF DETERMINING THE ORIENTATION OF A STABILIZED PLATFORM IN MOVING ROCKET SLED, by H. Palmer Hotz. Nov 59, 11p. 1 ref. AFMDC-TN-59-30.
Order from LC mi$2.40, ph$3.30 PB 143 993

The problem is to locate accurately, and with respect to the ground, a stabilized platform inside a rocket sled while it is traveling down the track. Of various methods, only optical methods appear to be practical for making these measurements. Two general classes of optical methods could be used: optical levers, and measurements of the plane of polarization. The optical lever method is shown to be impossible unless the deflection caused by the shock wave is known. The polarization method can probably be made to work on the track.

Air Force Missile Test Center, Patrick AFB, Fla.
POWER SERIES SOLUTION OF ROCKET EQUATIONS OF MOTION, by Robert C. Meacham. Rept. on Missile Test Project, Contract AF 08(606)1156. 18 Sep 59, 109p. 8 refs. RCA Data Processing Technical rept. no. 45; AFMTC-TR-59-18.
Order from LC mi$5.70, ph$16.80 PB 143 990

The equations of motion of a powered rocket subject to aerodynamic and gravitational forces are nonlinear and consequently solutions are difficult to obtain analytically. Numerical solutions are commonplace, however, due to the arithmetic capabilities of high speed digital computers. For general study an analytical solution in terms of physical parameters is usually preferable to particular solutions in the form of numerical tables. In this paper analytical solutions under various conditions will be approximated in the form of truncated Taylor's Series expansions. The position coordinates of the rocket are presented as polynomial functions of time, after the series are truncated

Allied Research Associates, Inc., Boston, Mass.
LAUNCHING OF AIRBORNE MISSILES UNDERWATER. PART II. RESPONSE OF A SLENDER MISSILE TO SEA AND SWELL, by Theodore R. Goodman and Eugene L. Krasnoff. Rept. on Contract Nonr-2343(00). 31 Dec 58, 26p. 4 refs. Document no. ARA-528.
Order from LC mi$2.70, ph$4.80 PB 144 117

The technique of generalized harmonic analysis is employed to evaluate the trajectory responses of a hydrodynamically unstable slender missile moving vertically towards the free surface of a sea with waves. The free surface of the sea is represented by a Gaussian random function. The wave spectrum is composed of the sum of the spectrum of a stormy sea (waves generated by a local storm) and the spectrum of a swell (waves generated by a distant storm). The Neumann-Pierson spectrum is employed for the stormy sea and a line spectrum is assumed for the swell. The missile considered is a body of revolution without fins and its forward speed is taken as constant. General expressions for the mean squares and the correlation coefficients of the trajectory response components are presented in forms which are suitable for numerical evaluation. (See also PB 139 965)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
AN EVALUATION OF MODE SELECTOR SWITCH ARRANGEMENTS, by Gurdon B. Wattles, Edward C. Weiss, and David E. Holzen. Aug 59, 20p. Technical memo. 10-59.
Order from LC mi$2.40, ph$3.30 PB 144 078

A study was initiated to determine the optimum switching arrangement in terms of operator performance for the selection of the track, acquisition and search modes for a proposed AA weapon system. Five switching arrangements were evaluated and these constituted the independent variable conditions. The dependent variables were: (1) Errors of omission; (2) Errors of commission; (3) Breakdown rate; and (4) Subjective statements of preference. One hundred subjects from the Ordnance School, Aberdeen Proving Ground, Maryland were examined in terms of their performance on the various switching arrangements using time as a stressor.

[Army Rocket and Guided Missile Agency] Redstone Arsenal, Ala.
GRAIN DESIGN HANDBOOK, by Baylen Kaskey. 8 June 56, 267p. Rept. no. 3Y12.
Order from LC mi$11.10, ph$41.10 PB 144 125

Parameters for five types of solid-propellant grain configurations have been worked out by digital computer and are presented here. A method of using these results to solve most types of grain design problems is given. The equations and approximations necessary in grain design are presented and explained in handbook fashion.

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
AN/DRW-13 (XO-1) RECEIVER SPECTRUM UTILIZATION, by Merwin A. Olson and William E. Castilo. 9 Oct 59, 25p. AFC Rept. DC 9-10-59-RdeC.
Order from LC mi$2.70, ph$4.80 PB 144 280

Results are presented on a partial laboratory investigation of the interference characteristics (affecting spectrum utilization) on an AN/DRW-13 Drone Control Receiver. This information is necessary for frequency allocation purposes. This FM receiver operates in the frequency range from 406 to 549 MCS with signals having 300 KCS deviation. Selectivity, spurious emissions and responses, and interference characteristics were determined empirically. Selectivity was 359 KCS at the half power points. A clear channel width, involving two identical receivers, of 1600 KCS is recommended for J/S ratios of 20 db.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE RESPONSE OF TAPERED CANTILEVER BEAMS WITH A TERMINAL MASS WHEN A CONSTANT FORCE IS APPLIED INSTANTANEOUSLY AT THE MASS, by A. S. Elder. Apr 56, 54p. 24 refs. Rept. no. 979.
Order from LC mi$3.60, ph$9.30 PB 144 034

Interaction of a high-speed aircraft machine gun and the mounting structure may severely affect the functioning of both the gun and the mount. An adequate mount may be constructed by mounting the gun in the center of a uniform beam which is hinged or fixed at the ends. Considerations led to the design and construction of an elastic mount in which flat plates were tapered linearly so as to give cantilever beams of constant static bending strength.

California U., Los Angeles.
DIFFERENTIAL EXPRESSIONS FOR LOW-ECCENTRICITY GEOCENTRIC ORBITS, by Samuel Herrick, Louis G. Walters, C. Geoffrey Hilton. Astrodynamical rept. no. 2 on A Range Planning Study for Project Mercury, Contracts [NASA-204] and AF 49(638)498. 11 June 59, 31p. 3 refs. AFOSR-TN-59-768.
Order from LC mi$3.00, ph$6.30 PB 144 277

In the planning and evaluation of a tracking complex for space vehicles, two functions are served by differential expressions relating uncertainties, errors,

or corrections in selected orbital elements to corresponding uncertainties, errors, or corrections in the observed coordinates. These functions are: (1) The translation of orbit uncertainties into observed quantities, or vice versa, for an evaluation of ability to correct an orbit from given observations, or for an evaluation of the accuracy of an ephemeris based upon these observations. (2) The translation of residuals in observed coordinates into differential corrections to the orbital elements (or parameters). The analysis presented here is divided into two steps because of the need for data intermediate between the parameters and the ephemeris.

California U., Los Angeles.
EFFICIENT PRECISION ORBIT COMPUTATIONAL TECHNIQUES, by Robert M. L. Baker, Jr., George B. Westrom, and others. Rept. on Contracts AF 49(638)498 and DA 04-495-ORD-1389. 11 June 59, 77p. 22 refs. Astrodynamical rept. no. 3; AFOSR-TN-59-766.
Order from LC mi$4.50, ph$12.30 PB 144 014

A comparison is made of the methods of Cowell's, Encke's and the variation-of-parameters for the computation of high-precision orbits. Analysis of the integration of an analytical three-body trajectory and an analytical low-thrust spiral trajectory indicated the importance of decreasing the overall number of integration steps to avoid round-off errors. Comparative computations demonstrated that Encke's method is preferable in the ballistic lunar trajectory, variation-of-parameters in the low-thrust trajectory, and Cowell's method in the high-thrust trajectory. The overall computational efficiency of the Encke's and the variation-of-parameters method is also shown.

California U., Los Angeles.
PRECISION ORBITS AND OBSERVATION REDUCTION, by Samuel Herrick. Astrodynamical rept. no. 1 on Contracts AF 49(638)498, AF 33(616)6005, NOas-59-6110-C, DA 04-495-ORD-1389, and NASA-204. 11 June 59, 25p. AFOSR-TN-49-769.
Order from LC mi$2.70, ph$4.80 PB 144 278

The advantages and disadvantages, in the reduction of observations, of "fixes", triangulation, assumed motions or orbits, reduction to the center of the Earth, and reference systems are discussed in the light of astrodynamical experience and the requirements of different types of orbit and of errors of observation. The differential correction is defined and outlined. The "fix" and "complete observations" are discussed in relation to the determination of orbits and compared with the differential correction. The provinces of observer and orbit analyst are differentiated. The need for accurate observations and reductions is stressed.

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK: MASTER GRAPHS. Contract AF 04(647)59-3. 10 Dec 59, 36p.
Order from OTS $1.00 PB 161 093-2

See PB 161 093

Diamond Ordnance Fuze Labs., Washington, D. C.
CHEMICAL TRANSDUCERS (PROPOSED PROGRAM), by Raymond H. Comyn. 28 May 59, 12p. 9 refs. Technical rept. TR-727.
Order from LC mi$2.40, ph$3.30 PB 144 388

Chemical transducers are those which use chemical reactions in their input, intermediate, or output stages. This report reviews the basic problem of using chemical transducers as sensing devices for ordnance applications. The use of chemical reactions in transducers is discussed, and a summary is made of chemical reactions which are applicable to transducers. It is recommended that a search be made for literature on chemical transducers, and on chemical reactions which are thought to be suitable for future transducers.

General Electric Co. [Schenectady, N. Y.]
AEROELASTIC EFFECTS ON CENTER OF PRESSURE AND NORMAL FORCE COEFFICIENTS, by Helen C. Engvold and Otto Klima, Jr. 24 Nov 52, declassified. 3p. 1 ref. Hermes A-3A Aerodynamic Data Memo. 24G.
Order from LC mi$1.80, ph$1.80 PB 144 357

This memorandum does not affect the validity of previously distributed memos on center of pressure and normal force coefficients. It merely shows the forward movement in the center of pressure and the reduction in missile normal force, caused by deflection of the nose, afterbody, and fins under load. It is necessary to consider these aeroelastic effects in determining the static stability margin for the various trajectories.

General Electric Co. [Schenectady, N. Y.]
AEROELASTIC EFFECTS ON THE FIN NORMAL FORCE COEFFICIENTS, by Otto Klima, Jr. and Patricia E. Adams. 14 Jan 53, declassified. 2p. 2 refs. Hermes A-3A Aerodynamic Data Memo. 3E.
Order from LC mi$1.80, ph$1.80 PB 144 367

This memorandum does not affect the validity of Memo #3D. It merely shows the change in fin normal force coefficient per degree fin deflection as affected by the dynamic pressure. It should be used with Memo #24G to calculate trim conditions for the missile subjected to air loads.

General Electric Co. [Schenectady, N. Y.]
BASE DRAG COEFFICIENTS FROM FLIGHT TEST - ROUNDS 1 AND 3, by Harold L. Bloom and Constance Carhart. 17 Feb 54, declassified 28 May 58. 8p. Hermes A-3A Aerodynamic Data Memo. 7F.
Order from LC mi$1.80, ph$1.80 PB 144 364

This memorandum presents jet-on base drag coefficients derived from flight test measurements of base pressure on Rounds 1 and 3, which were fired on the same theoretical trajectory. Jet-off base pressures are not available for these rounds. No usable base pressure data were obtained from Round 2. The information contained herein is to be considered as a preliminary step toward revision of estimated A-3A base drag coefficients. Such revision, however, of A-3A Aerodynamic Data Memorandum #7D should await the additional data from Rounds 4 through 7, which were fired on a different trajectory from Rounds 1 through 3.

[General Electric Co., Schenectady, N. Y.]
COMPLETE MISSILE CENTER OF PRESSURE AND NORMAL FORCE COEFFICIENT, by O. Klima, Jr. 9 Mar 53, declassified, 1p. Hermes A-3A Aerodynamic Data Memo. 24H.
Order from LC mi$1.80, ph$1.80 PB 144 356

Recent wind tunnel tests on the Hermes A-3A at M-4.06 and 4.50 indicate that the center of pressure in this Mach number range is slightly aft of predicted values. Since this information does not appreciably affect the performance of missiles through #8 a new aerodynamic memorandum will not be issued. Memorandum 24G can be considered final. The effect of pitch angle on stability in the yaw plane was also investigated and found to be negligible for the angle of attack range of missiles through #8. The results of these high Mach number tests are filed in DFB 53 AO 534 and the final results will be issued in a Jet Propulsion Laboratory report. The report is here quoted in its entirety.

[General Electric Co., Schenectady, N. Y.]
COMPLETE MISSILE DRAG COEFFICIENT, by O. Klima, Jr. 9 Mar 53, declassified. 2p. Hermes A-3A Aerodynamic Data Memo. 7E.
Order from LC mi$1.80, ph$1.80 PB 144 365

The drag value given in Aerodynamic Data Memo #7D should be used for performance estimates of Hermes A-3A missiles through #8. Additional drag data for this missile will become available this summer from NACA free flight shoots of a 1/5 scale missile. By comparing this NACA data with drag measurements from the full scale firings of the A-3A, it should be possible to better predict the drag of the full-scale Hermes A-3B. At the present time it does not appear necessary to issue a new A-3A drag memo after the NACA data is obtained. This report is here quoted in its entirety.

[General Electric Co., Schenectady, N. Y.]
COMPLETE MISSILE SUPERSONIC NORMAL FORCE COEFFICIENTS AND CENTER OF PRESSURE, by Robert B. Chamberlin and Helen C. Engvold. 11 Aug 52, declassified. 8p. 3 refs. Hermes A-3A Aerodynamic Data Memo. 24-E
Order from LC mi$1.80, ph$1.80 PB 144 359

This memorandum replaces the supersonic portion of A-3A Aerodynamic Data Memorandum #24-D. Additional supersonic wind-tunnel tests at the Langley Laboratory have made it possible to further refine the original estimates and show the effects of increasing angles of attack. The subsonic data as given in A-3A memorandum 24-C are still valid.

[General Electric Co., Schenectady, N. Y.]
DRAG COEFFICIENTS, by Robert B. Chamberlin and Margaret A. Lavelle. 12 Aug 52, declassified. 8p. 5 refs. A-3A Aerodynamics Data Memo. 7D.
Order from LC mi$1.80, ph$1.80 PB 144 366

This memorandum revises and supersedes A-3A Aero. Data Memo. #7B to account for new information from NACA Free-flight tests for Mach number .8 to 1.4 and later base-drag data.

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF EMERGENCY CUT-OFF ANTENNA ON HERMES A-3A AERODYNAMIC CHARACTERISTICS, by John O. Powers and Patricia A. Gill. 23 Apr 53, 1p. Hermes A-3A Aerodynamic Data Memo. 47.
Order from LC mi$1.80, ph$1.80 PB 144 352

A study has been made to determine the effect of the nose-mounted external emergency cut-off antenna on the Hermes A-3A aerodynamic characteristics. It was considered that the most probable detrimental effect due to the antenna would result from an induced rolling moment.

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF LARGE PITCH ANGLES ON STATIC STABILITY IN YAW FOR SMALL YAW ANGLES, by Helen C. Engvold and Otto Klima, Jr. 12 Nov 52, declassified. 7p. Hermes A-3A Aerodynamic Data Memo. 24-F.
Order from LC mi$1.80, ph$1.80 PB 144 358

Results of wind tunnel tests recently conducted at Aberdeen at M = 3.80 and M = 2.47 to determine the effect of large angles of attack (in pitch) on the center of pressure of the force vector in the yaw plane, for small side slip angles, are presented.

[General Electric Co., Schenectady, N. Y.]
RESULTS OF FORCE TESTS TO DETERMINE BEST POSITION OF JET VANE, by George E. Bowden. 13 Sep 52, declassified. 4p. Hermes A-3A Aerodynamic Data Memo. 16D.
Order from LC mi$1.80, ph$1.80 PB 144 361

This memorandum does not supersede Hermes A-3A Aero. Data Memo. #16C but gives additional information. Hermes A-3A Aero. Data Memo. #16C is still valid for finding the expected values of jet vane forces, while this memorandum shows the effect of jet vane position on these forces. A series of tests have been made at Malta Test Station to determine the loss in jet vane lift due to moving the vanes outward from their original position. Tests were made with jet vanes in their original position (Jet Vane base 1/8" outward from nozzle wall) at 10^{o} and 20^{o} deflection angle. The vane was then moved so that the base was 1/2" outward from nozzle wall and tests made at 10^{o} and 20^{o} deflection angle. The vane was moved as far back as the test rig allowed (Jet Vane base 13/16" outward from nozzle wall) and another set of tests made.

General Electric Co. [Schenectady, N. Y.]
RESULTS OF JET-VANE FORCE TESTS, by R. E. Geiger. 9 Apr 53, declassified. 5p. Hermes A-3A Aerodynamic Data Memo. 16F.
Order from LC mi$1.80, ph$1.80 PB 144 360

The jet-van characteristics presented herein are based on an analysis of the results of a recent experimental investigation conducted at the Malta Test Station. In addition to the A-3A production vane design, an experimental design (designated GEB-11), incorporating a 45° leading-edge sweep, was also tested. This design is of interest because tail-ring burning tests (without a deflector skirt at the nozzle exit) have demonstrated that in contrast to the production type vane, it does not cause burning of the missile tail ring. In order to obtain center of pressure data this recent series of force tests utilized a 5-component strain gage balance of a type used in Hermes wind-tunnel tests.

General Electric Co. [Schenectady, N. Y.]
REVISED ESTIMATION OF TRANSIENT SKIN TEMPERATURE (HA-3A) (NOSE SECTION - STATION 60) by W. D. Breingan and W. W. Fischer. 31 Oct 52, declassified 28 May 58. 2p. 1 ref. Hermes A-3A Aerodynamic Data Memo. 12C.
Order from LC mi$1.80, ph$1.80 PB 144 363

The object was to recalculate HA-3A skin temperature at station 60 using the W.S.P.G. 61 nautical mile trajectory. Other refinements, such as using the Van Driest correction, variable specific heats, and more recent pressure data are also included.

[General Electric Co., Schenectady, N. Y.]
STATIC STABILITY MARGIN FOR ROUNDS 5-8 (61 MILE TRAJECTORY) by Patricia E. Adams and Otto Klima, Jr. 27 Oct 52, declassified. 13 refs. Hermes A-3A Aerodynamic Data Memo. 14B.
Order from LC mi$1.80, ph$1.80 PB 144 351

This memorandum supplements Aerodynamic Data Memorandum #14A by giving the static stability margin versus time for rounds 5-8. The nominal margin is affected by Reynolds Number and aeroelastic effects. Variations from the nominal, caused by atmospheric conditions, missile tolerances, program tolerances and wind-tunnel measuring tolerances are also presented.

[General Electric Co., Schenectady, N. Y.]
STATIC STABILITY MARGIN FOR ROUNDS 5-8 (61 NAUTICAL MILE TRAJECTORY) by Patricia E. Adams and Otto Klima, Jr. 28 Jan 53, declassified. 1p. 2 refs. Hermes A-3A Aerodynamic Data Memo. 14C.
Order from LC mi$1.80, ph$1.80 PB 144 362

This memorandum supplements Aerodynamic Data Memorandum #14B. A revised nominal trajectory study has been run on the ENIAC to account for minor changes in jet vane drag and total missile drag, and the results have been compared with the original. There is no significant difference between the normal static stability margins based on the original and the revised trajectories. This report is here quoted in its entirety.

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
AN OPTICAL ANALOG-DIGITAL TRANSDUCER FOR USE IN SERVO SYSTEMS, by Philip Warren Cheney. Rept. on Contract AF 04(645)09. Sep 58, 70p. 9 refs. Rept. T-189; AD-203 947.
Order from LC mi$3.90, ph$10.80 PB 144 223

An analysis of the Optisyn, an analog-digital transducer, in several types of servo systems is presented with emphasis upon the digital control features. The Optisyn consists of two glass disks with photographic patterns of alternate transparent and opaque sectors and a light source. As one of the disks is rotated, the resulting modulated light intensity is sensed by phototransistors. By using two cascoded pairs of these phototransistors, two output waveforms 90 degrees out of phase, are generated. These outputs are interpreted to yield shaft rotation or to control other servomechanisms.

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
EFFECTS OF METALLURGICAL VARIABLES ON GUN STEEL QUALITY, by C. Wells, C. C. Busby and others. Final rept. on Contract NOrd-12672, 1 Aug 58, 69p. 31 refs; AD-201 794.
Order from LC mi$3.90, ph$10.80 PB 144 054

Correlations between transverse reduction of area and yield strength and between transverse impact and yield strength have been determined for a number of heat-treated, low-alloy, medium-carbon, steel forgings. Basic information pertaining to the average, variation, and degree of control with respect to yield strength, transverse reduction of area, and transverse impact in heat-treated wrought steel products was obtained and utilized in the specification of steel for gun tube forgings.

Naval Ordnance Test Station, China Lake, Calif.
DESTRUCTOR CHARGES EX 25 AND EX 26 AND INTERVAL TIMER EX 1 FOR THE SUBROC FLIGHT-INTERRUPTER SYSTEM, by J. H. Davidson. 14 Aug 59, 32p. NOTS TP-2312; NAVORD rept. 6584.
Order from LC mi$3.00, ph$6.30 PB 144 202

The design, development, and test of two destructor charges, plus an interval timer--components of the Command Flight-Interrupter System for the SUBROC missile--are reported.

Office of Ordnance Research, Durham, N. C.
TRANSACTIONS OF THE CONFERENCE OF ARSENAL MATHEMATICIANS [NO. 4] AT PICATINNY ARSENAL, DOVER, N. J., 5-6 JUNE 1958. Apr 59, 158p. 13 refs. Rept. no. 59-1.
Order from LC mi$7.50, ph$24.30 PB 144 052

Picatinny Arsenal, Dover, N. J.
EVALUATION OF BEKEN MIXER FOR PROPELLANT MANUFACTURE, by K. H. Russell. May 59, 65p. Technical rept. DB-TR: 7-59; AD-225 204.
Order from LC mi$3.90, ph$10.80 PB 144 076

Studies with a 15 gallon unit indicate a Beken mixer can be successfully substituted for a sigma blade mixer for the mixing and colloiding of solvent-mixed cannon propellants. The Beken blade design gives good blending of ingredients and provides more efficient mixing action than a sigma blade mixer with solvent-mixed cannon propellants. Single-base propellant dough from a Beken mixer can be directly extruded without need for maceration or screening operations, and at no sacrifice of propellant quality. Triple-base propellant compositions of good quality can be mixed in a Beken mixer in 1/3 or less the time required in a sigma blade mixer for the same compositions. A Beken mixer is safe for use in the above applications. Use of 150-gallon Beken mixers would permit an estimated $755,000 capital cost saving for a plant to manufacture 4,000,000 pounds per month of a single-base propellant (an approximate 39% saving in equipment cost for mixing through graining operations) and mill cost savings of $1.43 per 100 pounds of propellant to operate this plant. Use of 150-gallon Beken mixers would permit an estimated $2,500,000 capital cost saving for a plant to manufacture 3,000,000 pounds per month of triple-base propellant (an approximate 63% saving on equipment cost for mixing area), and some minor savings in mill costs.

Pitman-Dunn Labs., Div., Frankford Arsenal, Philadelphia, Pa.
ARMOR-PIERCING STEEL PROJECTILES: MECHANICAL PROPERTIES, by R. F. Hehemann (Case Inst. of Tech.) and J. G. Kerr (Lehigh U.). Sep 58, 90p. 95 refs. Rept. R-910.
Order from LC mi$4.80, ph$13.80 PB 144 041

Mechanical properties of steels, particularly those of armor piercing projectiles, and the principal mechanical tests (tension, compression, and indentation hardness) which measure the resistance of these steels to plastic deformation are discussed. The relationships between projectile dynamic impact behavior and mechanical properties are shown in terms of correlations with hardness, metallurgical history, and compression tests.

Polytechnic Inst. of Brooklyn, N. Y.
ANALYSIS OF CENTRAL FORCE SYSTEMS IN THE PRESENCE OF SMALL DISTURBING FORCES, by Frederick V. Pohle and Peter Feitis. Rept. on Contract DA 30-069-ORD-2346. June 59, 39p. 12 refs. PIBAL rept. no. 498; AD-226 187.
Order from LC mi$3.00, ph$6.30 PB 144 075

General theorems which relate to central force systems are presented and the effects of drag are included. Perturbation methods of solution are indicated in terms of dynamical invariants and energy equations are given for the cases of disturbed motion. The hodograph representation is used to supplement the discussion.

Watertown Arsenal Labs., Mass.
BUCKLING OF THIN TRUNCATED CONICAL SHELLS SUBJECTED TO UNIFORM EXTERNAL PRESSURE, by P. P. Radkowski. May 58, 28p. 8 refs. Technical rept. 893.3/1.
Order from LC mi$2.70, ph$4.80 PB 143 838

The buckling of simple supported, thin, conical shells subjected to uniform pressure is analyzed in this report. Predicted critical pressure curves are presented in Figures 3 through 9 for various base angles. In using the critical pressure curves for design purposes, it is suggested that the comparison between the predicted results and known experimental values in Figure 11 be taken into consideration.

Ship Building

George Washington U., Washington, D. C.
ELECTRONICS AND ORDNANCE USAGE DATA FOR NINE SUBMARINES, by Henry Solomon, Raymond Lewis, and Marvin Denicoff. Rept. on Logistics Research Project, Contract Nonr-761(05). 15 Jan 59, 13p. 1 ref. Serial T-97/59.
Order from LC mi$2.40, ph$3.30 PB 144 403

Maritime Administration [Washington, D. C.]
RATPROOFING OF SHIPS, by Stevens and Wood, Inc., New York. July 59, 73p. 58 refs.
Order from OTS $1.50 PB 161 019

The ratproof construction of a vessel is accomplished by so designing and building it as to eliminate, or to render inaccessible to rats, every space which might afford them harborage to shelter, nest, breed or obtain food. This manual was developed to assist shipyards, Naval Architects, Inspectors and others in designing and constructing a ship which will meet the present ratproofing requirements of the U. S. Public Health Service. Acceptable details for ratproofing are not necessarily limited to the details in this manual.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Iowa Agricultural Experiment Station, Ames.
STORAGE LIFE OF FRESH, CURED AND PROCESSED MEATS, by John C. Ayres. Rept. no. 36 (Termination) for 16 Mar 53-15 June 54 on Contract DA 44-109-qm-1423. [1954] 29p. 58 refs. File no. M-608.
Order from LC mi$2.70, ph$4.80 PB 144 058

This investigation was divided into three phases. Phase I concerned itself with the development of methods and media to be used in the determination

and characterization of the number and kinds of organisms isolated from fresh, cured and processed meats. Phase II was directed primarily toward the characterization of the organisms isolated from the meats. Species representative of each of the several distinct groups encountered were identified. Phase III was directed to the investigation of the microbiological changes accompanying storage of meats at various time-temperature relationships. Organoleptic changes, moisture loss and changes in pH were recorded. An attempt was made to relate the changes in the number and types of organisms in and on the meat to other changes which occur in the meat.

Quartermaster Food and Container Inst. for the Armed Forces, Chicago, Ill.
FOOD FROM ALGAE: A REVIEW OF THE LITERATURE, by John Lavery and Robert G. Tischer. Oct 58, 32p. 124 refs. Library Bulletin no. 1; AD-206 502.
Order from LC mi$3.00, ph$6.30 PB 138 412

The manuscript was completed in August of 1956 and is here presented without change because as it stands it constitutes an important and basic summary of what was known about algae culture at that time. Some of the titles which have appeared since will be listed in a bibliography on space feeding to appear in the September 1958 issue of FOOD TECHNOLOGY.

Whirlpool Corp., St Joseph, Mich.
EVALUATION OF SHELF LIFE OF IRRADIATED FOOD, by Aaron L. Brody. Rept. no. 8 (Final) for 12 July 56-11 July 58. [1958] 72p. 6 refs. QFCIAF File S-718.
Order from LC mi$4.50, ph$12.30 PB 144 183

Storage characteristics of several foods which had received pasteurizing doses of ionizing radiations and had been stored at refrigerator temperatures were studied. Foods studied were: Frankfurters, raw oysters, strawberries, blueberries, sour cherries, asparagus, snap beans, lima beans, and cauliflower. Several fruits and vegetables including peaches, apples, pears, and tomatoes were given uniform surface doses of irradiation in an effort to suppress mold growth with a minimum of damage to the product. Results, while showing trends toward mold growth retardation, were inconclusive.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Bell Aircraft Corp. [Buffalo, N. Y.]
A HIGH-SPEED AND HIGH-RESOLUTION PHOTOGRAPHIC TECHNIQUE FOR THE OBSERVATION OF PROPELLANTS INJECTED INTO A FIRING COMBUSTION CHAMBER, by Theodor G. Rossmann. Technical note on Contract AF 49(638)260. 18 May 59, 50p. 20 refs. Rept. no. 8007-981-008, Pt. 1; AFOSR-TN-59-8; AD-208 304.
Order from LC mi$3.30, ph$7.80 PB 143 902

Objective is to "conduct research in the general field of Observation of Burning Propellants in Rocket Engines", for the purpose of obtaining design criteria for liquid propellant rockets which will permit a more rational approach to design of rocket engines. An experimental method has been developed employing high-speed and magnifying photographic techniques. The light of a high intensity source, flashing at rates up to 10,000/sec, is directed through two windows in opposite walls of a rocket combustion chamber. It produces, by means of a photographic objective, a series of up to ten consecutive magnified shadow pictures of the liquid core of the evaporating or burning propellant droplets and ligaments on a photographic film. Evaluation of these films enables one to follow the time history of the physical phenomena mentioned before which occur in a firing rocket combustion chamber.

Bell Aircraft Corp. [Buffalo, N. Y.]
A HIGH-SPEED AND HIGH-RESOLUTION PHOTOGRAPHIC TECHNIQUE FOR THE OBSERVATION OF PROPELLANTS INJECTED INTO A FIRING COMBUSTION CHAMBER, by Theodor G. Rossmann. Technical note on Contract AF 49(638)260. 18 May 59, 88p. Rept. no. 8007-981-008, Pt. 2; AFOSR-TN-59-8; AD-208 304.
Order from LC mi$4.80, ph$13.80 PB 143 915

This section of report is exclusively photos involved in the project and must be used in conjunction with Part 1, PB 143 902)

James Forrestal Research Center, Princeton, N. J.
A COOPERATIVE PROGRAM OF FUNDAMENTAL RESEARCH AS RELATED TO JET PROPULSION. Semi-annual progress rept. for 1 Apr-30 Sep 57 on Project Squid, Contract N6ori-105(03). 1 Oct 57, 129p. 101 refs. AD-146 061.
Order from LC mi$6.30, ph$19.80 PB 137 703

(See also PB 130 671)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EVALUATION OF PROTECTIVE COATINGS FOR MOLYBDENUM NOZZLE GUIDE VANES, by John R. Giancola. Rept. for Jan 54-Jan 57 on Metallic Materials. June 59, 47p. WADC Technical note 58-241; AD-215 442.
Order from OTS $1.25 PB 151 912

Thirty seven molybdenum nozzle guide vanes, prepared and coated for resistance to jet engine operating conditions, were evaluated in an engine exhaust stream at 1860-1890°F for 4 hours. Non destructive and metallographic examinations revealed the degree of deterioration of each type of coating after test. Results indicate that, in the temperature range of the test, multilayer electrodeposited metallic coatings have the longest service life. No one coating combination survived the test without some serious damage. All coatings tested increased the life of the guide vanes over unprotected molybdenum.

Pennsylvania State U. Coll. of Engineering and Architecture, University Park.
THE FILM VAPORIZATION COMBUSTOR FOR GAS TURBINE ENGINES: THEORETICAL AND EXPERIMENTAL INVESTIGATIONS, by Gunter W. Maybach. Doctoral thesis. Technical rept. on Contract Nonr-656(13). Jan 59, 157p. 34 refs.
Order from LC mi$7.50, ph$24.30 PB 144 371

The objectives of this study were to realize a new combustion principle for gas turbines, one that would inherently reduce the formation of smoke and the formation of deposits inside the combustion chamber; to analyze the mixture formation and combustion mechanisms pertinent to the new combustion principle; and to determine the operational characteristics of a research prototype combustor incorporating the new principle. The new combustion principle is based on the vaporization of the fuel from a liquid film spread along the inner wall surface of a cylindrical combustor section by means of a high-velocity air stream.

Sundstrand Turbo Div., Sundstrand Corp. [Pacoima, Calif.]
SCALING PROCEDURES FOR ROCKETS UTILIZING LIQUID PROPELLANTS OF VARIABLE COMPOSITION AND MIXTURE RATIO, by S. S. Penner. Technical note no. 7 on Contract AF 18(603)107. 31 Aug 59, 20p. 13 refs. S/TD no. 1733; AFOSR-TN-59-908.
Order from LC mi$2.40, ph$3.30 PB 144 012

Generalized scaling rules are derived for liquid-fuel rocket engines on the assumption that the dependence of the overall, effective, conversion time is a known function of propellant mixture ratio and propellant type. The resulting scaling rules provide an important supplementary approach to current programs relating to the development of rational scaling procedures for liquid fuel rocket engines. The present analysis serves to emphasize the importance of continued basic research on the mechanism and rates of combustion reactions in engines.

Manufacturing Equipment and Processes

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
REVIEW OF ELECTRICAL MACHINING METHODS, by Max J. Trzeciak and Francis W. Boulger. 5 Aug 59, 14p. 37 refs. DMIC memo. 28; AD-225 298.
Order from OTS $0.50 PB 161 178

This is a review of recent literature describing the application of electrical machining methods. The three common nonconventional electrical machining methods are the spark-discharge, electrolytic grinding and milling, and arc-discharge methods. Sparking occurs between the tool and workpiece electrodes, which are separated by a dielectric fluid, when the voltage between these electrodes is increased until it exceeds the resistance of the dielectric. The sparking is usually forced to occur at a rate of 20,000 to 300,000 electrical discharges per second. Electrolytic erosion may be considered as an accelerated etching and lapping operation such as that used in preparing metallographic specimens. The metal surface is etched electrolytically and lapped concurrently many times during the course of machining by this method. A rotating metallic (copper or brass) wheel containing abrasive grains imbedded in its surface serves as a cathode. Alternatively, an abrasive wheel impregnated with graphite filler to make it current-conducting can be used. The characteristic of the arc-discharge method is that it thermally erodes the workpiece. The method ordinarily uses a low-voltage, high-amperage direct current power source, although alternating current may be used.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SPINDLE SHAPING OF TITANIUM SHEET, by Carl T. Olofson. 15 July 59, 4p. 1 ref. DMIC memo. 26; AD-220 196.
Order from OTS $0.50 PB 161 176

Spindle shaping is a hand-fed, edge-profiling operation for certain types of sheet-metal parts. The blank is firmly clamped to a template of desired edge contour. By means of a suitable fixture, the template and blank are then hand fed into an inverted single-spindle cutter protruding through a table. A bearing surface on the milling-type cutter traces the contour of the template, thereby guiding the cutter as it cuts the profile of the part. Parts can be produced from titanium and titanium-alloy sheet with aircraft-quality edge finish. This method is feasible for shaping sheet metal in gages from 0.060 to 0.187 inch using carbide cutters and carbon dioxide as a coolant.

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by A. F. Watts and Glen N. Rardin. Interim technical engineering rept. no. 6, 1 July-30 Sep 59, on Contract AF 33(600)35543. [1959] 15p. LR-14059.
Order from LC mi$2.40, ph$3.30 PB 144 411

This report describes the preliminary planning for testing explosive forming on aircraft parts.

Princeton U., N. J.
BENEFICIATION OF UNITED STATES MANGANESE RESERVES, by Oskar Morgenstern. Technical rept. no. 1 on Economics Research Proj., Contract Nonr-1858(02). 15 Jan 57, 54p. 71 refs. AD-147 123.
Order from LC mi$3.60, ph$9.30 PB 138 418

Domestic Mn ore and slag reserves: Oxide and carbonate ores (Cuyuna Range, Chamberlain Region, and Artillery Peak); and silicate ores and slags (Aroostook County and open hearth slags). Mn ore beneficiation processes: Oxide and carbonate ores (Chemical processes include ammonium carbamate-carbonate leach, H_2SO_4 and related compounds leach, HNO_3 leach (Nossen), HCl leach (King), and electrolysis; while physical processes include flotation, heavy media seperation and tabling, and crushing and jigging); silicate ores and slags (pyrochemical processes include lime clinkering (Sylvester), lime clinkering-carbamate leach (Sylvester-Dean), chemical roasting (Bruce Williams), and chlorine vaporization; pyrometallurgi-

cal processes include selective oxidation of slag-spiegel (Bureau of Mines), electric furnace reduction (Udy), and selective oxidation of pig iron (Wright); and the high-intensity-arc physical process). Alloy production methods: Ferromanganese (blast furnace and electric furnace); and silicomanganese. Characterization of physical input coefficients and dollar cost data.

Springfield Armory, Mass.
PREPARATION OF A PRECOAT FOR INVESTMENT CASTING, by G. Pributsky and W. M. Kisner. Rept. on The Application of Cast Materials and Processes to the Manufacture of Small Arms Weapons.
22 Oct 58, 21p. Rept. SA-TR18-1066; AD-225 972L.
Order from LC mi$2.70, ph$4.80 PB 144 055

A study was conducted to obtain data in order to establish a standard precoat formulation for use in precision investment castings. One precoat formulation with a sodium silicate binder had superior properties.

Transport, Traction and Hoist Facilities

Army Engineer Research and Development Labs., For Belvoir, Va.
ENGINEERING TESTS OF THE BRIDGE, FLOATING ALUMINUM LIGHT TACTICAL, PONTON BOAT CRADLE, by Gerard J. Welch. 18p. 2 refs. Technical rept. 1584-TR.
Order from LC mi$2.40, ph$3.30 PB 144 151

Requirements for a versatile cradle capable of supporting eight or less aluminum pontons on standard, general-purpose transportation equipment. Design of a Light Tactical Ponton Bridge Cradle, a 600-pound welded steel, skeleton pallet, designed to carry a maximum load of eight pontons nested in an inverted position on a 2 1/2-ton basic utility trailer.

Land Locomotion Research Branch, Ordnance Tank Automotive Command, Center Line, Mich.
EVALUATION OF VEHICLE SINKAGE IN OFF THE ROAD LOCOMOTION, by M. G. Bekker. June 58, 53p. 4 refs. Rept. no. 35.
Order from LC mi$3.60, ph$9.30 PB 143 949

The problem presented in this paper is to outline the solutions pertaining to vehicle sinkage, and to illustrate them with practical examples in order to assist the user and designer in the application of the latest developments of land locomotion mechanics. The present report has been prepared to provide information which may aid in the design and evaluation of wheeled and tracked vehicles.

Midwest Applied Science Corp., Lafayette, Ind.
BEHAVIOR OF A LINEAR ONE DEGREE OF FREEDOM VEHICLE MOVING WITH CONSTANT VELOCITY ON A STATIONARY GAUSSIAN RANDOM TRACK, by J. L. Bogdanoff and Frank Kozin. Rept. on Contract DA 33-008-ORD-1738. Feb 59, 33p. 6 refs. Rept. no. 48.
Order from LC mi$3.00, ph$6.30 PB 144 233

A method for analyzing a linear one degree of freedom vehicle when excited by a weakly stationary random process is discussed. If the surface of rough terrain is a Gaussian random process, this method can then be applied to determine the motion characteristics of the vehicle. A solution of the power required to maintain a constant velocity is presented.

Rome Air Development Center, Griffiss AFB, N. Y.
EVALUATION OF SURGE-TYPE BRAKE SYSTEM, by Harold Nares. July 59, 21p. RADC-TN-59-138; AD-214 494.
Order from LC mi$2.70, ph$4.80 PB 144 082

A qualitative analysis was made of an automatic trailer-brake system proposed for use in Project Two Wheels which is considered worthy of consideration for use in other military trailer systems. Although there was no attempt made in the reported test program to compile a strict engineering evaluation, sufficient work was done to indicate that the brake system shows considerable merit and that this could profitably become the subject for a funded engineering investigation.

Rome Air Development Center, Griffiss AFB, N. Y.
PROJECT TWO WHEELS, by John J. Guba. Aug 59, 29p. RADC-TR-59-38; AD-212 071.
Order from LC mi$2.70, ph$4.80 PB 144 299

Project Two-Wheels is a series of highly mobile, air-transportable communications and navigational facilities, developed for Airways and Air Communications Service, to support air operations under emergency or austere conditions. The five original facilities were developed by integrating standard communications and navigation equipment with a trailer van specifically designed for the purpose of forming a complete operating system. These facilities are described with primary emphasis on the development in the mechanical area.

MATERIALS

Bockamöllan, Brösarps Station (Sweden).
STATISTICAL EVALUATION OF DATA FROM FATIGUE AND CREEP-RUPTURE TESTS. PART I. FUNDAMENTAL CONCEPTS AND GENERAL METHODS, by Waloddi Weibull. Rept. for 1 Mar 58-28 Feb 59 on Materials Analysis and Evaluation Techniques, Contract AF 61(514)1208. Sep 59, 80p. 19 refs. WADC Technical rept. 59-400, Pt. 1.
Order from OTS $2.00 PB 161 297

Fatigue tests are classified into three types with consideration to the appropriate method of evaluating the data. Fundamental statistical concepts, general methods, and useful tools are presented. The possibilities of estimating distribution parameters have been examined. Starting from the concept of information available in a sample, various methods of extimating the parameters of location, scale, and shape are discussed, completed by a comparison of the efficiency of various estimates. General principles of fitting curves to observations are outlined and applied to the methods of maximum likelihood, linear regression, and best linear estimators.

Michigan U. Research Inst., Ann Arbor.
THE PHOTOGRAPHIC SEQUENCE EFFECT, by J. H. Enns and Ernst Katz. Final rept. pt. 2 on Contract AF 49(638)69. Aug 59, 23p. 5 refs. 2613-9-F; AFOSR-TR-59-122.
Order from LC mi$2.70, ph$4.80 PB 144 152

In Section 1 the motivation of this study is given; In Section 2 the method of sequence exposures is briefly described experimentally and theoretically and the experimental results are described. The results confirm qualitatively the trend of the theoretical work but lead to quantitative difficulties, which are discussed in Section 3. The conclusions are summarized in Section 4.

Metals Processing Lab., Mass. Inst. of Tech., Cambridge.
CHROMIUM COATINGS FROM LIQUID METAL SOLUTIONS, by Peter Schwarzkopf, Ernst B. Weglein and John Wulff. Technical rept. on Contract Nonr-1841(30). Dec 58, 31p. 12 refs.
Order from LC mi$3.00, ph$6.30 PB 143 984

Three types of solid-liquid interface are found to form by continuous cooling of a saturated solution of chromium in tin below the liquidus temperature. It was found possible to produce circa 0.001 inch coatings of chromium which are soft, dense and relatively smooth. Such coatings are too thin to offer protection to molybdenum above about 900°C in air. The .001 inch chromium deposits offer some promise as a barrier substrate for spray coats. (See also PB 151 126)

Virginia Agricultural Experiment Station, Blacksburg.
QUALITY CONTROL METHODS FOR SEVERAL RELATED VARIABLES, by J. Edward Jackson. Technical rept. no. 4 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Dec 58, 31p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 143 925

Ceramics and Refractories

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
GLASS-BONDED REFRACTORY COATINGS FOR IRON- OR NICKEL-BASE ALLOYS, by T. E. Cook and B. W. King. 25 Apr 59, 19p. 40 refs. DMIC memo. 16.
Order from OTS $0.50 PB 161 166

Ceramic coatings are applied to metal to (1) prevent oxidation, corrosive attack or erosion, and (2) thermally insulate the metal or change the radiation characteristics of the surface. To be effective, they must be continuous and bond tightly to the metal. Some do not adhere to the metal directly but require an intermediate undercoat. The quality of the coating material, (2) preparation of the metal surface, and (3) application and firing procedures used to obtain a bond between the metal and the glassy coating. Enamels are mixtures of oxides smelted into glasses and fritted by quenching--usually in water. Metals are prepared for coating by degreasing, sand blasting, scouring, pickling or combinations of these methods. The enamel frit is milled with water (and sometimes small amounts of conditioning agents) to form a slip or suspension, similar in appearance to water-base paints, of fine frit particles in water. The slip is applied to the metal by dipping or spraying as uniformly as possible. The coated piece is dried to remove water, sometimes baked at 300 to 600 F, and fired for 4 to 10 minutes at temperatures ranging from 1600 to 2400 F. Recommended coatings for iron- and nickel-base alloys, coating compositions, and details of procedures for metal preparation and application are given.

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
CREEP TESTS ON GRAPHITE. 23 June 50, 4p. NEPA 1480.
Order from LC mi$1.80, ph$1.80 PB 144 024

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
ZIRCONIA, by George Hall. 4 Mar 42, 57p. 21 refs. NEPA 437-IHR-E12.
Order from LC mi$3.60, ph$9.30 PB 144 025

Watertown Arsenal Labs., Mass.
THE SPECTRAL EMISSIVITY AND TOTAL NORMAL EMISSIVITY OF GRAPHITE AT ELEVATED TEMPERATURES, by Albert F. Grenis and Albert P. Levitt. Nov 59, 17p. 11 refs. Technical rept. no. WAL TR-397.1/2.
Order from LC mi$2.40, ph$3.30 PB 144 329

Apparatus developed for measuring the spectral and total normal emissivity of electrically conducting refractory materials. The total normal emissivities and spectral emissivities, at an effective wavelength of 0.65 microns, were determined for machined surfaces of graphite. The spectral emissivities were investigated within the range of 1000°C to 3000°C.

Fuels, Lubricants, and Hydraulic Fluids

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF AN INDICATOR TEST PAPER TO DETECT INSTABILITY OF STORED PROPELLANTS, by Phillip Rochlin. Nov 58, 32p. 7 refs. Technical rept. 2567; AD-202 006.
Order from LC mi$3.00, ph$6.30 PB 138 349

To evaluate the abilities of 3 experimental propellant test papers to detect incipient instability in stored propellants.

General Electric Co., Schenectady, N. Y.
FUEL TRANSIENT TEMPERATURE AND PRESSURE DUE TO AERODYNAMIC HEATING, by W. W. Fischer. Rept. on Project Hermes. Dec 50, declassified 17 Mar 58. 38p. Technical Information Series DF 50A0521.
Order from LC mi$3.00, ph$6.30 PB 144 123

An analysis was made of the effect of aerodynamic heating upon the Hermes B-1 fuel temperature and pressure. Both the annular and island fuel tanks were considered for 3 sets of conditions, viz., no insulation on either tank, insulation on diffuser side of island tank and insulation on diffuser side of both tanks. Calculation results indicate that this system of pressurization is unsatisfactory. Without insulation the fuel temperature becomes too high and a low pressure occurs shortly after B-1 launching. Insulation keeps the fuel cool enough but then the fuel pressure is so low that an auxiliary means of pressurization is necessary to prevent fuel pump cavitation.

General Electric Co., Schenectady, N. Y.
PREPARATION OF DIBORANE BY REACTION OF LITHIUM HYDRIDE AND BORON HALIDES: USE OF TETRAHYDROFURAN AS A SOLVENT, by E. M. Boldebuck and J. R. Elliot. Rept. on Proj. Hermes. Dec 49, 6 refs. Rept. no. R49A0534.
Order from LC mi$1.80, ph$1.80 PB 144 391

Tetrahydrofuran has been found to be an efficient solvent for diborane, and its use as a solvent in the lithium hydride-boron halide reaction results in good yields of diborane in the absence of catalyst or special operating temperatures.

General Electric Co., Schenectady, N. Y.
PREPARATION OF DIBORANE BY THE REACTION OF LITHIUM HYDRIDE AND BORON FLUORIDE ETHERATE, by J. R. Elliott and F. F. Roedel. Rept. on Proj. Hermes. 18 Feb 48, declassified 11 Aug 49, 54p. 9 refs. Rept. no. TR-55251.
Order from LC mi$3.60, ph$9.30 PB 144 393

A fundamental investigation of the reaction of lithium hydride and boron fluoride etherate in ethyl ether to form lithium fluoride and diborane has been performed under rigidly controlled conditions. Under rigidly controlled anhydrous conditions, no induction period precedes the reaction between lithium hydride and boron fluoride. A method has been found for the elimination of induction periods. This method involves pretreatment of lithium hydride in ether with diborane immediately before addition of the boron fluoride etherate.

General Electric Co., Schenectady, N. Y.
SOLUBILITY OF DIBORANE IN ETHYL ETHER AND IN TETRAHYDROFURANE, by E. M. Boldebuck, J. R. Elliott and others. Rept. on Proj. Hermes. 19 Nov 48, declassified 11 Aug 49, 11p. Rept. no. TR-55288.
Order from LC mi$2.40, ph$3.30 PB 144 395

The pressure over a solution of diborane in ethyl ether and in tetrahydrofurane has been measured in a bomb at different temperatures. From these data the solubility of diborane at 20°C and diborane pressure of one atmosphere has been calculated as 1.1 g. per 100 g. ethyl ether, 8.1 g. per 100 g. tetrahydrofurane. Solubility of diborane in ethyl ether is proportional to pressure and slightly higher than predicted by Raoult's law. In tetrahydrofurane solubility increases as the square root of diborane pressure, suggesting the formation of a complex with the solvent. Molar heat of solution of diborane in ethyl ether has been calculated, roughly, as -2800 cal; in tetrahydrofurane as -4900 cal.

Michigan U. Research Inst., Ann Arbor.
THERMAL CONDUCTIVITY OF LUBRICATING OILS AND HYDRAULIC FLUIDS, by D. W. McCready. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5745. July 59, 32p. 12 refs. WADC Technical rept. 59-185.
Order from OTS $1.00 PB 161 040

An all-metal concentric cylinder type of thermal conductivity cell was used to measure the thermal conductivity of twelve natural and synthetic base lubricating fluids. Thermal conductivity values in the temperature range of from 70 to 500°F are reported for fluids considered stable to the higher temperature. The maximum temperatures for other fluids were limited by their instabilities under test conditions. Since each fluid has individual characteristics, no correlation of conductivity values appears possible. Values are considered precise and for possible correlation can be compared to those of a fluid chosen as a "standard reference."

Naval [Weapons Plant] Washington, D. C.
PROPERTIES OF DIMETHYL POLYSILOXANE FLUIDS, by S. H. Cole. 23 Dec 58, 9p. 1 ref. NGF-T-34-58; NAVORD rept. 6488.
Order from LC mi$1.80, ph$1.80 PB 144 119

Tests were conducted to determine properties of dimethyl polysiloxane fluids in the viscosity range 0.65 to 214,000 centistokes. These properties included viscosity, viscosity-temperature coefficient, pour point, flash point, specific gravity, refractive index, dielective constant, acid number and volatility of the more viscous grades. A military specification was prepared from the data obtained from these tests.

Rocket Research Lab., Ohio State U. Research Foundation, Columbus.
INVESTIGATION OF LIQUID NITRIC OXIDE AS A ROCKET OXIDIZER, by Loren E. Bollinger and Rudolph Edse. Rept. on Contract AF 33(616)5615. May 59, 29p. 6 refs. WADC Technical rept. 59-12; AD-208 327.
Order from OTS $0.75 PB 161 300

An experimental investigation has been made of the use of liquid nitric oxide as an oxidizer for rocket engines. Since nitric oxide is an endothermic compound, it follows from thermodynamic calculations that nitric oxide - fuel mixtures have a higher specific thrust than do corresponding oxygen-fuel mixtures. It was found that extremely long residence times were required for the propellant in the combustion chamber. Originally it was planned to use JP-4 as the fuel with liquid nitric oxide but methyl alcohol was substituted because of the difficulties encountered in burning JP-4 with liquid nitric oxide. From the limited experiments which were conducted, liquid nitric oxide does not appear favorable as an oxidizer for rockets because of the long residence time required for nitirc oxide to react fully with the fuels used. Most of the experiments were conducted with a nominal 50-pound thrust motor having a characteristic length of 1515 inches; the design chamber pressure was 300 pounds per square inch. An experimental, uncorrected value of 211 seconds was obtained for the specific thrust at a chamber pressure of 327 pounds per square inch for an oxidizer-to-fuel weight ratio of 1.46. In addition, the results of these studies showed that nitric oxide, which is one of the important intermediate products in the combustion of the various nitric-acid type oxidizers, may affect the smooth combustion of nitric acid with a fuel because of the long chemical reaction time of nitric oxide.

Shell Development Co., Emeryville, Calif.
FUNDAMENTALS OF GEAR LUBRICATION, by V. N. Borsoff and R. Lutwack. Final rept. for June 55-May 56 on Contract NOas 53-356-c. [1956] 101p. 8 refs. Rept. no. S-13694; AD-143 172.
Order from LC mi$5.70, ph$16.80 PB 137 817

The extreme pressure film established on the working surfaces of gear teeth becomes gradually attrited when the gears are operated with an unreactive oil. The rate of attrition is high in the beginning of operation with unreactive oil. The rates of attrition decreased with time. Approximately 2/3 of the extreme pressure film could be attrited, and 1/3 remains firmly attached to the surfaces. Rolling motion has little effect on the attrition of an extreme pressure film. When gears with an extreme pressure film on the tooth working surface are operated with an unreactive oil in the thick film zone of lubrication, the mechanism of attrition is primarily that of "washing" by the lubricant. The shifting of the peaks of the extreme pressure film in the direction of sliding suggests a plastic like nature of the E. P. film formed by dibenzyl disulfide compounded oil. When gears with a radioactive E. P. film established on the teeth working surfaces are operated with an inert E. P. compound oil (DBDS in this case), the exchange of atoms of the active ingredient (sulfur) or molecules of the resultant product of reaction (iron-sulfide) in the extreme pressure film is a continuous process. This confirms our previous conclusion that extreme pressure films are being continuously formed and attrited during the operation of gears. The results of the tests with tagged DBDS performed last year confirm well the results of the two previous years of investigations.

Springfield Armory, Mass.
EVALUATION OF SHELL FOUR-BALL TEST RESULTS ON VARIOUS CUTTING FLUIDS AND LUBRICANTS, by L. Krasnor. Partial rept. no. 1, 2 Mar 59, 30p. Rept. SA-TR16-1055.
Order from LC mi$2.70, ph$4.80 PB 144 130

Measurements are given of the extreme pressure properties of more than 110 cutting fluids and lubricants taken in accordance with Federal Standard VV-L-791e, Method 650.3, with Shell Four-Ball Extreme Pressure Lubricants Tester. Highest Mean Hertz Load values were obtained from tests of blended materials of multiple compounding containing sulfur, chlorine, or phosphorus. Three of the four additives tested, which were used with mineral seal oil as a diluent, showed improved performance over their use with 100 second viscosity mineral oil. Adequate explanation for this is not yet available. Copper powder, cuprous chloride, and copper oleate showed some degree of extreme pressure activity especially in conjunction with sulfur and sulfur compounds.

Leather and Textiles

Cornell U., Ithaca, N. Y.
MASS TRANSFER COOLING OF PARACHUTE MATERIALS, by Rodney H. Cornish, Franklin J. Ahimaz, and others. Rept. for June 58-Jan 59 on Parachute Materials and Functional Textiles, Contract AF 33(616)5852. Sep 59, 97p. 7 refs. WADC Technical rept. 58-684.
Order from OTS $2.25 PB 161 293

Seventy-three tests were made on different parachute ribbon materials and protective coatings. These tests were conducted at Mach 5, pressure altitude of 100,000 feet and stagnation temperatures of 700 to 900°F. Most of the effort was devoted to mass transfer cooling (sublimation and melting). Hexachloroethane, Chloro-anthraquinone, Methyl-anthraquinone, Hydroxy-anthraquinone, and Camphene were applied by various techniques in several thicknesses. The results of these tests are plotted in the form of: lifetimes parameterized in terms of coating weight, temperature profiles, and heating rates. Tabular data is presented for all of the runs. This data indicates that coating weights on the order of the weight of the ribbons are required to give significant protection at the test conditions and that mechanical protection must be provided to the coatings to improve their efficiency.

Quartermaster Research and Engineering Center, Natick, Mass.
MEASURING AND PREDICTING THE GENERATION

OF STATIC ELECTRICITY IN MILITARY CLOTHING, by Aldo M. Crugnola and Horace M. Robinson. Sep 59, 71p. 44 refs. Textile Series rept. no. 110. AD-225 497.
Order from LC mi$4.50, ph$12.30 PB 143 888

The study reported in the following pages represents a review of the problem presented by static generation in clothing, and an exploration of the methods by which the problem can be minimized and the generation of a charge be evaluated on a clothing system. An investigation is reported on the effectiveness and durability of 12 antistatic finishes on various fabrics, and one finish is pinpointed which possesses the best combination of effectiveness and durability. From a review of published instrumental methods by which the electrostatic behavior of a fabric may be assessed, it was concluded that none of these is capable of giving an adequate, quantitative forecast of the hazard inherent in a particular multi-layer system. For this purpose, an instrument has been developed and is described herein. Results obtained with this instrument agree with those obtained from "on-the-individual" type test.

Plastics

Army Engineer Research and Development Labs., Fort Belvoir, Va.
GENERAL FORMULA FOR CREEP AND RUPTURE STRESSES IN PLASTIC MATERIALS, by S. Goldfein. 31 July 58, 40p. 14 refs. Rept. no. 2409-17.
Order from LC mi$3.00, ph$6.30 PB 144 044

The purpose of this work was to derive a general formula which would accurately describe the time-temperature relationship for creep and rupture stresses in plastic materials.

Brown U. Div. of Engineering, Providence, R. I.
THE VALIDITY OF MODEL REPRESENTATION FOR LINEAR VISCOELASTIC BEHAVIOUR, by H. Kolsky and Y. Y. Shi. Technical rept. no. 5 on Contract Nonr-562(14). Jan 58, 43p. 27 refs. AD-156 118.
Order from LC mi$3.30, ph$7.80 PB 137 917

The observed mechanical response of some linear viscoelastic materials as measured by Lethersich and others is compared with the response predicted by two and three parameter models. It is found that two parameter models are completely inadequate in describing the observed behavior over even a narrow frequency range. Of the two three-parameter models the standard linear solid is preferable, and this model gives at least qualitative agreement with experiment over a frequency range of one or two decades. It is shown that this degree of agreement is adequate to predict the mechanical behavior of the materials when subjected to smooth stress or strain cycles quasi-statically.

Frick Chemical Lab., Princeton U., N. J.
EXISTENCE OF A SHARPLY DEFINED MAXIMUM RELAXATION TIME FOR MONODISPERSE POLYSTYRENE, by A. V. Tobolsky and K. Murakami. Rept. on Contract Nonr-1858(07). 29 Jan 59, 31p. 8 refs. ONR Technical rept. RLT-28.
Order from LC mi$3.00, ph$6.30 PB 144 144

Relaxation of stress measurements were carried out in the region of rubbery flow on two samples of polystyrene.

Rubber and Elastomers

Frick Chemical Lab., Princeton U., N. J.
THE MECHANISM OF OXIDATIVE SCISSION IN NATURAL RUBBER, by A. V. Tobolsky and A. Mercurio (Doctoral thesis). Rept. on Contract Nonr-1858(07). 29 Dec 58, 24p. 22 refs. ONR Technical rept. RLT-27.
Order from LC mi$2.70, ph$4.80 PB 143 853

The free radical producers 2-azobisisobutyronitrile, di-t-butyl peroxide, and benzoyl peroxide, have been used to initiate the oxidation of natural rubber in dilute benzene solutions at 60-80°C. Quantitative comparisons are made between the measured rate of scission of natural rubber and the known rate of initiation of oxidation chains (in the kinetic sense) by these agents under these conditions. The rate of rubber scission in dilute benzene solutions and in solid rubber has been used to investigate the ability of the systems tetramethyl thiuram disulfide and benzoyl peroxide-dimethyl aniline to initiate oxidation chains. The rates of initiation in both cases depend strongly on rubber concentration approaching, in solid rubber, values comparable to the rates of initiation of polymerization by these agents in bulk styrene and bulk methyl methacrylate.

Rock Island Arsenal Lab., Ill.
EVALUATION OF POTENTIAL AGE RESISTING INHIBITORS FOR SBR 1600 VULCANIZATES, by D. Ilten. 2 Nov 59, 21p. 8 refs. Rept. no. 59-2825.
Order from LC mi$2.70, ph$4.80 PB 144 335

Previous work had indicated that certain organo metallic compounds formed in situ during the vulcanization of rubber were very effective in improving the age resistance of the rubber. This work was done to evaluate related members of this class as antioxidants in order to determine the degree of protection obtained and if possible to find a better antioxidant. It was found that the residues formed during curing in both the sulfur-accelerator cure and a cure based on the use of accelerators only were more effective as antioxidants than any of the potential inhibitors which were evaluated. In all cases investigated, the age resistance of the accelerator cured vulcanizates was superior to that of the corresponding sulfur-accelerator cured vulcanizates. Some of the compounds evaluated made the age resistance of the vulcanizates poorer than that of the control. This was considered to reflect their activity as vulcanization accelerators even at the relatively low aging temperatures.

Rock Island Arsenal, Ill.
SYNTHESIS OF RUBBER COPOLYMERS BY SOME NEW METHODS, by W. Jurgeleit and R. R. Freeman. 28 July 59, 15p. 4 refs. Rept. no. 59-2001. AD-226 101.
Order from LC mi$2.40, ph$3.30 PB 143 885

The copolymerization of butadiene and styrene by Ziegler catalysts was investigated. An adsorption process as the time determining step is suggested in the Ziegler polymerization. Grafting by means of an anionic initiator was accomplished in concentrated solutions and in a solvent free process on a roll mill. The catalyst, Na alcoholate, was prepared from Na or NaH dispersions and an alcohol. It is essential first to bring the Na or NaH dispersions together with the polymer under conditions that might allow at least a partial reaction of the polymer with Na, either substitution or addition. Furthermore, the catalyst must be prepared in the presence of both the monomer and the polymer. The described method was used to graft (a) acrylonitrile onto polybutadiene and a butadiene/styrene copolymer, and (b) styrene onto polybutadiene and a butadiene/acrylonitrile copolymer. The graft copolymers were identified by solubility changes and IR spectra. The solvent free grafting procedure might have some technical possibilities and shows certain advantages when compared with similar methods known to date.

MATHEMATICS

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON CENTERING INFINITELY DIVISIBLE PROCESSES, by Ronald Pyke. Technical rept. no. 24 on Contract Nonr-225(21). 8 Jan 59, 13p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 144 291

The concept of centering stochastic processes having independent increments, introduced by Lévy, is applied to processes having both stationary and independent increments. The question of what centering functions preserve the stationarity of the increments is studied.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON THE GAUSS CURVATURE OF MINIMAL SURFACES, by Robert Osserman. Technical rept. no. 11 on Contract DA 04-200-ORD-704. 18 Aug 59, 26p. 12 refs. OOR rept. 1323.16-M.
Order from LC mi$2.70, ph$4.80 PB 144 333

The majority of results in this paper are derived from the following observation. Given a point p on a minimal surface, one may assign to each point of a suitable neighborhood N of p two complex variables ζ and w, such that the correspondence between ζ and w is analytic, and for the Gauss curvature K at each point of N we have the formula

$$K = -\left[\frac{4}{(1+|w|^2)^2}\left|\frac{dw}{d\zeta}\right|\right]^2$$

This allows us to translate elementary properties of analytic functions into geometric statements about minimal surfaces.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE REPRESENTATIONS OF LINEAR FUNCTIONALS BY MEASURES ON SETS OF EXTREME POINTS, by Errett Bishop and Karel Deleeuw. Technical rept. no. 6 on Contract AF 49(638)294. 26 Oct 59, 44p. 11 refs. AFOSR-TR-59-133.
Order from LC mi$3.30, ph$7.80 PB 144 348

The existence of representations of linear functionals on subspaces and subalgebras of a C(X) by measures on "boundaries" smaller than the Silov boundary are discussed.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
STATISTICAL INFERENCE ON TIME SERIES BY HILBERT SPACE METHODS, I, by Emanuel Parzen. Technical rept. no. 23 on Contract Nonr-225(21). 2 Jan 59, 132p. 14 refs.
Order from LC mi$6.90, ph$21.30 PB 144 406

This paper is the first of a series of projected papers on modern time series analysis, in which it is hoped to show how Hilbert space methods (which were introduced in the 1940's to clarify the probabilistic structure of time series) can be used to clarify, and to solve, various problems of statistical inference on time series. In this paper, among other things, we introduce a tool which plays a major role in our work, namely the representation of a stochastic process with finite second moments by means of a reproducing kernel Hilbert space.

[Army] Chemical Corps Engineering Agency, Army Chemical Center, Md.
METHODS OF SAMPLING ACCEPTANCE BY VARIABLES, by David R. Howes and Evelyn J. Leonard. 21 July 53, 32p. 11 refs. Engineering Agency Manual no. 4; AD-51 450.
Order from LC mi$3.00, ph$6.30 PB 144 394

A discussion is given of the uses of variables acceptance in production and acceptance inspection for percent defective. Charts and tables are given of the levels of protection and discrimination afforded by explicit plans. The basic assumptions, operations, and statements of requirements common to all modern variables acceptance systems are presented. The discussion is intended to make clear the use and advantages of variables acceptance procedures. Arguments and examples are furnished to show that variables sampling is able to (1) reduce inspection and save materials, acceptance delay, man hours, and facilities; (2) improve protection to the consumer by decreasing

the risks that isolated lots of inferior material will escape detection, and (3) improve discrimination. The latter implies that the acceptance quality levels can be relaxed to permit faster production, and that rejections can be reduced while maintaining the same protection to the consumer.

Army Chemical Corps Engineering Command, Army Chemical Center, Md.
PROCEEDINGS OF THE ANNUAL STATISTICAL ENGINEERING SYMPOSIUM [NO. 4] 7-8 MAY 1958, by T. M. Vining. [1958] 187p. 102 refs.
Order from LC mi$8.40, ph$28.80 PB 144 138

Contents:
Theoretical aspects of MIL-STD-414
MIL-STD-414 sampling procedures and tables for inspection by variables for percent defective
Practical application of OSTD 80
The use of sample quasi-ranges in estimating population standard deviation
Statistical quality control in the Soviet Union
The relationship of sample size to lot size in acceptance inspection
Evaluation of surveillance sampling plans
An optimal depletion of inventory for known utility functions
Evaluation of surveillance sampling plans
Optimal conditions for LIFO and FIFO inventory systems
A reliability model for the case of dependent components
The role of environmental testing in missile programs
Panel on proposed department of defense handbook on single level continuous sampling
The proposed DOD handbook on procedures and tables for single level continuous sampling inspection by attributes
Field application of single-level continuous sampling
Multi-level continuous sampling plans
Mathematical and statistical principles underlying chemical corps inspection procedures for product verification

[Army Rocket and Guided Missile Agency] Redstone Arsenal, Ala.
DIAGONALIZATION OF OPERATOR MATRICES, WITH APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS, by Ben Fitzpatrick, Jr. 1 Sep 57, 17p. Rept. no. 2R24F; AD-146 524.
Order from LC mi$2.40, ph$3.30 PB 144 194

Using matrix theoretic methods, conditions for reducibility of a first order linear operator matrix have been determined. When a system of partial differential equations has a coefficient matrix L that can be so reduced, the system is readily solvable. While most systems of partial differential equations cannot be solved in this manner, the method gives the solution in closed form when applicable. It is furthermore to be hoped that some of the results obtained will prove useful in matrix theory as such, in addition to the above applications to partial differential equations.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE NUMERICAL SOLUTION OF A FOURTH-ORDER PARABOLIC DIFFERENTIAL EQUATION, by Horace Flatt. Apr 56, 18p. 8 refs. Memo. rept. no. 999.
Order from LC mi$2.40, ph$3.30 PB 144 084

The purpose of this report is to describe a numerical method for obtaining the solution of a boundary-value problem involving a fourth-order parabolic differential equation. This method uses finite differences, and a comparison is made between the numerical solution obtained in this way and the solution as obtained by evaluating the analytical solution.

Minnesota U., Minneapolis.
AN ANALYTIC PROBLEM WHOSE SOLUTION FOLLOWS FROM A SIMPLE ALGEBRAIC IDENTITY, by Glen Baxter. Technical rept. no. 8 on Contract AF 18(603)30. 1 June 59, 25p. 6 refs. AFOSR-[TN]-59-592; AD-217 184.
Order from LC mi$3.70, ph$4.80 PB 143 956

The solution of a particular operator equation involving elements in a Banach algebra is shown to follow directly from an algebraic identity involving the operator. A combinatorial lemma of a rather general nature is proved and then used to show the result above. Applications to probability theory, etc. are considered.

California U., Berkeley.
THE GELFAND-LEVITAN EQUATION APPROACH TO QUESTIONS IN PHASELESS SCATTERING, by S. F. Tuan. Technical rept. no. 22 on Contract Nonr-222(37). Feb 58, 27p. 14 refs. AD-153 848.
Order from LC mi$2.70, ph$4.80 PB 138 138

Contents:
The radial equation for angular momentum, angular momentum $\ell = 0$
The outgoing Eigenfunctions: The scattering operator
The Gelfand-Levitan equation: The weight operator
The Bargmann potentials
ℓ-wave scattering and generalized bargmann potentials

California U., Berkeley.
A GENERAL COHOMOLOGY THEORY OF SHEAVES, by Charles E. Watts. Technical rept. no. 16 on Contract Nonr-222(37). Oct 57, 38p, 9 refs. AD-148 298.
Order from LC mi$3.00, ph$6.30 PB 137 562

California U., Berkeley.
ON THE MORSE-LERAY SPECTRAL SEQUENCE, by S. R. Fary. Technical rept. no. 2 on Contract Nonr-222(62). Nov 58, 18p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 144 315

California U., Berkeley.
WHICH LIE GROUPS ARE HOMOTOPY-ABELIAN? by Ioan James and Emery Thomas. Technical rept. no. 11 on Contract AF 49(638)79. Sep 59, 9p. 12 refs. AFOSR-TN-59-982.
Order from LC mi$1.80, ph$1.80 PB 144 369

We say that a topological group G is homotopy-abelian if the mappings f and $\bar{f}$, of G x G to G, are homotopic, where

$$f(x,y) = xy = f(y,x) \quad (x,y \in G).$$

The problem we consider in this paper is whether any of the non-abelian Lie groups are homotopy-abelian. Our main result is: Theorem: The classical structure classes contain no Lie group which is homotopy-abelian but not abelian. Our method is a generalization of that used by H. Samelson to show that Sp(1) is not homotopy-abelian.

Duke U., Durham, N. C.
SOME PROPERTIES OF THE FUNDAMENTAL SOLUTION OF THE PARABOLIC EQUATION, by Stewart M. Robinson. Rept. on Contract AF 18(600)1341. July 59, 29p. 15 refs. AFOSR-TN-59-789.
Order from LC mi$2.70, ph$4.80 PB 144 374

Harvard U., Cambridge, Mass.
NOTE ON DEGREE OF APPROXIMATION BY BOUNDED ANALYTIC FUNCTIONS: PROBLEM β, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Oct 59, 24p. 11 refs. AFOSR-TN-59-952; AD-228 076.
Order from LC mi$2.70, ph$4.80 PB 144 472

The present writer has recently published a general result on Problem β, and now wishes to indicate a stronger result. The older result deals with Lipschitz conditions in the hypothesis, while the new one deals with integrated Lipschitz conditions; the latter were introduced into the theory of degree of trigonometric approximation in theorems stated without proof by Hardy and Littlewood and later proved in detail by Quade. The present note is made possible by an investigation on integrated Lipschitz conditions for the complex variable made by Walsh and Russell.

Harvard U., Cambridge, Mass.
ON THE ANALOGUE FOR MAXIMALLY CONVERGENT POLYNOMIALS OF JENTZSCH'S THEOREM, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Dec 58, 24p. 7 refs. AFOSR-TN-58-1086; AD-207 583.
Order from LC mi$2.70, ph$4.80 PB 144 344

Although sequences of rational and analytic functions of the complex variable have been studied in some detail regarding geometric degree of convergence, and convergent sequences of analytic functions have been basically studied with reference to their zeros, no adequate applications to maximally convergent sequence of polynomials as such have been made. In particular there has been no special study of the analogue of Jentzsch's theorem, that every point of the circle of convergence of a Taylor development is a limit point of zeros of the partial sums. The object of the present paper is to investigate specifically the zeros of maximally convergent sequences of polynomials, including in detail some illuminating special expansions.

Harvard U., Cambridge, Mass.
ON THE ASYMPTOTIC PROPERTIES OF EXTREMAL POLYNOMIALS WITH PRESCRIBED CONSTANT TERM, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Oct 59, 16p. 5 refs. AFOSR-TN-59-1037.
Order from LC mi$2.40, ph$3.30 PB 144 368

The object of the present note is to study the analogue of $\lim_{n\to\infty} \|T_n(z)\|^{1/n} = \tau(E)$,
for the polynomials

$$p_n(z) = z^n + a_1 z^{n-1} + \ldots + a_n$$

of least norm where the numbers $a_n = A_n$ are prescribed; under suitable conditions on E we obtain necessary and sufficient conditions on the A_n that the analogue be valid.

[Illinois U., Urbana]
ON THE CONSTRUCTION OF CERTAIN AUTOMORPHIC FORMS OF NON-NEGATIVE DIMENSION, by Marvin Isadore Knopp. Technical rept. on Contract Nonr-1834(18). 1958, 51p. 8 refs.
Order from LC mi$3.60, ph$9.30 PB 144 402

Institute for Advanced Study, Princeton, N. J.
RESEARCH IN ANALYSIS: EXTREME LENGTH, by James A. Jenkins. Final rept. on Contract DA 36-034-ORD-2453. Aug 59, 4p.
Order from LC mi$1.80, ph$1.80 PB 144 028

The work done under this contract has dealt with the method of the extremal metric, the results obtained showing once again the manner in which it provides a unifying principle in the Theory of Functions as well as a powerful method for deriving new results. The range of subjects covered includes quasiconformal mappings, type problems, the trajectories of quadratic differentials and especially the General Coefficient Theorem, its extensions and applications to the theory of univalent functions.

Institute for Advanced Study, Princeton, N. J.
A VARIANT OF HELLY'S THEOREM, by Branko Grünbaum. Rept. on Contract AF 49(638)253. Sep 59, 10p. 18 refs. AFOSR-TN-59-980; AD-228 283.
Order from LC mi$1.80, ph$1.80 PB 144 477

The following modification of Helly's theorem on intersections of convex sets is established, together with some related results. Let K, a subset of Euclidean space, be the union of a finite number of disjoint, compact, convex sets. Then there exists an integer $N = N(K)$ with the following property: For any family $\{K_\alpha\}$, where each K_α is the transform of K by a non-singular affine transformation T_α (depending on α), if any N of the sets K_α have a non-empty intersection, then the intersection of all the sets K_α is not empty. Examples show that none of the underlined conditions may be dropped.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
NEW INEQUALITIES FOR MEMBRANE AND PLATE EIGENVALUES, by L. E. Payne. Rept. on Contract AF 49(638)228. Sep 59, 16p. 5 refs. Technical note BN-186; AFOSR-TN-59-1040; AD-226 856.
Order from LC mi$2.40, ph$3.30 PB 144 292

Two notes are presented on isoperimetric inequalities for membrane and plate eigenvalues. The first give upper and lower bounds for clamped plate eigenvalues in terms of fixed membrane eigenvalues for the same region. The second gives a natural extension of the isoperimetric inequality of Faber and Krahn.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
A THEORY OF LOWER BOUNDS FOR EIGENVALUES, by H. F. Weinberger. Rept. on Contract AF 49(638)228. Aug 59, 99p. 59 refs. Technical note BN-183; AFOSR-TN-59-974.
Order from LC mi$5.40, ph$15.30 PB 144 306

A polynomial equation whose roots are lower bounds for the eigenvalues of a differential operator is derived. The coefficients of the equation depend upon some arbitrary functions and upon the minimal information necessary to determine any lower bounds. Conditions are given under which the lower bounds so obtained converge to the correct eigenvalues as more arbitrary functions are used. The method serves to unify and improve many of the known methods of finding lower bounds.

Institute of Mathematical Sciences, New York U., N. Y.
MATRIX INVERSION AND THE SOLUTION OF LINEAR EQUATIONS, by J. H. Curtiss. Technical rept. no. 5 on Contracts DA 30-069-ORD-1257 and N6ori-201, T. O. 1. Aug 55, 85p. 5 refs. IMM-NYU-220; AD-115 793.
Order from LC mi$4.80, ph$13.80 PB 143 840

There are a number of other ways in which the basic facts concerning the existence of solutions to systems of linear algebraic equations can be stated. The formulation given has the advantage of telling the story with a minimum amount of technical terminology. Also, it is of interest to mathematical analysts because the existence theorems for integral equations can be given a parallel formulation. The proof of the theorem is constructed in the course of the chapter. At the same time a number of other fundamental results are derived, which are essential for an understanding of the theory of linear computations.

Institute of Tech., U. of Minnesota, Minneapolis.
CONVERGENT SOLUTIONS OF ORDINARY LINEAR HOMOGENEOUS DIFFERENCE EQUATIONS IN THE NEIGHBORHOOD OF AN IRREGULAR SINGULAR POINT, by William J. A. Culmer. Technical rept. no. 6, 16 June-15 Sep 59, on Problems in the Theory of Ordinary Differential and Difference Equations, Contract DA 11-022-ORD-2042. 31 Aug 59, 136p. 9 refs. OOR rept. 1469-6-M.
Order from LC mi$6.90, ph$21.30 PB 144 245

This paper deals with the solution of the linear homogeneous difference equation $X(S+1) = S^h A(S)X(S)$, where h is a constant; the independent variable S is complex; and A(S) is a 2X2 square matrix representable as a power series in 1/S, namely

$A(S) = A_0 + \frac{A_1}{S} + \frac{A_2}{S^2} \cdots$, $|S| > S_0$, which, as indicated, is convergent in some neighborhood of $S = \infty$. The coefficients A_0, A_1, A_2, $\cdots$ are known constant matrices with complex elements. The unknown X(S) is a 2X2 matrix also.

Institute of Tech., U. of Minn., Minneapolis.
SINGULAR PERTURBATIONS OF TWO POINT BOUNDARY PROBLEMS FOR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS, by W. A. Harris, Jr. Technical rept. no. 5, 16 Mar-15 June 59, on Problems in the Theory of Ordinary Differential and Difference Equations, Contract DA 11-022-ORD-2042. 15 July 59, 27p. 11 refs. OOR rept. 1469-5-M.
Order from LC mi$2.70, ph$4.80 PB 144 246

Asymptotic solutions of linear systems of ordinary differential equations are employed to discuss the relationship of the solution of a certain "complete" boundary problem.

$$\begin{cases} dx_1/dt = A_{11}(t,\varepsilon)x_1(t,\varepsilon) + \cdots + A_{1\rho}(t,\varepsilon)x_\rho(t,\varepsilon) \\ \varepsilon^{h_2}(dx_2/dt) = A_{21}(t,\varepsilon)x_1(t,\varepsilon) + \cdots + A_{2\rho}(t,\varepsilon)x_\rho(t,\varepsilon) \\ \vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ \varepsilon^{h_\rho}(dx_\rho/dt) = A_{\rho 1}(t,\varepsilon)x_1(t,\varepsilon) + \cdots + A_{\rho\rho}(t,\varepsilon)x_\rho(t,\varepsilon) \end{cases}$$

$$R(\varepsilon)x(a,\varepsilon) + S(\varepsilon)x(b,\varepsilon) = c(\varepsilon)$$

as $\varepsilon \to 0+$ and the related "degenerate" problem obtained by setting $\varepsilon = 0$. Here the h_i are integers, $0 < h_2 < \cdots < h_\rho$, x_i is a vector of dimension n_i, $A_{ij}(t,\varepsilon)$ are matrices of appropriate orders with asymptotic expansions, x is the vector $\begin{pmatrix} x_1 \\ \vdots \\ x_\rho \end{pmatrix}$, R and S are square matrices of order $\sum_{i=1}^{\rho} n_i$ and $\varepsilon > c$. It is shown that under certain conditions the solution of the "complete" problem as $\varepsilon \to 0+$ approaches a solution of the "degenerate" differential system and satisfies n_1 appropriate "degenerate" boundary conditions.

Johns Hopkins U., Baltimore, Md.
ON SPHERICAL IMAGE MAPS WHOSE JACOBIANS DO NOT CHANGE SIGN, by Philip Hartman and Louis Nirenberg. Technical rept. no. 10 on Contract AF 18(603)41. Mar 59, 30p. 11 refs. AFOSR-TN-59-549; AD-216 659.
Order from LC mi$2.70, ph$4.80 PB 144 340

The first part of the paper deals with mappings $p = p(x)$ of an n-dimensional x region into n-dimensional p space with a Jacobian J(x) which does not change sign. A map $p = p(x)$ is called a gradient map if p(x) is locally a gradient. One of the theorems proved, for example, states that a gradient map $p = p(x)$ with a Jacobian which does not change sign is monotone in the sense that the boundary of the image set is contained in the image of the boundary. Analogous results are valid for the spherical image mapping of an n-dimensional hypersurfaces immersed in (n + 1)-dimensional Euclidean space. The next part of the paper concerns applications of the results of the first part; for example, there are obtained an n-dimensional generalization of the Rado (von Neumann) theorem on saddle surfaces, a characterization of complete hypersurfaces of constant zero curvature in Euclidean spaces as cylinders, and, for n = 2, properties of the x sets grad z(x) = const. if the Hessian determinant of z is identically zero.

Kansas U., Lawrence.
A NOTE ON THE CLOSED HULL OF AN ALMOST PERIODIC FUNCTION: SOME EXAMPLES ASSOCIATED WITH THE REPRESENTATION PROBLEM, by James C. Lillo. Technical rept. no. 2 on Basic Research of Nonlinear Differential Equations, Contract DA 23-072-ORD-1289. Aug 59, 5p.
Order from LC mi$1.80, ph$1.80 PB 144 244

A study of the relationship between the set of Fourier coefficients for an almost periodic function and the set of Fourier coefficients associated with the closed hull of the almost periodic function.

Kansas U., Lawrence.
ON EXPONENTIAL REPRESENTATIONS OF ANALYTIC FUNCTIONS IN THE UPPER HALF-PLANE WITH POSITIVE IMAGINARY PART, by N. Aronszajn and W. F. Donoghue, Jr. Technical rept. 20 on Studies in Eigenvalue Problems, Contract Nonr-583(04). 1957, 76p. 20 refs. AD-145 600.
Order from LC mi$4.50, ph$12.30 PB 137 574

The work presented in this paper has its origin in certain theorems which were needed by the authors for their forthcoming paper on "Finite dimensional perturbations of spectral problems and approximation methods". These theorems were closely related to results obtained by S. Verblunsky and H. Delange but could not be deduced from those results. Thus we were led to investigate in general the question of the exponential representation of functions analytic in the upper half-plane with positive imaginary part there, a class denoted in this paper by P. The results of that investigation form the content of the paper, and the theorems which we required for out future paper as well as the theorems of Verblunsky and Delange occur as very special cases of those results.

Laboratory of Statistical Research, U. of Washington, Seattle.
SOME RELATIONSHIPS INVOLVING SUBORDINATION, by R. M. Blumenthal. Technical rept. no. 30 on Contract Nonr-477(11). 3 Oct 58, 15p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 143 792

Michigan State U. [East Lansing].
MULTIVARIATE CHEBYSHEV TYPE INEQUALITIES, by Albert W. Marshall and Ingram Olkin. Interim technical rept. no. 14 on Contract DA 20-018-ORD-14735. 25 Aug 59, 35p. 9 refs. OOR rept. 1840.12-M.
Order from LC mi$3.00, ph$6.30 PB 144 466

Various inequalities involving the minimum component or the product of components of a random vector are considered. Derivations and proofs of sharpness for these two classes of inequalities show remarkable similarities. Some of each type occur as special cases of a general theorem.

Michigan State U., [East Lansing].
A ONE-SIDED INEQUALITY OF THE CHEBYSHEV TYPE, by Ingram Olkin and Albert W. Marshall. Interim technical rept. no. 13 on Contract DA 20-018-ORD-14735. 25 June 59, 12p. 2 refs. OOR Rept. no. 1840:11.
Order from LC mi$2.40, ph$3.30 PB 144 086

Let $x = (x_1, \ldots, x_k)$ be a random vector with $Ex_i = 0$ and either (i) $Ex_i^2 = \sigma^2$, $Ex_ix_j = \sigma^2\rho$ $(i \neq j)$, $i, j = 1, \ldots, k$, or (ii) $Ex_i^2 = \sigma_i^2$, $i = 1, \ldots, k$. In each case a sharp upper bound (only involving the specified moments) for $P[x_1 \geq 1 \text{ or } \ldots \text{ or } x_k \geq 1]$ is obtained. A formulation for more general one-sided bounds is also discussed.

Michigan State U., East Lansing.
ORTHOGONAL POLYNOMIALS IN ONE AND TWO DIMENSIONS, by Heinrich Larcher and Ingram Olkin. Technical rept. no. 7 on Basic Research in Multivariate Analysis, Contract DA 20-018-ORD-14735. 17 May 57, 17p. 3 refs. AD-131 491.
Order from LC mi$2.40, ph$3.30 PB 137 834

Two methods of obtaining systems of orthogonal polynomials for given 1- and 2-dimensional regions are developed. One technique is the modification of that presented by Grobner (Monatshefte fur Mathematik 52:38-54, 1948) so that the system for certain regions in the x-y plane may be obtained immediately by the calculus of variations. The method concerns itself with regions for which a closed form expression for the polynomial exists. In certain cases the polynomial might be a function of x alone; the procedure may be carried out with x and y interchanged. Examples are worked out which define systems of orthogonal polynomials for the square with corners (1, 1), (-1, 1), (-1, -1), and (1, -1); and for the triangle with vertices (0, 0), (1, 0), and (0. 1). A new method is also developed which permits a generalization to higher dimensions. Two examples are considered, one for a linear interval and a second for a triangular region in the x-y plane. These polynomials are the same as those obtained by Grobner. From this procedure it is evident that by defining polynomials in 2 variables differently, other systems of orthogonal polynomials for a given region which are complete may be obtained.

Minnesota U. School of Business Administration, Minneapolis.
CONTRIBUTIONS TO THE THEORY OF RANK ORDER STATISTICS: THE ONE-SAMPLE CASE, by Richard Savage. Technical rept. no. 3 on Contract Nonr-2582(00). 25 Jan 59, 10p. 4 refs.
Order from LC mi$1.80, ph$1.80 PB 144 399

The one-sample problem is considered using techniques developed earlier. Let $Z=(Z_1, \ldots, Z_N)$ be a random vector with $Z_i=1(0)$ if the i-th smallest in absolute value in a sample of N from the density f(x) is positive (negative). Then

$$P(Z=z) = N! \int \ldots \int \prod_{i=1}^{N} [f^{1-z_i}(-y_i) f^{z_i}(y_i) dy_i]$$

$$0 \le y_1 \le \ldots \le y_N \le \infty$$

Conditions are found implying $P(Z=z) > P(Z=z')$ where z is derived from z' by replacing a 0 by a 1, or interchanging a 0 and 1 in z' by moving the 1 to the right. These conditions are met by the normal and other distributions.

Missouri U., Columbia.
ON A THEOREM OF E. SPARRE ANDERSEN AND ITS APPLICATION TO TESTS AGAINST TREND, by H. D. Brunk. Technical rept. no. 13 on Contract AF 18(600)1108. Aug 59, 46p. 11 refs. AFOSR-TN-59-856.
Order from LC mi$3.30, ph$7.80 PB 144 309

Missouri U., Columbia.
UNSTABLE HOMEOMORPHISMS AND THE CLOSED 2-CELL, by J. F. Jakobsen and W. R. Utz. Technical rept. no. 12 on Contract AF 18(600)1108. Aug 59, 15p. 7 refs. AFOSR-TN-59-855.
Order from LC mi$2.40, ph$3.30 PB 144 308

Naval Ordnance Test Station, China Lake, Calif.
SOLVING DIFFERENTIAL EQUATIONS BY FOURIER SERIES, by H. J. Fletcher and C. J. Thorne. 17 Sep 59, 38p. 7 refs. NOTS TP-2322; NAVORD rept. 6590.
Order from LC mi$3.00, ph$6.30 PB 144 201

A promising method of solving linear and nonlinear problems is investigated and many properties of use in obtaining such solutions are developed. This worl was performed during 1957. It was supported by Bureau of Ordnance Task Assignment 520-226-61006/02054, Local Project 278, and Technical Overhead, a distributable general overhead expense. Properties of Fourier series useful in obtaining solutions of linear and nonlinear differential equations are investigated.

Northwestern U., Evanston, Ill.
ON THE APPROXIMATION OF INTEGRABLE FUNCTIONS BY FUNCTIONS OF BOUNDED VARIATION, by William T. Reid. Technical rept. no. 4 on Contract AF 49(638)400. Aug 59, 11p. 9 refs. AFOSR-TN-59-825.
Order from LC mi$2.40, ph$3.30 PB 144 375

Northwestern U. [Evanston, Ill.]
PROPERTIES OF SOLUTIONS OF A RICCATI MATRIX DIFFERENTIAL EQUATION, by William T. Reid. Technical rept. no. 3 on Contract AF 49(638)400. Aug 59, 30p. 17 refs. AFOSR-TN-59-826.
Order from LC mi$2.70, ph$4.80 PB 144 497

In the present paper it is shown that the analytic methods of the author's earlier paper yield properties of the type presented by Redheffer; an amended form is given for the final conclusion of Redheffer's Theorem XII, which is in error. In addition, certain results of the present paper are cast in a form to establish the existence of solutions, rather than to postulate their existence as in the earlier treatments of the author and Redheffer. In particular, the improved result corresponding to Theorem 4.1 of the author's earlier paper involves an extension of a quadratic form problem considered a number of years ago by the author and several other writers. Special attention is given to Riccati equations arising as the Legendre equation for a variational problem. Finally, it is shown that the methods of the author provide the main theorem of a recent report by Redheffer on the Mycielski-Paszowski diffusion problem.

Princeton U., N. J.
A GENERAL THEORY OF MEASUREMENT: APPLICATIONS TO UTILITY, by Johann Pfanzagl. Research memo. no. 5 on Econometric Research Program [Contract Nonr-1858(02)] 8 Dec 58, 20p. 18 refs.
Order from LC mi$2.40, ph$3.30 PB 144 290

Purdue Research Foundation, Lafayette, Ind.
ANALYTICAL THEORY OF CONTINUOUS TRANSFORMATIONS, III, by Togo Nishiura. Technical note no. 22 on Contract AF 18(600)1484. Aug 59, 19p. 22 refs. PRF-1203; AFOSR-TN-59-496; AD-215 921.
Order from LC mi$2.40, ph$3.30 PB 144 071

This technical note is the last of a series of three notes. The three notes concern extensions of the area theory developed by L. Casari in his book Surface Area, Princeton University Press, 1956. The first two notes ("Analytic Theory of Continuous Transformations I, II") concerned the analog of the Geöcze area for continuous mappings from certain subsets of Euclidean k-space E_k into Euclidean n-space E_n, $n \ge k \ge 2$. The present note deals with the generalized length of a contour and the Cavalieri inequality for continuous mappings defined on admissible sets in the plane. (See also PB 143 179)

Purdue U., Lafayette, Ind.
ANALYTIC THEORY OF CONTINUOUS TRANSFORMATIONS I, by Togo Nishiura. Technical note no. 20 on Contract AF 18(600)1484. Aug 59, 67p. 22 refs. PRF 1203; AFOSR-TN-59-496; AD-215 921.
Order from LC mi$3.90, ph$10.80 PB 143 179

This technical note is the first of a series of three notes. The three notes concern extensions of the area theory developed by L. Cesari in his book Surface Area, Princeton University Press, 1956. The first two notes concern the analog of the Geöcze area for continuous mappings from certain subsets of Euclidean k-space E_k into Euclidean n-space E_n, $n \ge k \ge 2$.

Purdue U., Lafayette, Ind.
ANALYTIC THEORY OF CONTINUOUS TRANSFORMATIONS II, by Togo Nishiura. Technical note no. 21 on Contract AF 18(600)1484. Aug 59, 67p. 22 refs.

PRF-1203; AFOSR-TN-59-496a; AD-215 921.
Order from LC mi$3.90, ph$10.80 PB 143 180

The present note is a continuation of the extension of the theory of the Geöcze "k-area" which was started in the first note. (See also PB 143 179)

Purdue U., Lafayette, Ind.
RETRACTION ONTO DENDRITES, by A. Lauria and C. J. Neugebauer. Technical note no. 18 on Analytical Theory of Continuous Transformations, Contract AF 18(600)1484. Nov 59, 14p. 6 refs. PRF 1203; AFOSR-TN-59-802.
Order from LC mi$2.40, ph$3.30 PB 144 214

Rensselaer Polytechnic Inst., Troy, N. Y.
A COMPUTATIONAL PROOF PROCEDURE; AXIOMS FOR NUMBER THEORY; RESEARCH ON HILBERT'S TENTH PROBLEM, by Martin Davis and Hilary Putnam (Princeton U.). Rept. on Contract AF 49(638)527. Oct 59, 80p. 9 refs. AFOSR-TR-59-124.
Order from LC mi$4.50, ph$12.30 PB 144 296

Wayne State U., Detroit, Mich.
GROUPS OF AUTOMORPHISMS OF KAEHLER MANIFOLDS, by S. I. Goldberg. Rept. on Contract AF 49(638)14. July 59, 8p. 4 refs. AFOSR-TN-59-727.
Order from LC mi$1.80, ph$1.80 PB 143 953

Lichnerowicz proved that the largest connected Lie group of conformal transformations of a compact Einstein-Kaehler space $M^{2k}(k>1)$ leaves invariant the Kaehlerian structure. In this note the following much stronger result is obtained: The largest connected Lie group of conformal transformations of a 4k - dimensional compact Kaehler manifold coincides with the largest connected group of automorphisms. Theorems of a less general nature but with no restriction on the dimension of the manifold are also obtained. These results can be partially extended to the open Kaehlerian manifolds and hold also for those symplectic manifolds in which the fundamental exterior 2- form is harmonic.

Computing Devices

Air Force Cambridge Research Center, Bedford, Mass.
THE USE OF COSET EQUIVALENCE IN THE ANALYSIS AND DECODING OF GROUP CODES, by Eugene Prange. June 59, 32p. 12 refs. AFCRC-TR-59-164.
Order from LC mi$3.00, ph$6.30 PB 143 967

For an error-correcting code group A, the group G of coordinate permutations that map A onto itself is used to define an equivalence relation on A-cosets. It is shown that this equivalence relation can be used in the analysis of the error-correcting properties of A, and in the definition and verification of operationally feasible decoding algorithms that satisfy the minimal distance criterion. Decoding algorithms under a (weak) block length criterion are also considered for a special class of group codes. Applications are made to some specific codes, the largest being a code in two symbols whose words have 45 information and 28 check positions.

Avion Div., ACF Industries, Inc., Alexandria, Va.
TWELVE DIGIT BINARY ENCODER, by R. W. Smith. Final rept. on Research and Development of an Experimental Model Binary Encoder, Contract DA 36-039-sc-72814. 15 Aug 57, 50p. AD-144 403.
Order from LC mi$3.30, ph$7.80 PB 138 092

An analysis is presented of the work done on developing and constructing a 12-digit binary encoder which converts dc analog voltages to corresponding binary numbers. The device produces binary digital numbers consisting of 11 bits and a sign bit at the rate of 500 complete codes per second. The encoding rate is determined by the frequency of an external start pulse and can vary from zero to the maximum of 500 codes per second. The analog input range is -50 v to +50 v, while the binary parallel output range extends from all zeros at -50 v to all ones at 50 v. The 5 phases of the project are discussed; they include system study and design, circuit design and test, prototype construction and test, final model construction and test, and the instruction manual and final report. The problems encountered are pointed out and their solutions are given. Photographs of the final model are included with drawings and specifications. The conclusions indicate that the unit can be reproduced easily and economically. The feasibility of transistorizing the encoder is discussed.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EDVAC SYNCHRONOUS MAGNETIC DRUM, by Chester H. Wallin and John G. Gregory. Apr 56, 24p. 5 refs. Memo. rept. no. 1001.
Order from LC mi$2.70, ph$4.80 PB 144 085

The electrical, logical, operational and servicing features of the EDVAC Synchronous Magnetic Drum Storage System are described in this report. The technique used to synchronize drum rotation with the EDVAC system, the method of transferring information to and from the drum, and the necessary controls for controlling the flow of information are completely described. Schematic, logical and mechanical drawings are included.

Columbia U. School of Engineering, New York
A DIGITAL ANALOG CONTROLLER FOR SAMPLED DATA SYSTEMS, by Stephen C. Bigelow. Technical rept. no. T-36/B on Contract AF 18(600)677 22 July 59, 55p. 6 refs. CU-56-59-AF-677-EE; AFOSR-TN-59-803.
Order from LC mi$3.60, ph$9.30 PB 143 961

This report describes a practical digital controller for sampled data control systems designed and constructed by the author under this contract. The controller is a hybrid digital-analog computer programmed to solve the control equations. The machine input and output signals are voltage analogs in the

range of from -50 to +50 volts. Arithmetic operations are performed using analog computer circuits, while storage is accomplished in digital storage registers. Analog-to-digital and digital-to-analog conversions are performed internally. It is believed that this controller serves a twofold purpose: First to demonstrate the feasibility of applying the well-developed theory of sampled data control systems to real processes, and second to provide a useful tool for further study of such systems.

General Kinetics, Inc., Arlington, Va.
OPTIMUM CODING 1103A COMPUTER, by A. C. Hendrikson, J. G. Mackinney, and A. E. Roberts, Jr. Final technical rept. on Contract DA 36-034-ORD-2519. 7 Jan 59, 60p. AD-210 180.
Order from LC mi$3.60, ph$9.30 PB 144 243

This report presents detailed results of a study performed to develop an "optimum" coding for the ERA 1103A type high-speed electronic computer. This coding is constructed to obtain characteristic values and vectors of symmetrical 2x2, 3x3, and 4x4 matrices (formed from coefficients of normal equations derived by least squares methods). The coding is general and intended to separate two, three, or four nearly identical characteristic values. Provision is included for print-out of direction cosines, magnitude, square root of magnitude and its reciprocal; checks are made for orthogonality of vectors to six significant figures and agreement to ± 10 units upon substitution in the original normal equations. Options for conversion of direction cosines to direction angles or to azimuth and elevation angles for print-out are supplied. The studies upon which coding was based included analysis of the many mathematical methods available and selection of those most appropriate for the required purpose. It is contemplated that a complete listing of the program code, together with operating instructions, will be included in a later Supplementary Report covering operational verification of the coding, which was not obtained during the subject contract period.

Northeastern U., Boston, Mass.
AN EXAMPLE AND EXTENSION OF CAPACITY CALCULATION OF A CERTAIN DISCRETE CHANNEL WITH MEMORY, by Sze-Hou Chang and Paul G. McHugh. Scientific rept. no. 2 on Contract AF 19(604)3053. 31 Aug 59, 21p. 2 refs. AFCRC-TN-59-569.
Order from LC mi$2.70, ph$4.80 PB 144 419

In a previous report the capacity of a certain binary channel with finite memory is studied. To illustrate the method of capacity calculation a channel is devised which possesses two types of imperfections, (1) the distortion due to memory and (2) contamination due to noise. This example demonstrates the relative effects of noise and memory, the increase of capacity by tolerating a greater interdigital interference and the use of pulse weighting to counteract the effect of memory. The method of calculation is further extended from the binary channel to the m-nary channel.

Rome Air Development Center, Griffiss AFB, N. Y.
IBM MILITARY COMPUTER SYSTEM, by Frank S. Morreale. Oct 59, 19p. 2 refs. RADC-TN-59-283.
Order from LC mi$2.40, ph$3.30 PB 144 467

The general design characteristics of a computer system developed by International Business Machines, Inc., is described. The system was developed to meet the data processing requirements of Semi-automatic Ground Environment (SAGE) and the Strategic Air Command Control (SACCS) Systems. The term "IBM Military Computer" is an IBM nomenclature. Air Force nomenclature for the SAGE version is AN/FSQ7-A. SACCS version has no Air Force nomenclature. Brief functional descriptions of the major computer elements are given. Typical peripheral equipments that make up the complete data processing system are also given a brief resumé.

MECHANICS

Brown U. Div. of Engineering, Providence, R. I.
ON THE STABILITY OF RIGID-PLASTIC SOLIDS, by G. R. Cowper and E. T. Onat. Technical rept. no. 10 on Contract Nonr-562(20). Dec 58, 10p. 5 refs. Nonr-562(20)/10.
Order from LC mi$1.80, ph$1.80 PB 143 982

An alternative derivation of the stability of a rigid strain-hardening body under dead loading bases on a rational perturbation procedure.

Brown U. Div. of Engineering, Providence, R. I.
PREDICTION OF ELASTIC CONSTANTS OF MULTI-PHASE MATERIALS, by B. Paul. Technical rept. no. 3 on Contract Nonr-562(19). Jan 59, 17p. 5 refs. Nonr-562(19)/3.
Order from LC mi$2.40, ph$3.30 PB 144 146

The energy theorems of elasticity theory are used to find upper and lower bounds on the elastic moduli in tension and shear for two-phase materials. A "strength of materials" type of approximate solution is also given. Comparison with experimental data for a particular alloy system shows good correlation for the approximate solution, with the scatter band bounded by the predicted limits. It is shown that the method may also be used for more general multi-phase systems, and to predict temperature dependence of the elastic constants of the composite material.

Brown U. Div. of Engineering, Providence, R. I.
AN EXPERIMENTAL INVESTIGATION OF THE INTERNAL FRICTION OF THIN PLATINUM ALLOY WIRES AT LOW FREQUENCIES, by J. Kestin and J. M. Moszynski. Technical rept. 11 on Contract AF 18(600)891. July 58, 32p. 7 refs. AF-891/11; AFOSR-TN-58-752; AD-201 516.
Order from LC mi$3.00, ph$6.30 PB 137 431

Measurement of viscosity of gases and vapours by the method of small oscillations requires the knowledge of the internal friction of the suspension wire, and of its variation with temperature. An instrument was built for the measurement of internal friction of thin wires at low frequencies and at elevated temperatures. Wire made of No. 479 Platinum Alloy (8% Tungsten, 92% Pt), stress relieved and in sizes of 0.002" diameter or over are most suitable and their damping characteristics and elastic constants at any temperature in the range up to 400 C can be predicted quite accurately.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
STRESSES IN THE PLASTIC RANGE AROUND A NORMALLY LOADED CIRCULAR HOLE ON AN INFINITE SHEET, by O. L. Mangasarian. Technical rept. no. 4 on Contract Nonr-1866(02). Dec 58, 38p. 16 refs.
Order from LC mi$3.00, ph$6.30 PB 143 987

The stresses in the plastic range around a normally loaded circular hole in an infinite sheet are found numerically on the basis of both J_2 deformation and incremental theories. The results of deformation theory are quantitatively assessed in the light of a criterion, recently developed by Budiansky, for the acceptability of deformation theories. The criterion is completely satisfied. Moreover, the results obtained by using these two different theories of plasticity do not differ greatly despite the fact that the stress paths are far from being radial.

Illinois Inst. of Tech., Chicago.
YIELD CONDITIONS FOR ROTATIONALLY SYMMETRIC SHELLS, by Philip G. Hodge, Jr. Rept. on Contract Nonr-1406(04). Dec 58, 34p. 12 refs. DOMIIT Rept. no. 1-4.
Order from LC mi$3.00, ph$6.30 PB 143 985

The yield condition for a rotationally symmetric shell may be represented as a surface in a four dimensional stress space. The exact yield surface according to the Tresca yield condition is compared with various approximations. A new approximation is suggested which combines the advantages of mathematical simplicity and reasonable accuracy. The theory is illustrated with reference to a spherical cap under uniform pressure.

Illinois Inst. of Tech., Urbana.
THE YIELD POINT LOAD OF AN ANNULAR PLATE, by Philip G. Hodge, Jr. Rept. on Contract Nonr-1406(04). Jan 59, 8p. 1 ref. DOMIIT Rep. no. 1-5.
Order from LC mi$1.80, ph$1.80 PB 144 142

The yield point load is computed for an annular plate, simply supported at its inner and outer edges, and subjected to a uniform load. A previously published solution is shown to be incorrect.

Institute of Flight Structures, Columbia U., New York.
DYNAMICAL RESPONSE OF AN ELASTIC HALF-SPACE TO TANGENTIAL SURFACE LOADINGS, by Chi-chang Chao. Technical rept. no. 11 on Contract Nonr-266(20). Mar 58, 62p. 22 refs. CU-11-58-ONR-266(20)CE.
Order from LC mi$3.90, ph$10.80 PB 138 589

Exact and closed-form solutions are obtained for both tangential and vertical surface displacements of a homogeneous isotropic elastic half-space due to the application, at a point on the surface, of a concentrated force tangential to the plane boundary and varying with time as the Heaviside unit function. Similar expressions for the displacements in the interior of the body along a line directly below the applied force are derived. Solutions are obtained by a semi-inverse method with the aid of Laplace and Hankel transforms. Combination of these solutions with those given earlier by Lamb and Pekeris, which give the surface displacements due to the application of a normal time-dependent force, will give the response to any inclined time-dependent force applied on the plane boundary. The reciprocal relation in the static case, between tangential surface displacement due to a vertical force and vertical surface displacement due to a tangential force applied on the plane boundary is preserved in the dynamic case.

Naval Civil Engineering Lab., Port Hueneme, Calif.
ELASTO-PLASTIC RESPONSE OF REINFORCED CONCRETE BEAMS TO SHORT-DURATION LOADS, by S. K. Takahashi. 25 Sep 59, 21p. 5 refs. Technical rept. 035.
Order from LC mi$2.70, ph$4.80 PB 143 964

Response of beams to short-duration loads as predicted by the spring-mass theory agrees well with measurements.

Naval Ordnance Lab., White Oak, Md.
MOMENTS OF INERTIA OF N-GONALLY SYMMETRIC BODIES, by R. S. Sery. 6 Apr 59, 21p. 5 refs. NAVORD rept. 6301.
Order from LC mi$2.70, ph$4.80 PB 144 334

Moment of inertia problems usually involve single objects such as cubes, spheres, cones or more complicated types. Occasionally a problem arises in which a group of identical, symmetrically arranged objects must be considered as an entity in order that its moment of inertia may be determined. The five fins of a hypothetical guided missile, for example, can be considered as a compound body. If the symmetry of this body is such that a rotation of $2\pi n/N$ ($n = 1, 2, 3, 4$) about the axis of symmetry is a covering operation, i.e., the final distribution of matter in the body is identical to the initial distribution, then the compound body is N-gonally symmetric. In this report three N-gonal moment of inertia equations are derived. The first of the two equations gives the moments of inertia of the body about the two principal axes which are transverse to the axis of symmetry. The second equation gives the moment of inertia of the body about the third principal axis (the axis of symmetry).

Naval Research Lab., U. of Wisconsin, Madison.
EQUATION OF STATE FOR BINARY FLUID MIXTURES, by Charles E. Hecht. Rept. on Contract N7onr-285(11). 9 Aug 57, 20p. 16 refs. WIS-ONR-24; AD-143 280.
Order from LC mi$2.40, ph$3.30 PB 137 695

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Moment of inertia problems usually involve single objects such as cubes, spheres, cones or more complicated types. Occasionally a problem arises in which a group of identical, symmetrically arranged objects must be considered as an entity in order that its moment of inertia may be determined. The five fins of a hypothetical guided missile, for example, can be considered as a compound body. If the symmetry of this body is such that a rotation of $2\pi n/N$ ($n = 1, 2, 3, 4$) about the axis of symmetry is a covering operation, i.e., the final distribution of matter in the body is identical to the initial distribution, then the compound body is N-gonally symmetric. In this report three N-gonal moment of inertia equations are derived. The first of the two equations gives the moments of inertia of the body about the two principal axes which are transverse to the axis of symmetry. The second equation gives the moment of inertia of the body about the third principal axis (the axis of symmetry).

Naval Research Lab., U. of Wisconsin, Madison.
EQUATION OF STATE FOR BINARY FLUID MIXTURES, by Charles E. Hecht. Rept. on Contract N7onr-285(11). 9 Aug 57, 20p. 16 refs. WIS-ONR-24; AD-143 280.
Order from LC mi$2.40, ph$3.30 PB 137 695

A perturbation technique already used for the equation of state of pure substances by Zwanzig is developed to deal with binary fluid mixtures. We use a modified Lennard-Jones potential of pseudo-one component form for the unperturbed ensemble and introduce some effects of the specific potentials of the species involved as the perturbation. The most useful part of this report may be the zeroeth order results which give compressibility factors for gaseous mixtures fairly well at high temperatures.

Technische Hochschule, Hannover (West Germany).
DYNAMICS OF STRUCTURES BY TRANSFER MATRICES, by E. Pestel. Technical rept. no. 1 on Contract AF 61(052)33. June 59, 185p. 36 refs. AFOSR-TR-59-95.
Order from LC mi$8.40, ph$28.80 PB 144 294

Contents:
Eigenvalues and the transfer matrix
Calculation of rotating disks using transfer matrices.
Catalogue of transfer matrices
Coupling of beams
Delta-matrices and other modifications of the use of transfer matrices
Modified transfer matrix method
Structural analysis of aircraft components by transfer matrices
Application of transfer matrices to plates
Bibliography

Technische Hochschule, Hannover (West Germany).
THIN-WALLED COMPRESSION MEMBERS, by A. Pflüger. Rept. no. 2 (Final) on Contract AF 61(514)1140. July 59, 15p. 10 refs. AFOSR-TR-59-138.
Order from LC mi$2.40, ph$3.30 PB 144 313

This report treats the magnitude of the deformations occurring as a result of the buckling process. As a consequence of inaccuracies of shape and of the application of load, deformations will occur even before the buckling limit is reached. However, the statistical evaluation of the measurements taken shows these deformations not to exceed the limits permissible within the scope of reasonable demands regarding the outer appearance of a construction. When exceeding the critical value, however, the deformations will increase rapidly. Consequently, the necessary safety factor has to be related to the buckling limit. (See also PB 140 693)

Yale U., New Haven, Conn.
ROTATION TESTS IN PLASTICITY, PART II, by Aris Phillips. Technical rept. no. 6 on Contract Nonr-609(12). Dec 58, 23p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 143 981

This report is a continuation of technical report No. 3 which appeared in December 1957. In the present report the ten rotation tests K-1 to K-10, which have been presented previously, are submitted to an additional evaluation. The reader is reminded here that in a rotation test the state of stress is changed by keeping the principal stresses constant while the principal directions are rotated. The ten rotation tests which are considered here were made on thin-walled tubes of aluminum alloy 3S-O. In these tests plane states of stress σ_1, σ_2 ($\sigma_1 > \sigma_2$), existing on the outside surface of a thin-walled tube, were rotated to various angles (up to 90°) about the radical direction (the direction of σ_3). The rotation of the principal axes of stress was achieved by using a combination of axial load, internal pressure, and torque.

Aerodynamics and Pneumatics

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
VIBRATION AND FLUTTER OF CYLINDRICAL AND CONICAL SHELLS, by Yechiel Shulman. Rept. on Contract AF 49(638)219. June 59, 181p. 55 refs. ASRL technical rept. no. 74-2; AFOSR-[TN]-59-776.
Order from LC mi$8.40, ph$28.80 PB 144 307

The theory of thin shells is examined and some simplified general expressions are presented. These reduce to Donnell's expressions in the case of circular cylindrical shells. An appropriate variational principle is formulated and the similarity to shallow-shell theory is shown. These results and those of the more exact Flügge shell theory are applied to the problem of free vibration of conical shells. Approximate solutions are obtained by variational methods using the various theories and various displacement and stress functions. Comparison of the results indicates that the method which utilizes a logarithmic transformation of the axial coordinate in conjunction with appropriate displacement expansion modes satisfying the geometrical boundary conditions yields results valid for both the membrane and bending cases and is capable of being used to obtain higher approximations. The results reveal that the influence of taper on membrane and bending frequencies of circular cylinders is opposite in nature, the former being increased, the latter decreased by the taper.

Aeronautical Research Inst. of Sweden.
A THEORETICAL INVESTIGATION OF SECOND-ORDER SUPERSONIC INTERFERENCE EFFECTS, by Beverly J. Beane and Marten T. Landahl. Technical note no. 1 on Contract AF 61(052)75. Apr 59, 18p. 7 refs. FFA rept. AU-II-93:1; AFOSR-TN-59-962.
Order from LC mi$2.40, ph$3.30 PB 144 305

An approximate solution, valid for high Mach numbers, for the second-order supersonic flow problem of two interfering flow fields is given. The approximate solution requires that the spanwise curvature of the body flow field is small. A further approximation is made which leads to a very simple formula for the interference pressure. This formula is found to give relatively small errors in the cases investigated. It is found that second-order interference effects may be large at Mach numbers above 3. Thus it is demonstrated that large gains in control surface efficiency may be obtained by placing the control surface in a region of high pressure from the body.

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
RECENT ADVANCES IN CHEMICAL KINETICS OF HOMOGENEOUS REACTION IN DISSOCIATED AIR, by W. G. Zinman. Rept. on Contract AF 04(647)269. 21 Sep 59, 20p. 41 refs. Technical information series R59SD426.
Order from LC mi$2.40, ph$3.30 PB 143 900

It is shown that the kinetics of certain types of homogeneous gas phase reactions should be considered in many flow problems involving diatomic gases at moderate temperatures. There are two general types of reactions: atom recombination ($A + A + M \rightarrow A_2 + M$) and two body reactions (i.e. $N + O_2 \rightarrow NO + O$). For many atom recombination reactions of technical importance, k_r is about $10^{11} ft.^6/lb.\text{-}mol.^2 sec$. In general, two body reactions are so rapid compared with atom recombination that certain equilibrium relations will be obeyed in many gas mixtures not in complete thermodynamic equilibrium. The rate constants necessary to determine when this can be done are given.

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE SELECTION OF ORGANIC COMPOUNDS AS ABLATING MATERIALS, by Albert H. Blatt. Oct 59, 9p. 1 ref. AFMDC-TN-59-28.
Order from LC mi$1.80, ph$1.80 PB 144 397

The use of organic compounds as ablating materials for the outer surface of the nose cones of re-entering ballistic missiles and satellites is examined. The paper is concerned with the chemist's point of view; that is, the cracking and dissociation processes. The paper concludes with suggestions about the choice of organic ablating materials.

Air Force Missile Test Center, Patrick AFB, Fla.
THE EDITING OF FLIGHT DATA, by Masao Yoshitsu. Rept. on Missile Test Project, Contract AF 08(606)1156. 3 Aug 59, 76p. 11 refs. RCA DATA Processing Technical rept. no. 50; AFMTC-TR-59-16.
Order from LC mi$4.50, ph$12.30 PB 143 991

Any method of the numerical determination of observations is more or less liable to error. This is expected, provided the errors are small enough to have the data appear credible. On the other hand, the large errors are undesirable as they are outside the scope of the probability theory. An editing technique to eliminate the large errors from flight data, leaving the good statistical data, is developed in this paper. Three examples are worked out to show that even a cluster of five large errors in consecutive observations may be systematically eliminated in the 58 steps of the technique. It is seen that the entire procedure may be readily programmed for a high speed electronic computer.

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
COMPRESSIBLE FLOW TABLES k = 1.26 ISENTROPIC PROCESS, by C. Hoebich. Rept. on One-Dimensional Compressible Flow Tables for a Perfect Gas in Mach Number Increments of 0.001 (k = 1.26); Isentropic Process. Jan 59, 89p. ARGMA TN 1H 1N-1.
Order from LC mi$4.80, ph$13.80 PB 144 413

This report tabulates functions of Mach numbers for compressible perfect gas. The ratio of specific heats k is 1.26. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate time-consuming interpolation.

Arnold Engineering Development Center [Tullahoma, Tenn.]
REDUCTION OF AIRSTREAM-INDUCED VIBRATIONS OF A PWT MODEL SUPPORT SYSTEM BY TUNNEL MODIFICATIONS, by H. L. Chevalier and W. E. Carleton. Rept. on ARO, Inc., Contract AF 40(600)800. Oct 59, 15p. 2 refs. AEDC-TN-59-125.
Order from LC mi$2.40, ph$3.30 PB 144 339

The effect of several modifications to the tunnel, designed to improve the vibrational characteristics of the support strut, was investigated in the 16-Ft Transonic Circuit of the Propulsion Wind Tunnel Facility. The modifications included changing the shape of the leading edge of the model support strut, the depth and position of bulges in the test section walls, and the position of the scavenging scoop for engine exhaust gases. The results show that the modifications permit the operation of the tunnel over a range of test conditions with safe sting vibrational amplitudes and with a suitable Mach number distribution through the tunnel test section.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A THEORY OF WING-PROPULSION COMBINATIONS IN SLOW FLIGHT, by R. J. Vidal. Rept. on Proj. 9-38-01-000 Task 902, Contract DA 44-177-tc-439. Sep 59, 39p. 9 refs. Rept. no. AI-1190-A-1; AD-216 171.
Order from LC mi$3.00, ph$6.30 PB 144 241

The development of a theory treating wing-propulsion systems in slow flight is presented. This development is applied to a class of configurations, characterized by wing and propulsion wakes which are equal in span, and is used to predict the performance of this class of aircraft. It is concluded that for aircraft of equal span, those generating thick propulsion wakes require the least power, and that configurations typified by thin jet wakes are inherently inefficient as regards power consumption in the very slow speed range. The theory is compared with the available helicopter data, and good correlation is obtained.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION OF HYPERSONIC STAGNATION TEMPERATURE PROBES, by Richard D. Wood. Rept. on Hypersonic Research Project, Contract DA 04-495-ORD-19. 15 July 59, 100p. 40 refs. Memo. no. 50.
Order from LC mi$5.40, ph$15.30 PB 144 167

By the combined use of both shield and base heating, a probe recovery factor of r = 1.0 was obtained over a

range of Reynolds numbers at M_∞=5.75. By using the experimental data and simple heat balance equations, the probe losses, for the conditions investigated, were found to be in the proportion: shield conduction loss - 15; base conduction loss - 3; thermocouple conduction loss - 1; and thermocouple radiation loss - 3/100. The typical decrease in probe recovery factor observed for decreasing Reynolds number appears to be related to a decrease in the base temperature and not to the wire conduction loss as commonly assumed.

Institut de Recherches Scientifiques et Techniques du Centre-Ouest (France).
RESEARCH ON EXPERIMENTAL INVESTIGATION OF VARIABLE CIRCULATION AROUND AN ASPIRATED CYLINDER. Rept. on Contract AF 61(514)1379. [1959]| 42p. Etude IRST-E1/573; AFOSR-TN-59-105.
Order from LC mi$3.30, ph$7.80 PB 144 295

The object of this study is to determine the conditions necessary to obtain maximum lift and lift/drag ratio for a porous cylinder arranged to permit the aspiration of the surface laminar sub-layer. The method used to create a particular circulation consisted in (assuming complete suppression of the laminar layer) shifting the transition point, normally behind the cylinder, through an angle O to the right or left. This was obtained by a deflector fin which caused flow of air away from the aspirating surface. Two variations in procedure were also studied: 1. the fin was replaced by a small arc of surface devoid of aspiration pores thus allowing the flow to separate. 2. aspiration was provided on one side of the cylinder only allowing separation flow on the other side.

Institute for System Research, U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING ON AN AIR VEHICLE: A REVIEW OF THE LITERATURE, by M. Z. Krzywoblocki. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Dec 58, 105p. 332 refs. WADC Technical note 56-360, Pt. 9; AD-161 012.
Order from OTS $2.50 PB 151 819

This work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly, others are listed without comment. (See also PB 151 815)

Midwest Research Inst. [Kansas City, Mo.]
FLUTTER OF CURVED PANELS, by John E. Yates and Edmond F. E. Zeijdel. Rept. on Contract AF 49(638)429. Sep 59, 45p. 6 refs. [AFOSR-TR-59-163]
Order from LC mi$3.30, ph$7.80 PB 144 486

Previous studies on panel flutter treated the panel as initially flat in the equilibrium state. A natural point of inquiry is the effects of panel curvature on panel flutter, and this is the subject of the present report. To investigate flutter of curved panels, the general equations of motion of shallow cylindrical shells are developed. The initial curvature is then taken as circular in the chordwise direction. The special case of infinite aspect ratio is considered and appropriate equations are developed for finite aspect ratio panels. Results are obtained for unit and infinite aspect ratio curved panels with simply supported edges for two Mach numbers (M = 1.5 and 2).

Naples U. (Italy).
LAMINAR MIXING OF STREAMS OF DIFFERENT GASSES, by Luigi G. Napolitano and A. Pozzi. Technical note no. 1 on Contract AF 61(052)160. Apr 59, 75p. 14 refs. Istituto di Aeronautica rept. no. 10; AFOSR-TN-59-977; AD-226 469.
Order from LC mi$4.50, ph$12.30 PB 143 911

Preliminary results of a study of laminar, isobaric mixing of streams of different gases are presented.

Naval Ordnance Lab., White Oak, Md.
THE THEORY OF STABILITY OF COMPRESSIBLE LAMINAR BOUNDARY LAYERS WITH INJECTION OF A FOREIGN GAS, by S. F. Shen. 28 May 57, 34p. 10 refs. Aeroballistic Research rept. 374; NAVORD rept. 4467; AD-158 520.
Order from LC mi$3.00, ph$6.30 PB 144 158

The stability theory of laminar boundary layers with regard to infinitesimal disturbances is extended to the case involving binary gas mixtures, as may occur when a different coolant is injected into the free stream (air) through pores along the surface. The "inviscid" solutions are given. The "viscous" solutions, the asymptotic solutions and the eigen-value problem are discussed. Based upon the "inviscid-criterion", it appears that a lighter coolant would result in a more stable laminar boundary layer than a heavier coolant, at least for subsonic free stream.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
FREE CONVECTION PAST A VERTICAL FLAT PLATE: SOME NUMERICAL RESULTS, by Judson R. Baron and Morton Finston. Mar 59, 29p. 3 refs. Technical rept. 269.
Order from LC mi$2.70, ph$4.80 PB 144 186

Exact solutions are presented in numerical form for the free convection flow past a vertical plane surface of non-uniform temperature.

New York U. Coll. of Engineering, N. Y.
ATTEMPTS AT DERIVATION OF TRANSITION FROM LAMINAR INTO TURBULENT FLOW ALONG A FLAT PLATE, by H. F. Ludloff, H. B. Keller and others. Progress rept. on Contract AF 18(603)25. June 59, 30p. 7 refs. AFOSR Technical note 59-686.
Order from LC mi$2.70, ph$4.80 PB 144 324

Polytechnic Inst. of Brooklyn, N. Y.
SOME REMARKS ON THE SOLUTION OF A SYSTEM OF EQUATIONS OCCURRING IN LAMINAR MIXING WITH AXIAL PRESSURE GRADIENTS, by Luigi G. Napolitano. Rept. on Contract AF 18(600)693. Sep 57, 16p. 1 ref. PIBAL rept. no. 393; AFOSR-TN-57-609; AD-136 599.
Order from LC mi$2.40, ph$3.30 PB 137 507

A fifth-order system of equations with 3-point boundary conditions is investigated from the point of view of obtaining solutions by high-speed computing machines. The first method of solution changes the variables and reduces the original equations to integro-differential equations defined over a finite interval of the independent variable. An iteration scheme is adopted and asymptotic solutions are presented as they are needed to compute the solution in the proximity of the end points. The second method considers the solution as an initial value problem. The 4-fold indeterminacy which arises when the solution is started from the point where the independent variable is zero, is shown to be reducible to a 2-fold one. The 2 parameters left are related to the attainment of the required asymptotic behavior of the solution.

Polytechnic Inst. of Brooklyn, N. Y.
TRANSONIC ROTATIONAL FLOW OVER A CONVEX CORNER, by Roberto Vaglio-Laurin. Rept. on Contract AF 49(638)217. Aug 59, 66p. 12 refs. PIBAL rept. no. 431; AFOSR-TN-59-355; AD-213 681.
Order from LC mi$3.90, ph$10.80 PB 144 381

A singularity is encountered in the flow field about two-dimensional and axisymmetric bodies characterized by a sharp corner, where the fluid velocity becomes sonic. Such is the case for several practical configurations in transonic and hypersonic flow. An investigation of this sonic singularity, and the application of results thereof to the analysis of flow fields about blunt bodies in the aforementioned category are presented. It is shown that the problem in question, as many other discontinuity problems, belongs to the family of asymptotic or boundary layer phenomena of mathematical physics. The solution of the first approximation equations is given by a series in powers of a variable measuring the distance from the corner with coefficients depending on an appropriate similarity variable. The leading coefficient of the series is independent of three-dimensional and rotationality effects, in complete analogy to the well-known solution of the corner problem in supersonic flow. Detailed results are presented for the leading singularity and for the first two corrections due to rotationality and axial symmetry of the flow.

Rome U. (Italy).
EXPERIMENTAL INVESTIGATION ON DELTA WING AND COMPLETE CONFIGURATION MODELS FOR AEROELASTIC SIMILARITY PROBLEMS AT SUPERSONIC BLOW DOWN WIND-TUNNEL, by Luigi Broglio, Carlo Buongiorno and others. Technical note no. 7 on Contract AF 61(514)888. Mar 59, 60p. 3 refs. SIARgraph no. 50; AFOSR-TN-59-954.
Order from LC mi$3.60, ph$9.30 PB 144 304

The experimental techniques for the aeroelastic investigation at the supersonic blow down wind tunnel are presented. Wind tunnel data at M = 3.01 on triangular wing model are given in. These results show the small importance of the chordwise deflection of the section on the aerodynamic characteristics. An experimental investigation at M = 3.12 on a complete airplane configuration is presented, showing the importance of the parameter $\frac{P_0}{E}$ on the lateral stability derivatives. In the Appendix of the report the preliminary design of a magnetic support for dynamic stability tests is presented.

Rome U. (Italy).
RESEARCH ON AEROELASTICITY, by Luigi Broglio. Final rept. on Contract AF 61(514)888. May 59, 12p. SIARgraph no. 51; AFOSR TR-59-134; AD-226 438.
Order from LC mi$2.40, ph$3.30 PB 144 297

Research is reported on the following: (a) modeling technique and theory for aeroelastic similarity in blow-down wind tunnel tests; (b) developing technique and an experimental device to study the same problems of point (a) but including dynamic effects; (c) finding exact solutions of the problem of the heat conduction in heterogeneous solids with boundary conditions function of space and time.

Technische Hochschule, Munich (West Germany).
SUPERSONIC FLOW PAST OSCILLATING BODIES OF REVOLUTION WITH A FREQUENCY NOT NECESSARILY SMALL, by Johann Muench. Technical note no. 8 on Contract AF 61(514)1080. 24 June 59, 13p. 3 refs. AFOSR-TN-59-452; AD-215 027.
Order from LC mi$2.40, ph$3.30 PB 143 965

This report gives a representation of the potential of linearized flow past bodies of revolution executing elliptic oscillations of arbitrary frequency. The potential is given in terms of BESSEL- and LEGENDRE-functions.

University of Southern California. Engineering Center, Los Angeles.
ANALYTICAL STUDY OF THE HEATING OF HYPERSONIC AIR FLOW BY ELECTRODE-LESS HIGH-FREQUENCY DISCHARGE, by James C. Williams, III, Paul C. Wilber, and Raymond L. Chuan. [Final rept.] on Contract AF 40(600)736. Oct 59, 75p. 24 refs. USCEC rept. 68-101; AEDC-TR-59-23.
Order from LC mi$4.50, ph$12.30 PB 143 921

The possibility of heating a supersonic gas stream by means of electrode-less high-frequency discharge is studied. This heating scheme logically can be divided into two parts: the discharge where energy is added to the gas stream and stored as potential energy of electron-ion separation, and the decay where the electrons and ions recombine and give up some of the separation energy as thermal energy of the gas. Qualitative consideration of the discharge phase indicates the necessary relations between the electric field parameters, the hydrodynamic parameters and the chamber dimensions for an efficient discharge. Both qualitative and quantative discussions of the decay are given, the latter of which yields the variation of the hydrodynamic variables in the decaying flow. Finally, in the latter portion of

this report, it is shown how high-frequency electrode-less discharge heating might be applied practically to the heating of a low density, high Mach number, wind tunnel gas stream.

Hydrodynamics, Hydraulics, and Hydrostatics

Indiana U., Bloomington.
A MATHEMATICAL EXAMPLE DISPLAYING FEATURES OF TURBULENCE, by Terence Butler. Rept. for 1 Sep 54-31 July 58 on Contract AF 33(616)2550. Mar 59, 75p. 16 refs. WADC Technical rept. 59-52; AD-213 590.
Order from OTS $2.00 PB 151 969

The Navier-Stokes equations have proven to be the proper description for laminar flow, but no solutions of these equations resembling turbulence have been found. Thus, the question arises whether a set of straightforward equations like the Navier-Stokes equations can have solutions of such complex nature as would be necessary to describe turbulent flow. An answer to this question is suggested by Dr. Eberhard Hopf who has contrived a set of equations which retain certain essential features of the Navier-Stokes equations, but which are much simpler. He has shown that these equations have very complex solutions, actually random functions, qualitatively similar to the velocity in turbulent phenomena. The present report explores Hopf's approach in further detail. The properties of turbulent flow as obtained in measurements are expressed by certain statistical averages. The present report investigates the corresponding quantities of Hopf's model by means of probability theory and thus establishes a basis for a more detailed comparison. It is found that the broader characteristics of turbulence are present in the solutions but that the inherent simplicity of Hopf's model limits the extent of the similarity. For example, the velocity has a normal distribution as in turbulence, but the probability distribution of the difference of the velocity at two points close together fails to exhibit the small but important deviations from the normal distribution that are found in turbulent flow. The results suggest the value of seeking to devise another set of equations which would be a step closer to the Navier-Stokes equations.

Rensselaer Polytechnic Inst., Troy, N. Y.
THE STABILITY OF VISCOUS FLOW BETWEEN ROTATING CONCENTRIC CYLINDERS WITH A PRESSURE GRADIENT ACTING ROUND THE CYLINDERS, by R. D. DiPrima. Rept. on Contract Nonr-591(12). 21 Jan 59, 18p. 10 refs. RPI MathRep no. 20.
Order from LC mi$2.40, ph$3.30 PB 144 116

In this paper the stability of a viscous fluid between concentric cylinders is analyzed, when the basic velocity distribution is the sum of a velocity distribution due to the rotation of the cylinders, Taylor (1923) and a "pumping" velocity distribution due to a pressure gradient acting round the cylinders, Dean (1928). The critical Taylor number is computed for a wide range of values of the ratio of average velocity of pumping to average velocity of rotation in the case that the outer cylinder is stationary. It is assumed that the spacing between the cylinders is small.

Technische Hochschule, Hannover (West Germany).
EFFECTS OF LONG-PERIOD WAVES IN HARBORS, by W. Hensen. Final technical rept. for 1 July 58-30 June 59 on Contract DA 91-508-EUC-355. [1959] 413p. 53 refs.
Order from LC mi$11.10, ph$63.60 PB 144 262

This report presents the results of basic model tests of the occurrence of resonant oscillations in harbor basins induced by long-period waves. The objectives of the experiments were to find out practicable means suitable for minimizing to a satisfactory degree the effects of resonant amplifications which, in most cases, are dangerous for shipping and harbor operations. Out of the numerous possibilities applicable to improve the nautical and operational conditions in harbors subject to long-period waves, the insertion of transversal moles of different lengths and groupings was selected for studies. The effects of such transversal moles on the vertical and horizontal water motions in a basin were investigated experimentally. The utilization of transversal moles for this purpose is considered serviceable because the moles simultaneously may be of use for harbor operations.

METALLURGY

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF COBALT-BASE ALLOYS, by John J. Rausch. Summary rept. for 1 July 57-31 Aug 58 on Contract NOas-58-136-c. 29 Oct 58, 61p. 4 refs.
Order from LC mi$3.90, ph$10.80 PB 144 136

In an intensive study of the potentialities of all useful cobalt-base binary alloy systems, approximately 200 alloy compositions were studied. The individual alloying elements have been classified, both empirically and quantitatively, as to their effects on the parameters forgeability, ductility, elevated temperature strength, and oxidation resistance. Two distinct classes of strong cobalt-base alloys have evolved. One of these contains chromium with the addition of molybdenum, tantalum, or niobium either singly or in combination. The other type is composed of combinations of molybdenum, tantalum, or niobium.

Commonwealth Engineering Co. of Ohio, Dayton.
DEVELOPMENT OF A METHOD TO ACCOMPLISH ALUMINUM DEPOSITION BY GAS PLATING, by Malvern J. Hiler and William C. Jenkin. Rept. for 16 June 58-16 Dec 59 on Materials Applications, Contract AF 33(616)5594. June 59, 64p. 3 refs. WADC Technical rept. 59-88; AD-214 887.
Order from OTS $1.75 PB 151 923

The deposition of aluminum was accomplished by thermally decomposing vapors of tri-isobutyl aluminum on the surface of cleaned, heated copper test panels in a heated plating chamber. The test panels were subjected to a preliminary deoxidation by induction heating to 800°F on a hydrogen atmosphere, purging the chamber with argon gas while cooling the sample to 500 degrees, then admitting a mixture of gases containing tri-isobutyl aluminum vapors for varying periods. The plate produced is substantially pure aluminum, lustrous and ductile, of excellent conductivity, and in thickness up to 4.7 mils. Adhesion varied from poor to excellent.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SOME METALLURGICAL CONSIDERATIONS IN FORGING MOLYBDENUM, TITANIUM, AND ZIRCONIUM, by Harry B. Goodwin. 25 Mar 59, 43p. DMIC memo. 12.
Order from OTS $0.50 PB 161 162

Reasons for the current interest in molybdenum, titanium, and zirconium are outlined briefly and typical uses are cited. The forging of each metal is discussed separately. In each case the metallurgy of the metal is reviewed briefly and the effect of the metallurgical characteristics on forging practice is explained. Practical hints on forging each metal are also given.

Minerals Research Lab., U. of California, Berkeley.
HEATS OF FORMATION OF Au_3ZN AND AuZn, by Ray W. Carpenter, Raymond L. Orr, and Ralph Hultgren. Technical rept. no. 3 on Contract DA 04-200-ORD-171, T. O. 15. 1 Oct 59, 18p. 15 refs. Series no. 126, issue no. 3; OOR rept. 2287.3 met
Order from LC mi$2.40, ph$3.30 PB 144 478

The heats of formation of gold-zinc alloys of compositions Au_3Zn and AuZn were measured at various temperatures. At the composition Au_3Zn the best X-ray diffraction data indicate the disordered fcc α phase decomposes on cooling below 693°K to a complex ordered α_1 phase, which on further cooling below 543°K decomposes to form a second ordered α_2 phase. Heat contents and heats of formation show that (AuZn (β') has no tendency to disorder on heating to 800°K.

Minerals Research Lab., U. of California, Berkeley.
THE HEATS OF FORMATION OF SILVER-PALLADIUM ALLOYS, by John P. Chan (Master's thesis) Philip D. Anderson and others. Technical rept. no. 4 on Contract DA 04-200-ORD-171, T. O. 15. 1 Oct 59, 21p. 12 refs. Series no. 126, issue no. 4; OOR rept. 2287.4 met.
Order from LC mi$2.70, ph$4.80 PB 144 483

Heats of formation of five silver-palladium alloys at 330°K. The skewing observed in these heats of formation when plotted versus the composition has been interpreted in terms of the filling of the vacant 0.6 orbital in the 4d shell of palladium which is completed at 60 atomic percent of silver.

New York U. Coll. of Engineering, N. Y.
THE GRAIN BOUNDARY ADSORPTION OF SOLUTES, by J. Winter and S. Weinig. Final rept. on Contract Nonr-285(22). Dec 57, 43p. 12 refs. AD-153 300.
Order from LC mi$3.30, ph$7.80 PB 138 075

The grain boundary adsorption of solutes was studied using internal friction techniques. The segregation of alloying elements to the grain interfaces was studied as a function of both the bulk concentration and the solution temperature. Interaction energies in the range of 0.3 ev were obtained. This value was used to obtain the actual concentration of solute at the grain boundary. In corroboratory creep studies the direct grain boundary contribution to the total creep strain was measured. It was found that the interface creep varied with the type and magnitude of the solute adsorbed.

Rock Island Arsenal Lab., Ill.
SPECTROGRAPHIC STANDARDS FOR THE ANALYSIS OF ALUMINUM AND MAGNESIUM ALLOYS, by L. H. Moorhead. 19 Nov 58, 30p. 7 refs. Rept. no. 58-3208; AD-210 518.
Order from LC mi$2.70, ph$4.80 PB 144 385

Methods were set up for the X-ray analysis of aluminum alloys for several elements in high concentration ranges where the accuracy of this method exceeds that of optical emission spectroscopy. Optical spectrographic methods were developed for the analysis of aluminum alloys and magnesium alloys. The analytical curves, spectrum lines and complete operating conditions are shown. A statistical study proved the optical spectrographic methods to be accurate and standard comparison samples to be homogeneous.

Rodman Lab., Watertown Arsenal, Mass.
DESIGN AND OPERATION OF A TUBE TYPE LABORATORY VACUUM FURNACE, by Francis S. Delacey. Apr 59, 12p. 5 refs. Technical rept. no. RPL 41/9; AD-225 374.
Order from LC mi$2.40, ph$3.30 PB 144 322

A laboratory furnace was designed and assembled for use in the vacuum firing of compacted, powdered metal specimens. The furnace assembly includes a refractory mullite tube in which the specimens are fired, a pumping system, a graphite susceptor, and auxiliary instruments for registering pressure and temperature within the furnace tube. The power source for inductively heating the susceptor is a high-frequency spark gap converter. In normal operation, the furnace accommodates the equivalent of six 3" x 3/8" square, pressed compacts. Vacuums of 10^{-4}mm Hg and temperatures of 1400°C (2552°F) are reached in approximately two and one-half hours when titanium powder compacts are being fired. On the basis of preliminary firings, it is concluded that the furnace can be profitably utilized in evaluating vacuum sintering techniques.

Ferrous Metals

Crucible Steel Co. of America, Syracuse, N. Y.
DEVELOPMENT OF A DUCTILE, OXIDATION-RESISTANT, LOW-DENSITY ALLOY SYSTEM FOR INTERMEDIATE TEMPERATURE USE, by R. C. Gibson and P. Lillip. Final rept. for 26 June 58-26 June 59 on Contract NOas-58-848-c. 26 Aug 59, 43p.
Order from LC mi$3.30, ph$7.80 PB 144 134

Development of an age-hardenable Fe-Al-Mn-C alloy with low density, good oxidation resistance, high strength, and good ductility at intermediate temperatures (1100 to 1400 F). Development of a stable, age hardenable austenitic alloy possessing excellent room temperature strength and good elevated temperature strength with oxidation resistance at 1800 F approaching that of Type 304.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
FABRICATION OF 17-7PH AND PH15-7Mo STAINLESS STEEL BY BEND ROLLING, DEEP DRAWING, AND SPINNING, by C. T. Olofson. 15 May 59, 5p. DMIC memo. 18.
Order from OTS $0.50 PB 161 168

James Forrestal Research Center, Princeton, N. J.
SELF-DIFFUSION IN ALPHA IRON, by C. Ernest Birchenall and Richard J. Borg. Rept. on Contract AF 49(638)533. Oct 59, 19p. 12 refs. Metallurgy rept. no. 20; AFOSR-TN-59-1085; AD-227 069.
Order from LC mi$2.40, ph$3.30 PB 144 006

The self-diffusion coefficients for α-iron have been determined between 980°C to 1167°K using Fe^{55} as the tracer. In the temperature region beginning at least 50°C above T_c the diffusion coefficient is given by $D = 118 \pm 2) \exp(-67240/RT) cm^2 sec^{-1}$.

Michigan U. Research Inst., Ann Arbor.
EFFECT OF PRIOR CREEP ON SHORT-TIME MECHANICAL PROPERTIES OF 17-7PH STAINLESS STEEL (RH 950 CONDITION COMPARED TO TH 1050 CONDITION) by Jeremy V. Gluck and James W. Freeman. Rept. for 1 Jan 58-31 Mar 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3368. Oct 59, 91p. 6 refs. WADC Technical rept. 59-339.
Order from OTS $2.25 PB 161 296

The effect of creep to 2 percent in 100 hours at temperatures from 600° to 900°F was determined on the tension, compression, and tension-impact properties of 17-7 PH(RH 950 Cond.) at room temperature or the exposure temperature. A substantial loss in ductility was observed in room temperature tension tests. Material exposed to creep at 600°F exhibited a substantial Bauschinger effect in tension and compression tests. The loss in ductility is attributed to stress and/or temperature induced aging during the creep-exposure.

Naval Weapons Plant, Washington, D. C.
EFFECTS OF CADMIUM PLATING THICKNESSES AND OVERLAYING UPON THE RECOVERY FROM HYDROGEN EMBRITTLEMENT OF AISI 4340, by S. V. Chek. 21 Sep 59, 20p. NAVORD rept. 6944; NWPW-T-27-59.
Order from LC mi$2.40, ph$3.30 PB 144 120

Recovery from hydrogen embrittlement at the 270,000 psi strength level by baking at 300°F was determined. Two procedures were used for the detection and evaluation of hydrogen embrittlement: the unnotched tensile test and the notched sustained load, static fatigue, test. Recovery was attained, at baking times within 4 hours when the cadmium plating ranged from 0.5×10^{-4} to 1.25×10^{-4} inch but recovery was unattained at commercial thicknesses of, or in excess of, 2.5×10^{-4} inch. Subsequent replating embrittled the steel.

Rodman Lab., Watertown Arsenal, Mass.
FACTORS AFFECTING DEPHOSPHORIZATION AND DESULPHURIZATION IN BASIC-ELECTRIC STEEL PRODUCTION, by John Zotos. Apr 59, 23p. 13 refs. Rept. no. RPL 10/18; AD-220 627.
Order from LC mi$2.70, ph$4.80 PB 143 947

Statistical analyses of equilibrium steelmaking data indicated that good correlation was obtained when: (1) the dephosphorizing power (P)/[P] = (percent phosphorus in the slag)/[percent phosphorus in the metal] was a logarithmic function of a slag parameter equal to the product of the slag's basicity $(\%CaO)/(\%SiO_2)$ times its oxidizing power (%FeO), and (2) the desulphurizing power (S)/[S] = (percent sulfur in the slag)/[percent sulfur in the metal] was a logarithmic function of a slag parameter equal to the quotient of the slag's basicity divided by its oxidizing power. Slag and metal compositions existing during the production of 4140, high nickel 4325, 4330 and 1040 AISI basic-electric steels were statistically analyzed using the same relationships. The results indicate that the dynamic (or non-equilibrium) dephosphorizing and desulphurizing powers of basic-electric slags are lower than their corresponding equilibrium values, and can be estimated at stage of a heat using the following equations: $(P)/[P] = 0.776 [(\%CaO)(\%FeO)/(\%SiO_2)]^{0.69}$ and $(S)/[S] = 10.38 [(\%CaO)/(\%SiO_2)(\%FeO)]^{0.48}$. These equations reveal that maximum dephosphorization and desulphurization conditions cannot exist simultaneously during basic-electric steel production due to the opposite effect of the slag's oxidizing power in the two slag parameters.

Rutgers State U., New Brunswick, N. J.
INHIBITION OF HYDROGEN EMBRITTLEMENT DURING PICKLING, by Donald B. Denney and Leonard Bauerman. Quarterly progress rept. no. 13, 1 Jan-31 Mar 59, on Contract DA 30-069-ORD-1689. [1959] 17p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 144 392

Preparation and study of compounds which are to be used in determining the mechanism of the action of hydrogen embrittlement inhibitors on steel in an acid pickling bath. The compounds which have been synthesized are structurally related to DHQ, one of the active ingredients in the reference standard inhibited hydrochloric acid.

Watertown Arsenal Labs., Mass.
INFLUENCE OF TEMPERATURE ON THE TENSILE AND FRACTURE PROPERTIES OF HIGH PURITY VACUUM MELTED IRON, by Harold G. Carter. Aug 58, 18p. 6 refs. Rept. no. WAL TR 330.3/1.
Order from LC mi$2.40, ph$3.30 PB 144 051

Specimens were tensile tested at +200°F, -319°F. At a testing temperature of liquid nitrogen (-319°F) the transgranular cleavage-type fracture was predominating. The ductility values approached zero. In addition, the microstructure contained many mechanical twins, which are believed to be found in very low temperature strained ferrite in nearly pure iron.

Watertown Arsenal Labs., Mass.
MECHANICAL PROPERTIES OF AISI 4340 STEEL IMPROVED BY CONSUMABLE-ELECTRODE VACUUM REMELTING, by Serge Cvikevich. Sep 59, 55p. 14 refs. Technical rept. no. WAL TR 310.1/1.
Order from LC mi$3.60, ph$9.30 PB 143 946

A slight improvement of impact properties due to consumable-electrode process remelting was observed in the material which was tempered in the upper tempering range. Marked improvement in fatigue properties was observed for samples tempered in the lower, as well as upper tempering ranges. An improvement in ductility properties was observed throughout the tempering range studied.

Light Metals

Chance Vought Aircraft, Inc., Dallas, Tex.
EVALUATION OF NEW HIGH STRENGTH TITANIUM SHEET ALLOYS, by J. W. Seeger and S. G. Young. Quarterly progress rept. no. 3, 1 July-30 Sep 58, on Contract NOas 58-104c. 31 Oct 58, 7p. CVA rept. no. E8R-11719.
Order from LC mi$1.80, ph$1.80 PB 138 472

Chart showing work schedule time table on this contract. Brief of current status.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
BAND SAWING OF TITANIUM AND TITANIUM ALLOYS, by Carl T. Olofson. 1 July 59, 15p. 12 refs. DMIC memo. 23.
Order from OTS $0.50 PB 161 173

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
BELT GRINDING OF TITANIUM SHEET AND PLATE, by Carl T. Olofson. 15 Mar 59, 8p. 5 refs. DMIC memo. 11.
Order from OTS $0.50 PB 161 161

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
EFFECTS OF HIGH STRAIN RATES AND RAPID HEATING ON THE TENSILE PROPERTIES OF TITANIUM ALLOYS, by F. R. Schwartzberg. 29 Dec 58, 33p. 7 refs. DMIC memo. 4.
Order from OTS $0.50 PB 161 155

The test data available allow the following generalizations to be drawn: (1) Yield and tensile strength increase with increasing strain rate; this behavior is most pronounced at temperatures above the present service limits of the subject alloys. Retention of strength to higher than normal temperatures can be achieved by testing at very high strain rates. (2) Ductility generally decreases with increasing strain rate. (3) Modulus of elasticity is not significantly affected by strain rate. (4) Holding time has no effect on tensile properties of titanium alloys annealed to a stable condition, except for losses in ductility due to surface oxidation at extremely high temperatures.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
HACKSAWING OF TITANIUM AND TITANIUM ALLOYS, by Carl T. Olofson. 6 July 59, 13p. 5 refs. DMIC memo. 24; AD-220 194.
Order from OTS $0.50 PB 161 174

Titanium and its alloys can be hacksawed under cutting conditions adapted to the behavior of titanium. The difficulties encountered in other machining operations are also present in sawing. They include galling, smearing, abrasiveness, and the generation of high temperatures in the cutting zone. During the sawing process, a tiny chip forms as each saw tooth penetrates the work. Chips gradually enlarge and curl into each tooth gullet as the blade moves through the cut. The chips remain trapped in the gullets until the teeth emerge from the kerf. At that time, chips either fall out or are flushed out by the cutting fluid directed into the cutting zone. The objectives in hacksawing include straightness of cut, smoothness of cut surface, ample cutting rates, and reasonable tool life. Appropriate selections of pitch, speeds, and feeds not only should minimize the sawing difficulties of titanium, but also should create an economic balance between cutting rate and blade life. Cutting rates for titanium are about 25 to 50 per cent lower than those associated with quenched and tempered alloy steels of equivalent hardness. Blade life in terms of productivity is about 50 per cent lower than that with alloy steels of equivalent hardness.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
JOINING OF BERYLLIUM, by N. E. Weare and R. E. Monroe. 30 Mar 59, 28p. 16 refs. DMIC memo. no. 13.
Order from OTS $0.50 PB 161 163

Beryllium is a brittle metal and is difficult to fabricate and join. Limited success has been reported on direct welding by tungsten-arc, pressure, and electron-beam processes. Good joints have been made by braze welding with aluminum filler and brazing with silver and the silver-copper eutectic alloy.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE MACHINING OF BERYLLIUM, by C. T. Olofson. 5 June 59, 16p. 10 refs. DMIC memo. 21.
Order from OTS $0.50 PB 161 171

Beryllium machines like cast iron, but is more abrasive to tools. Its brittle behavior can cause spalling at the exit of cuts and cracking at the surface. During machining, pieces of built-up edge slough off the tool, causing a scuffed, machined appearance. Carbide tools are normally used for turning, milling, and drilling at speeds up to 250, 150, and 100 surface feet per minute, respectively. The recommendation of the Atomic Energy Commission that "for the present it is safest to regard beryllium metal and all its compounds as potentially toxic" is the guiding principle in beryllium safety. Beryllium should be machined in an easy-to-clean, isolated area. The AEC recommendation for a safe beryllium-in-air concentration is 2.0 micrograms or less per cubic meter. Chemical pneumonitis in some persons working with beryllium has been attributed to suspended solid particles or mists of beryllium, its compounds, or solutions of soluble beryllium compounds. Chip cleanliness is required to maintain the maxium salvage value of beryllium. Cutting fluids are often omitted to prevent chip contamination.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
NITRIDING OF TITANIUM, by J. W. Holladay. 12 Aug 59, 13p. 26 refs. DMIC memo. 29; AD-225 299.
Order from OTS $0.50 PB 161 179

Contents:
Thermodynamic and kinetic considerations of nitriding titanium
Nitriding media
Nitriding procedures
Nitriding titanium with nitrogen gas
Nitriding with ammonia gas
Effect of alloy composition of nitriding
Nature of the nitride coating
Properties of the nitride coating

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF TANTALUM, by H. R. Ogden. 28 Aug 59, 19p. 27 refs. DMIC memo. 32; AD-225 589.
Order from OTS $0.50 PB 161 182

The physical properties of tantalum, having been the subject of numerous investigations during the past 50 years, are well established. Some selected physical properties are presented in Table 1, and specific physical properties at various temperatures are given in Tables 2 through 8. The mechanical properties of tantalum, especially at elevated temperatures, have become of marked interest during recent years. Unfortunately, complete information is not yet available. Table 9 presents the room-temperature tensile properties of tantalum in various commercial forms. Tables 10 and 11 present the tensile properties of tantalum sheet and rod, respectively, at subzero, room, and elevated temperatures. The properties of tantalum at temperatures of 3000 to 5000 F are given in Tables 12 through 15. The effect of oxygen contamination on the tensile strength of tantalum at about 4530 F is shown by the data in Table 16.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PREPARATION AND ANALYSIS OF TITANIUM-HYDROGEN STANDARD SAMPLES, by Max J. Trzeciak. Rept. on Contract AF 18(600)1375. 9 Feb 59, 14p. DMIC memo. 9.
Order from OTS $0.50 PB 161 160

Titanium-hydrogen standard samples were prepared individually from degassed titanium rods. The hydrogen was added to the degassed titanium sample in a modified Sieverts apparatus. Battelle analyses of 20 standards were in good agreement with the amounts of hydrogen added. Analytical results of 24 samples by two outside laboratories were in excellent agreement with the amounts of hydrogen added. Eight standard samples analyzed by two other laboratories were in excellent agreement with the amounts of hydrogen added, eight analyses were in good agreement, and six analyses showed poor agreement. Twelve samples were run by the spectrographic technique. The results showed that there is a degree of agreement between the standard samples and the spectrographic results.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PROFILE MILLING TITANIUM AND ITS ALLOYS, by Carl T. Olofson. 10 July 59, 4p. 2 refs. DMIC memo. 25; AD-220 195.
Order from OTS $0.50 PB 161 175

Profile milling is a method of milling in which the path of a single-spindle cutter is guided and controlled by a stylus tracing a master form or a template made to the contour, shape, or pattern to be reproduced on the workpiece. When profile milling titanium and its alloys, vibrations must be held to an absolute minimum. Vibrations, when present, are induced in the cutter stylus and hence are reproduced at the cutter spindle. These add to any vibrations already present at the cutter. The result is poor tool life, even fracture of harder cutter materials such as carbides.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
RECENT ADVANCES IN TITANIUM TECHNOLOGY, by E. W. Cawthorne and W. Stuart Lyman. 24 Oct 58, 34p. 2 refs. DMIC memo. 3.
Order from OTS $0.50 PB 161 154

Growth of commercial applications of titanium has been steady and careful. This usage can be expected to grow steadily and without fluctuation. Quality of mill products has continued to improve over recent months. Production brazing of titanium is still to be developed, but intensive research is underway. Titanium prices have continued to decline, although dramatic reductions have not occurred and are not to be expected. Titanium continues to have great promise in military aircraft and missile applications as a result of its weight-strength superiority over alternate materials and its superior corrosion resistance. Four major developments now underway will reinforce and augment these advantages offered by titanium. (1) Development of uniformly heat treatable high-strength alloy sheet (2) Development of sandwich construction techniques (3) Development of processing procedures and equipment to broaden the spectrum of forms and shapes in which titanium alloys are available (thin sheet, extrusions, castings) (4) Development of weldable alloys which will maintain useful strength up to 1000-1100 F and of alloys with room temperature strength of 200,000 psi, or greater.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
ROUTING OF TITANIUM SHEET, by C. T. Olofson. 12 June 59, 6p. 3 refs. DMIC memo. 22.
Order from OTS $0.50 PB 161 172

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SOME NOTES ON SAFE HANDLING PRACTICES FOR BERYLLIUM, by Webster Hodge. 22 Sep 58, 14p. 5 refs. DMIC memo. 2.
Order from OTS $0.50 PB 161 153

The rapid development of missiles systems has resulted in the introduction of beryllium metal into many machine shops, fabricating plants, and laboratories that have had no prior experience with this metal. It is generally known that beryllium and its compounds are highly toxic. The recommendations of the U. S. Atomic Energy Commission for control of beryllium hazards are also quite well known. However, many contractors appear to be somewhat puzzled about the practical steps necessary to stay within the limits of air contamination recommended by the AEC. The information that follows is based on a limited number of literature references, and a still more limited series of observations by DMIC personnel of shops in operation. No recommendations for safe handling of beryllium in setting up a new operation are intended or can be given in this report. However it is hoped that these references and brief descriptions may assist safety engineers, operators, and plant design groups in the task of setting up a reasonable program of safe handling practices to be adhered to in any shop that expects to handle beryllium for the first time.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THERMAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS, by J. W. Holladay. 25 Aug 58, 24p. 50 refs. DMIC memo. 1.
Order from OTS $0.50 PB 161 152

This memorandum contains available data on the thermal properties of titanium and titanium alloys. The properties covered are thermal conductivity, thermal expansion, heat capacity, thermal diffusivity, and emissivity. Methods are given for estimating values for these properties when experimental data are not available.

Minerals Research Lab., U. of California, Berkeley.
ACTIVATION ENERGIES FOR CREEP OF AN ALPHA SOLID SOLUTION OF MAGNESIUM IN ALUMINUM, by N. R. Borch, L. A. Shepard, and J. E. Dorn. Technical rept. no. 6 on Contract Nonr-222(49). 15 Feb 58, 35p. 29 refs. Series no. 103, issue no. 6; AD-157 760.
Order from LC mi$3.00, ph$6.30 PB 138 470

The activation energies for creep of an Al-3.2% Mg alloy were studied over a temperature range from 78°K to the melting point. With the exception of a temperature region from 200° to 380°K where locking effects and periodic yielding were observed, the activation energies for the alloy are the same as those previously reported for pure Al. Within this temperature region, however, an activation energy peak greater than 80,000 cal. /mole was obtained at 325°K, and creep became unmeasurably slow.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
EFFECTS OF SHORT PERIODS OF INTERMITTENT VERSUS CONTINUOUS HEATING ON THE ROOM TEMPERATURE TENSILE PROPERTIES OF 2024-T4 ALUMINUM ALLOY SHEETS, by H. R. Pritchard. Technical rept. Sep 59, 13p. 1 ref. Memo. rept. M60-4-1.
Order from LC mi$2.40, ph$3.30 PB 144 237

Tensile properties and hardness were determined at room temperature on sheet specimens of 2024-T4 aluminum alloy which had been exposed to continuous and intermittent heating at 400° F for total periods of 2 to 16 hours. The effects of intermittent heating were cumulative and resulted in the same properties as produced by continuous heating. In both instances, the tensile strength decreased to 80 percent of the room temperature value after 16 hours at 400° F, while the yield strength decreased to 95 percent in the longitudinal direction and 90 percent in the transverse direction. After shorter periods at elevated temperature, the yield strength increased because of the occurrence of artificial aging.

Nonferrous (except light) Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE AVAILABILITY AND PROPERTIES OF RHENIUM, by Daniel J. Maykuth. 22 May 59, 12p. 9 refs. DMIC memo. 19.
Order from OTS $0.50 PB 161 169

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
ELEVATED-TEMPERATURE MECHANICAL PROPERTIES AND OXIDATION RESISTANCE OF COLUMBIUM AND ITS ALLOYS, by, F. R. Schwartzberg and W. D. Klopp. 4 Feb 59, 12p. 28 refs. DMIC memo. no. 8.
Order from OTS $0.50 PB 161 159

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
IMPLICATIONS OF RHENIUM RESEARCH IN THE DESIGN OF REFRACTORY ALLOYS, by R. L. Jaffee. 2 Feb 59, 4p. DMIC memo. 7.
Order from OTS $0.50 PB 161 158

There appear to be three effects of rhenium in molybdenum which are responsible for its unique behavior. There are: oxygen redisposition, twinning, and unlocking of dislocations. By combination of elements we might provide complex alloys with the same behavior, which now seems to be unique for rhenium as a binary alloying element. Even if complexing of more abundant alloying elements fails to produce the effects of rhenium in improving the ductility of molybdenum and tungsten, the scientific value of the studies on rhenium will be considerable.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF MOLYBDENUM AND THE Mo-0.5Ti ALLOY, by Richard W. Douglass. 10 Apr 59, 23p. 18 refs. DMIC memo. 14.
Order from OTS $0.50 PB 161 164

Some physical properties of molybdenum and the Mo-0.5Ti alloys of interest in the elevated temperature applications of these materials are briefly summarized. Mechanical properties, including tensile, impact and fatigue data and creep and stress-rupture properties over a wide range of temperatures are also presented.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE PROPERTIES OF MAGNESIUM-THORIUM ALLOYS, by R. J. Jackson. 29 May 59, 29p. 13 refs. DMIC memo. 20.
Order from OTS $0.50 PB 161 170

It is the purpose of this memorandum to present available engineering data for magnesium-thorium alloys of interest for structural applications of high-speed manned aircraft, which are commercially produced or have reached an advanced developmental stage. In addition, limited attention is given to fabrication of the alloys and design requirements that favor their selection.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE STATUS OF CHROMIUM-BASE ALLOY DEVELOPMENT, by Daniel J. Maykuth. 30 Jan 59, 8p. 3 refs. DMIC memo. 6; AD-210 737.
Order from OTS $0.50 PB 161 157

Massachusetts Inst. of Tech., Cambridge.
CHROMIUM BASE ALLOYS, by H. L. Levingston and N. J. Grant. Technical rept. on Contract NOas-58-253-d. 1 Oct 58, 24p. 17 refs.
Order from LC mi$2.70, ph$4.80 PB 144 135

The brittle to ductile transition temperature of commercial electrolytic chromium was investigated. Elements with a high affinity for oxygen, nitrogen and carbon were added to the chromium. The reaction products which formed and their effect on several properties of chromium were correlated with ductility criteria. The investigation showed that the transition temperature of chromium, as determined by three point bend tests, can be lowered by deoxidation and denitrification techniques as well as by grain size refinement and by testing at reduced strain rates.

Structural Metallurgy and Corrosion

Army Chemical [Warfare] Labs., Army Chemical Center, Md.
CORROSION RESISTANCE OF METALS TOWARD ISOPROPYL METHYLPHOSPHONOFLUORIDATE (GB), by A. Stephens Hutchcraft, Jr., Virgil D. Mochel, and Lawrence C. Buckles. Special rept. 27 May 55, declassified 10 Dec 56. 12p. CRLR-510.
Order from LC mi$2.40, ph$3.30 PB 144 127

A summary of studies on the corrosion of various metals by GB (isopropyl methylphosphonofluoridate) a chemical warfare agent.

Battelle Memorial Inst., Columbus, Ohio.
MATERIALS-PROPERTY-DESIGN CRITERIA FOR METALS. PART 8. THE CREEP BEHAVIOR OF SELECTED MATERIALS IN THE RANGE UP TO 1 PER CENT NET CREEP STRAIN AND 1000 HOURS, by R. J. Favor, W. P. Achbach, and H. J. Grover. Rept. for 15 Aug 58-31 Jan 59 on Materials Application, Contract AF 33(616)3965. Sep 59, 30p. 21 refs. WADC Technical rept. 55-150, Pt. 8.
Order from OTS $0.75 PB 161 302

The objectives of this study were to compile and to evaluate creep strain versus time data on airframe structural materials. The range of interest, as recommended by the Elevated Temperature Task Group of the ANC-5 Panel, includes creep strain up to 1 per cent and time up to 1000 hours. Only two reference sources dealt with creep of airframe structural materials within the conditions of strain and time imposed. Although both of these sources have considerably extended the knowledge of creep behavior in the early stages of creep, it appears that neither has encompassed adequately the regions of interest specified. Reasons for this conclusion are discussed in this report. It should be emphasized that for creep strain above about 1 per cent, both sources of data appear adequate. (See also PB 131 515)

Case Inst. of Tech., Cleveland, Ohio.
RESEARCH ON STRAIN AGING EFFECTS IN TITANIUM, by Harold S. Gurev and William M. Baldwin, Jr. Rept. for May 58-May 59 on Metallic Materials, Contract AF 33(616)5691; Continuation of Contract AF 33(616)3536. Sep 59, 70p. 54 refs. WADC Technical rept. 59-223.
Order from OTS $1.75 PB 161 304

The effects of varying interstitial element content

(oxygen, carbon and nitrogen) on the tensile properties of an alpha-beta titanium alloy, Ti-140A, were determined at test temperatures ranging from room temperature to above 1000°F and at strain rates from 0.05 to 19,000 in/in/min. The stress rupture properties of such alloys and similar interstitial bearing modifications of an alpha alloy, A-110AT, were also determined between 400°F and 1000°F. The tensile properties of the alpha-beta modifications were strongly dependent on the nitrogen content alone, while the appearance of a strain rate dependent high temperature embrittlement in an alloy modification heat was governed by the identity of the principal interstitial present. (See also PB 131 381)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE INFLUENCE OF SHEET THICKNESS ON TENSILE PROPERTIES OF METAL SHEET, by Alfred Rudnick and Robert L. Carlson. 23 Jan 59, 19p. 18 refs. DMIC memo. 5.
Order from OTS $0.50 PB 161 156

A review of the literature on the effect of specimen geometry indicates that the percentage total elongation increases as some power of the product of specimen thickness and width. Thus, it is possible to combine the effects of thickness and width into a single parameter -- cross-sectional area. No significant influence of thickness on strength apparently exists. Consideration of the correlation between laboratory measurements and actual useful ductility leads to the conclusion that uniform elongation may be a more significant index of ductility than is the more commonly used total elongation.

Forest Products Lab., Madison, Wis.
DEVELOPMENT OF A CASE LINER FOR LONG-TERM OUTDOOR STORAGE (FINAL REPORT), by Louetta Dieruf and Donald J. Fahey. Aug 59, 29p. 2 refs. Rept. no. 55-2 (Final); DA Proj. no. 591-07-001.
Order from LC mi$2.70, ph$4.80 PB 144 386

This report summarizes four annual examinations of case liners and their contents, which were in wood shipping containers exposed outdoors at four locations representing a wide range of climatic conditions. Liners, contents, and boxes were examined for rupture corrosion, warping, and general deterioration. Based on these annual appraisals, liner C (1-mil aluminum foil laminated between a 3-mil polyethylene film and 44/40 cotton scrim) can be used satisfactorily in protecting metal items against corrosion for at least 4 years of outdoor exposure in a wide range of climates. Linear A (2-mil polyethylene film sandwiched between two sheets of 60-pound creped kraft paper and coated on one surface with a 2-mil polyethylene film) and liner B (3-mil polyethylene film on a 60-pound kraft paper) will be limited to hot and arid climates, such as Yuma, Ariz., and to areas that have moderate precipitation with below-freezing temperatures most of the year, such as Fort Churchill, Canada. These liners cannot be used for even 1 year in humid climates like the Panama Canal Zone and Madison, Wis. The Douglas-fir containers offered better protection to the liner and its contents than boxes made from oak or southern pine. Treatment of the southern yellow pine box with a water-repellent preservative was advantageous when the box was exposed in areas with a high atmospheric moisture content.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
CELLULAR STRUCTURE IN ZINC CRYSTALS GROWN FROM THE MELT, by Victor V. Damiano and Marvin Herman. Rept. on Contract AF 18(600)1581. Aug 59, 23p. 10 refs. Interim rept. I-A1878-4; AFOSR-TN-59-765.
Order from LC mi$2.70, ph$4.80 PB 144 015

Substructure in zinc single crystals resulting from constitutional supercooling was examined. The effect of orientation on the cell structure arrangement is described in terms of preferred growth directions.

Illinois U., Urbana.
THE EFFECTS OF INELASTIC ACTION ON THE RESISTANCE TO VARIOUS TYPES OF LOADS OF DUCTILE MEMBERS FROM VARIOUS CLASSES OF METALS. PART XI. PHOTOELASTIC ANALYSIS OF I-BEAMS WITH ELLIPTIC-TYPE WEB CUTOUTS, by Will J. Worley. Rept. on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5658. Sep 59, 27p. 6 refs. WADC Technical rept. 56-330, Pt. XI.
Order from OTS $0.75 PB 161 303

The data presented are intended to supplement the data presented in WADC TR 56-330 Pt. VII (PB 131 556). Report VII presented information on the fully plastic strength while Pt. XI discusses the elastic stress distribution in the web section of I-beams with various shapes of elliptic-type web cutouts. The prediction of the location of the fully plastic hinges using the shear difference method is discussed for one shape of web cutout. The method shows reasonable agreement when compared with available data on the actual aluminum alloy I-beam.

Industrial Research and Development Labs. (Gt. Brit.)
MECHANISM OF CORROSION OF COPPER AND COPPER ALLOYS BY AMMONIA SOLUTIONS WITH SPECIAL REFERENCE TO THE INHIBITORY ACTION OF SUGARS AND OTHER POLYHYDROXY COMPOUNDS, by J. A. Radley and J. S. Stanley. Final technical rept. for 1 Oct 58-1 Oct 59 on Contract DA 91-591-EUC-930. 31 Oct 59, 66p. 10 refs.
Order from LC mi$3.90, ph$10.80 PB 144 137

The investigation is a continuation of the investigation described in our previous report. It concerns the study of the mechanism of the reaction between metallic copper and ammonia solutions containing dissolved oxygen. An apparatus for measuring the kinetics of this reaction has been constructed, based on the use of a rotating disc, this apparatus shows considerable advantage over the rotating cylinders.

Manufacturing Labs., Inc., Cambridge, Mass.
DEVELOPING SUBSTITUTE BINDERS FOR COBALT IN WC-Co ALLOYS AND STUDYING THE EFFECT OF GRAIN SIZE OF WC ON THE STRENGTH OF WC-Co ALLOYS, by Harry Udin. Final rept. on Contract DA 19-020-505-ORD-4482. 30 June 58, 69p. 9 refs. Rept. no. WAL 330/16.
Order from LC mi$3.90, ph$10.80 PB 144 050

The optimum iron content of WC-Fe hot pressings, with or without additions of Si or B, is in the range of 4 to 5 wt. pct. Fe. Iron-silicon alloy binders containing 2.4-5.0 wt. pct. Si yield good quality pressings. Iron-boron alloy binders containing 0.02 to 1.0 wt. pct. B yield good quality pressings.

Modena U. (Italy).
BASIC RESEARCHES IN METAL CORROSION, by Giuseppe Bianchi. Technical final rept. on Contract AF 61(052)85. 30 Apr 59, 11p. AFOSR-TR-59-76.
Order from LC mi$2.40, ph$3.30 PB 144 122

The electrochemical processes of O_2 and H_2O_2 on platinum, graphite and gold electrodes have been studied, to get a knowledge of the mechanism of oxygen corrosion. The process of oxygen and hydrogen periozide reduction in alkaline solutions takes place, independently of the nature of the cathode, at tensions very near the reversible one corresponding to the process: $O_2 + H^+ + 2e = HO_2^-$.

Massachusetts Inst. of Tech., Cambridge.
THE GROWTH OF $Ni_3(Al, Ti)$ PRECIPITATES IN A NICKEL-CHROMIUM-TITANIUM-ALUMINUM ALLOY, by Neil Rogen and Nicholas J. Grant. Technical rept. on Contract NOas 58-253-d. [1959] 12p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 144 059

X-ray line broadening was used as a measure of precipitate particle growth during aging of a vacuum melted alloy. The variation of matrix lattice parameter, precipitate composition and hardness was related to the particle size.

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnott. Progress rept. no. 3. 25 Oct 48, 8p. NEPA 803-MIC-3; AD-204 943.
Order from LC mi$1.80, ph$1.80 PB 138 457

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnott. Progress rept. no. 5. 23 Dec 48, 13p. NEPA 864-MIC-5; AD-204 969.
Order from LC mi$2.40, ph$3.30 PB 138 460

Three of the four types of furnaces that were proposed for this project have been constructed and tested for various time periods and at various temperature levels. Work on the Geiger counter method of temperature measurement shows that this device is probably more accurate than the usual optical pyrometer with the sensitivity actually improving as the temperature is raised. An improved extensometer system has been evolved which practically eliminates creep in the specimen threads and has a sensitivity on the order of two-millionths of an inch per inch and should be applicable to 1800°C or 3250°F. (See also PB 138 457)

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500°F, by M. J. Sinnott. Progress rept. no. 6. 21 Jan 49, 10p. NEPA 886-MIC-6; AD-204 968.
Order from LC mi$1.80, ph$1.80 PB 138 461

The creep testing machine and extensometer system reported in the fifth progress report have been built and tested at room temperature. Work on the Geiger tube temperature measuring instrument has been proceeding satisfactorily. A simple molybdenum wound furnace has been developed and given service for over 150 hours at a temperature of 2700°F. (See also PB 138 460)

Northwestern Technological Inst., Evanston, Ill.
AN INVESTIGATION OF PHASE TRANSFORMATIONS AND OTHER STRUCTURAL CHANGES IN METALS BY MEASUREMENT OF ELASTICITY AND INTERNAL FRICTION, by M. E. Fine and A. Kelly. Final rept. for 1 June 55-31 Aug 59 on Contract AF 18(600)1468. 30 Sep 59, 51p. 25 refs. AFOSR-TR-59-141.
Order from LC mi$3.60, ph$9.30 PB 144 008

Apparatus for precise determination of dynamic young's modulus and internal friction at elevated temperatures; Kinetics and mechanism of zone formation in aluminum alloys; Studies of the deformation of single crystals of age hardened aluminum alloys; Structural and modulus changes in α-brass and $AuCu_3$; Acoustic relaxation effect in Mn_3O_4; Internal friction and young's modulus of hexagonal and cubic cobalt; Preparation of single crystals.

Ohio State U. Research Foundation, Columbus.
ELECTRONIC ENERGY BAND STRUCTURE AND EXCITATION STATES IN METALS, by J. Korringa, E. L. Jossem and others. Technical rept. no. 6 on Contracts N6onr-22521 and AT(11-1)-191. May 57, 35p. 23 refs. AD-139 131.
Order from LC mi$3.00, ph$6.30 PB 137 906

Electronic energy band structure and excitation states in metals are discussed under the following topics: (1) Band structure and excitation states in nickel, copper, and zinc, (2) Structures of the zirconium lines, (3) Report on the grating vacuum spectrometer, and (4) Corrections for self-absorption in the X-ray tube target. Theoretical and experimental data are discussed under the first topic. The study of the structures of zirconium lines was made before it was discovered that the structure on the high-frequency side of Zr L γ1 is caused by minute quantities of sulfate evaporated from the hot oxide cathode. However, the material was retained because of the possibility that such a study may add to the understanding of metallic alloying processes. The report on the grating vacuum spectrometer considers the problem of contamination.

Rock Island Arsenal Lab., Ill.
GUIDE FOR PRACTICAL PRESERVATION WITH VCI, by Ralph L. LeMar. 6 July 59, 30p. 3 refs. Rept. no. 59-1820.
Order from LC mi$2.70, ph$4.80 PB 144 387

VCI literature was surveyed for information which would provide packaging engineers with the detailed data that was necessary to utilize more readily, volatile corrosion inhibitors. This information was organized into sections so as to permit ready reference to any appropriate section. These sections are as follows: (A) Official documents relative to VCI. (B) General application fundamentals. (C) Environmental effects. (D) VCI compatibility: (1) Among different VCI materials. (2) With bearings. (3) With nonferrous metals. (4) With surface coatings and plates. (5) With nonmetals.

Watertown Arsenal Labs., Mass.
THE EFFECT OF CERIUM ON THE HEAT TREAT RESPONSE OF PRECIPITATION-HARDENING TITANIUM ALLOYS, by Ralph H. Hiltz, Jr. Apr 58, 25p. 11 refs. Technical rept. WAL TR 401/285; AD-157 339.
Order from LC mi$2.70, ph$4.80 PB 138 417

A study was made of the effect found in combining the weak precipitation-hardening alloys of titanium, Ti-Ag, Ti-Cu, and Ti-Si, with the more intense precipitation-hardening but hot-short Ti-Ce alloys. The three ternary alloys, Ti-Ag-Ce, Ti-Cu-Ce, and Ti-Si-Ce, showed appreciable precipitation-hardening response. The Ti-Si-Ce ternary showed a double peaking of hardness with aging. A portion of the response in this alloy was due to precipitation of elemental cerium, however, which indicates a hot-short material. The addition of cerium to the Ti-Ag alloy moved peak hardness to shorter times, and maximum hardness to a lower temperature. There is no alleviation of the rapid aging and overaging cycle characteristic of the binary silver alloy, and control of the hardening reaction is difficult. The alloy of titanium with copper and cerium showed pronounced precipitation hardening and a slow overaging reaction. This alloy shows promise of being suitable for commercial application.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

National Research Labs., Ottawa (Canada).
THE PREDICTION OF PIPELINE PRESSURE LOSSES WITH URANIUM TRIOXIDE SUSPENSIONS, by E. H. Dudgeon and W. C. Michie. Nov 57, 56p. 13 refs. Rept. MT-36.
Order from LC mi$3.60, ph$9.30 PB 134 228

Measurements of pipeline pressure losses for uranium trioxide aqueous suspensions have been made for two pipe diameters and a range of velocities, oxide concentrations, and temperatures. These results have been correlated using shear rate-shear stress information obtained from a specially designed rotational viscometer. The effect of pumping at high shear rates on the chemical and physical stability of the oxide has been investigated. The limiting velocity to avoid settling in a 1.85-inch diameter pipe has been measured.

New Mexico U., Albuquerque.
SIZE-SPECTRUM OF EXTENSIVE AIR SHOWERS OF THE COSMIC RADIATION, by John R. Green and James R. Barcus. Rept. on Contract AF 49(638)34. 7 Oct 59, 16p. 8 refs. AFOSR-TN-59-1068.
Order from LC mi$2.40, ph$3.30 PB 144 342

The operation and calibration of a single scintillator of area 7.3 m^2 is discussed.

Elementary Particles

Laval U. (Canada).
RESEARCH ON THE AUGER ELECTRONS ASSOCIATED WITH BETA-DISINTEGRATION, by Claude Geoffrion. Final rept. on Contract AF 18(600)1574. 31 Aug 59, 54p. 26 refs. AFOSR-TR-59-145.
Order from LC mi$3.60, ph$9.30 PB 144 007

This is a study of the energy of the electrons emitted by atoms when they reorganize themselves after vacancies have been made in their shells due to electron-conversions or electron-captures. This effect gives electron lines, the energy of which depends on the reorganizing process and on the atomic number of the emitter. These lines range from zero to a maximum of 80 kev, but are mainly in the low energy region. The experimental determination of Auger electron energy has been made with a 180° β-ray spectrometer. Theoretical work has been done and each part is reported separately in the following.

Maryland U., College Park.
HYPERFRAGMENT FORMATION FROM THE K^--DEUTERON INTERACTION IN FLIGHT, by T. B. Day, G. A. Snow, and J. Sucher. Rept. on Contracts AT(40-1)2504 and AF 49(638)24. [1959] 9p. 6 refs. Physics Dept. technical rept. no. 154; AFOSR-TN-59-1072.
Order from LC mi$1.80, ph$1.80 PB 144 343

The results show that the hope of observing hyperfragment formation in deuterium bubble chambers is not bright.

Michigan U., Ann Arbor.
PHOTOGRAPHY OF COSMIC RAY TRACKS WITH A CASCADE LUMINESCENT CHAMBER, by Lawrence W. Jones and Martin L. Perl. Luminescent Chamber Technical rept. no. 1 on Contract Nonr-1224(23). 24 Dec 58, 24p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 143 933

The tracks of minimum ionizing particles have been

photographed in a luminescent chamber for what is believed to be the first time. A cascade luminescent chamber made up of three image tubes coupled with refractive optics has been used to photograph tracks of cosmic ray μ mesons in a sodium iodide crystal. The apparatus is described, together with details of measurements on image tube characteristics and the nature of background. The same type of apparatus is applicable to other problems where very weak light signals (several thousand photons total) must be photographed.

Princeton U., N. J.
DETERMINATION OF THE SIGN OF THE ASYMMETRY PARAMETER IN Δ^0 DECAY FROM THE SCATTERING OF THE DECAY PROTON, by T. Bowen, C. R. Sun, and A. E. Werbrouck. Technical rept. no. 21 on Contract Nonr-1858(06). 3 Dec 58, 19p. 13 refs.
Order from LC mi$2.40, ph$3.30 PB 143 864

A statistical method is presented whereby the information provided by a small number of nuclear scatters of Δ^0 decay protons can be used to determine the sign of the asymmetry parameter due to parity non-conservation in Δ^0 decay. The analysis is applied to twenty-one proton scatters of Δ^0 hyperons decaying in the Princeton multiplate cloud chamber. Because the asymmetry to be expected in each observed nuclear scatter is small, our data do not yield a statistically significant result. However, if each experimenter would follow a similar procedure with his data, it should be possible to combine results to determine the sign with a high degree of certainty.

Purdue U., Lafayette, Ind.
POLARIZATION OF THE PROTON FROM PHOTODISINTEGRATION OF THE DEUTERON, by Masaaki Kawaguchi. Rept. on Contract AF 18(600)1579. [1958] 23p. 13p. AFOSR-TN-58-584; AD-162 104.
Order from LC mi$2.70, ph$4.80 PB 137 434

The transverse polarization of the outgoing proton from the photodisintegration of the deuteron is calculated in the angular momentum representation; without assuming any detailed interaction among particles. General formulas for the polarization as well as for the angular distribution are given in terms of the Racah coefficients. If we write the angular distribution in a form $a + b \sin^2 0\ (1 + 2c \cos 0)$, the polarization is given in terms of a, b, c, and the nucleon-nucleon scattering phase shifts of the S, P, and D states under reasonable assumptions. By using experimental values of a, b, and c, and scattering phase shifts as much as available and also some theoretical estimates of the phase shifts, 20 to 30% polarization is expected for up to 40 Mev gamma rays and 10 to 20% for 140 Mev gamma rays over a wide range of angles in the center of mass system.

Instruments and Installations

Eagle-Picher Research Labs., Miami, Okla.
RESEARCH ON GROWING OF CADMIUM SULFIDE CRYSTALS FOR DOSIMETER PURPOSES, by J. E. Powderly and K. E. Bean. Quarterly rept. no. 2, 17 July-17 Oct 57, on Contract DA 36-039-sc-73270. [1957] 50p. 8 refs. AD-154 774.
Order from LC mi$3.30, ph$7.80 PB 137 661

Single crystals of Cds weighing up to 100 g were produced. The test specimens obtained from the larger single crystals and from crystals having the least number of visible physical defects, were the most sensitive to γ rays and gave more reproducible results. A small concentration of In (0.001 to 0.004% of weight) increased the sensitivity of the crystals to γ rays. IR quenching prior to irradiation decreased the sensitivity of the crystals and caused longer rise times. A crystal prepared from very high purity CdS with no addition agents, had remarkable sensitivity to IR. Seeding at 1100°C, and when cooling, lowering the temperature slowly to 100°C and retaining that temperature for 24 hr, were favorable conditions for crystal growth.

Montana State U., [Bozeman].
ELECTRON LINEAR ACCELERATOR LABORATORY, by Mark J. Jakobson. Annual summary rept. for 1 Jan 58-1 Jan 59 on Contract Nonr-1662(00), [1959] 9p.
Order from LC mi$1.80, ph$1.80 PB 144 443

Summary of results of 1 year of research. Montana State University has a traveling wave electron linear accelerator with a 3.2 ft. two section cavity. The beam emerging from the analyzer magnet has an energy spread of 50 kev at 5 mev and an average current of 1.0 microamperes.

Naval Radiological Defense Lab., San Francisco, Calif.
A FIELD BETA-GAMMA DOSE-RATE METER, by Frank A. Devlin. May 57, 14p. Research and Development Technical rept. USNRDL-TR-178; AD-145 732.
Order from LC mi$2.40, ph$3.30 PB 144 396

A thin polyethylene chamber ionization detector has shown remarkable beta flux sensitivity. It was found that by adding a removable beta flux discriminator to the chamber it was practicable to differentiate between the beta component and the gamma component of the flux coming from a contaminated field. Laboratory experiments and field data substantiate the practicability of the system described. The gamma energy dependence of the detector was found to be a maximum of 17 percent high relative of Co^{60}.

Nuclear Reactions

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
ANALYTIC WAVE FUNCTION. III. THE SPIN-ORBIT, SPIN-OTHER ORBIT AND SPIN-SPIN INTERACTIONS, by R. G. Breene, Jr. Rept. on Contract AF 04(647)269. 20 Oct 59, 20p. 7 refs. R59SD414.
Order from LC mi$2.40, ph$3.30 PB 144 190

In two earlier papers we have described our methods and programs for calculations of certain classes of atomic wave functions. In this paper we consider the application of the wave functions so obtained to the calculation of the spin-orbit, spin-other orbit, and spin-spin interactions. These calculations remove the horizontal degeneracy from the Slater diagram. We assume the Coulomb potential for the spin-orbit calculation and show the relative contributions of the nucleus and other type electrons to the result. In this and the succeeding interactions oxygen is used as an example. Although the order of the splitting is as observed, the observed asymmetry is not obtained, for the sum of all three effects is a symmetric splitting of the three levels. An explanation of this lack of asymmetry is offered which appeals to our neglect of the exchange portion of the potential in the spin-orbit calculation.

Boston U., Mass.
AN EXPERIMENTAL STUDY OF THE REACTION $Al^{27}(d, n)Si^{28}$, by Allen G. Rubin. Doctoral thesis. Rept. on [Contract AF 18(600)997], 1957, 137p. 98 refs. AFOSR-TN-57-636; AD-136 623.
Order from LC mi$6.90, ph$21.30 PB 137 528

The neutron spectrum and angular distributions of neutron groups from the reaction $Al^{27}(d, n)Si^{28}$ were obtained by the method of proton recoils in nuclear emulsions. A thin Al target was bombarded with 2.16 -Mev deuterons from the M. I. T. Rockefeller Van de Graaff generator, and neutrons were detected by means of 400-μ Ilford C-2 emulsions placed at 9 angles to the incident beam. The plates were scanned with a Leitz binocular microscope equipped with a moving stage, at 1000 magnification. Neutron spectra were obtained at 8 angles from 0° to 120°. A total of 12,500 tracks was scanned. Excited states of Si^{28} were obtained from these measurements from 1.78 ± 0.10 to 10.25 ± 0.06 Mev. The cross-section for formation of the 9.37 state of 0° is 10.1 millibarns per steradian, within a factor of 2. A second bombardment for the same reaction was made with a bombarding energy of 6.00 Mev to obtain valid stripping angular distributions; emulsions were placed at 9 angles to the incident beam, at 15° intervals, from 0° to 135°. The angular distributions which were obtained were compared with the Butler stripping theory to obtain the parities and limits on the spins of the states in Si^{28} which were reached in the reaction. A thin target of isotopic boron was bombarded with 7.03 Mev protons. The neutrons from the $B^{11}(p, n)C^{11}$ reaction indicated an excited state of C^{11} at 2.01 ± 0.06 Mev. The reaction $P^{31}(p, n)S^{31}$ was studied at E_p ± 17.2 Mev. The energy spectrum of the neutrons was determined by means of proton-recoil measurements in nuclear emulsions. The mass excess (M - A) of S^{31} was calculated to be -10.04 ± 0.20 Mev. Excited states of S^{31} were located at 1.15 ± 0.15, 2.28 ± 0.20, 3.35 ± 0.20, 4.51 ± 0.15, 5.94 ± 0.30, and 6.41 ± 0.20 Mev.

Pennsylvania U., Philadelphia.
STUDIES IN PHOTONUCLEAR REACTIONS. Rept. on Contract AF 49(638)454. 15 Oct 59, 15p. 27 refs.
Order from LC mi$2.40, ph$3.30 PB 144 475

Reviews findings and publications covering their research.

Radioactivity

Army Chemical Warfare Labs., Army Chemical Center, Md.
SURVIVAL IN FALLOUT AREAS, by Harold E. Shaw. Feb 59, 39p. 6 refs. CWLR-2272.
Order from LC mi$3.00, ph$6.30 PB 143 739

This report attempts to summarize, amplify, and clarify the current information available, and to present it in such form that it can be readily applied by doctrinal agencies.

General Electric Research Lab., Schenectady, N. Y.
THRESHOLD MEASUREMENTS AND THE PRODUCTION OF RADIATION DAMAGE IN THE NOBLE METALS, by J. W. Corbett and R. M. Walker. Scientific rept. no. 2 on Contract AF 19(604)5557. Oct 59, 7p. 9 refs. AFCRC-TN-59-764.
Order from LC mi$1.80, ph$1.80 PB 144 199

It is shown that the threshold energy T_d for radiation damage production in Cu, Ag, and Au is 22, 30, and ≥ 40 ev respectively. The fact that the T_d values are not the same for this homologous series of metals requires a reconsideration of deuteron radiation damage theory and experiment comparison. This shows that even beyond the different T_d values, the noble metals are not identical as far as the damage process.

Naval Ordnance Lab., White Oak, Md.
PROCEDURES FOR COUNTING AND HANDLING LOW ACTIVITY FOILS, by Donald G. Simons. 26 Aug 57, 14p. 6 refs. NAVORD rept. 5698.
Order from LC mi$2.40, ph$3.30 PB 144 040

When determining low activities in radioactive foils, the optimum time for counting activity is 1.8 half-lives. The background count should be made over a period at least four times that long. Special precautions are discussed for avoiding foil contamination and systematic errors in accumulating data from several experiments.

Stevens Inst. of Tech., Hoboken, N. J.
LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS, by E. R. Johnson. Quarterly rept. no. 7, 1 Dec 58-28 Feb 59, on Contract DA 36-039-sc-73146. [1959] 21p. 18 refs.
Order from LC mi$2.70, ph$4.80 PB 143 897

It is recommended that studies on the effect of nuclear radiation in aging, in reference to shock and vibration be undertaken. The effect of nuclear radiation on cold cathodes is very much greater than on hot cathodes. The mechanism of reduction of cathode material by hydrogen is discussed.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF AN EMERGENCY PRESSURE SUIT (COVERALLS, HIGH-ALTITUDE, TYPE CSU-4/P) by Charles C. Lutz. Rept. on Pressure Suits and Accessories. Prototype garments developed at the David Clark Co. under Contracts AF 33(616)3329 and AF 33(600)36873. July 59, 26p. 7 refs. WADC Technical note 59-148; AD-226 056.
Order from OTS $0.75 PB 161 033

The design of coveralls, high-altitude, Type CSU-4/P attempts to correct operational deficiencies in presently available garments as to comfort, mobility, heat, ease of donning, fitting, and integration with other flight clothes. The requirements of the pressure suit were established, and seven prototype models were designed, each improving on the previous model. The outer layer of the most recent suit is orange in color as an aid to rescue operations. This suit will provide physiological protection for a large segment of the flying population for the times and altitudes required of such a garment (70,000 ft. for 5 minutes). Improved comfort and mobility are achieved in the unpressurized condition, and tolerable comfort and adequate mobility are maintained while pressurized. Present testing of the capabilities of the new garment and continued plans of the program are described.

George Washington U., Washington, D. C.
THE LOGISTICS OF CLOSE SUPPORT, by J. E. Hamilton. Rept. on Logistics Research Project, Contract Nonr-761(05). Jan 59, 110p. 1 ref. Serial T-86/59.
Order from LC mi$5.70, ph$16.80 PB 144 261

The Logistics of Close Support considers all of naval logistics as coming to an end within the confines of a ship. It relates the demands which arise within the ship to the ways and means of satisfying those demands. Ship logistics support starts with a man in a job on a ship and with the tools which he has and the things which he uses, and works its way through a tortuous path to the laying-in hospital, and the forest, the mine, the sea and the air. It embraces EVERYTHING except men's thoughts, the ideas which spring from these and the actions of the thinker or of others under his control which carry these ideas into purpose.

Quartermaster Research and Engineering Center, Natick, Mass.
ENVIRONMENTAL PROTECTION RESEARCH BY MEANS OF RADIO TELEMETRY, PART 1. TELEMETRIC INSTRUMENTATION AND EXAMPLES OF FIELD USE IN STUDYING THE MAN-CLOTHING-ENVIRONMENT SYSTEM, by Francis W. Botsch, James J. Powers, and Alfred A. Koch. Oct 59, 31p. 27 refs. Technical rept. EP-119.
Order from LC mi$3.00, ph$6.30 PB 144 203

This report describes a frequency-type radio telemeter and associated automatic data reduction equipment designed to sense, transmit, and reduce biophysical data obtained from soldiers performing military-type activities during field exercises. The system consists of a transducer-transmitter section which is carried by the test subject, a receiving and recording unit which is located at the test site, and a laboratory data-reduction system. The telemeter permits remote recording of temperature, pressure, relative humidity, air movement, heart rate, and breathing rate with provision for converting transmitted data into analog or digitized readout or into a form adaptable to IBM computation. Data are presented to show the effect of variations in environmental factors such as wind and radiation on the man and his clothing. Graphs are used to illustrate the manner in which thermal variations at the outer surface of the clothing are modified and delayed by the clothing system and the response of the man-clothing-environment system to physiological conditions accompanying exercise.

Wayne-George Corp., Boston, Mass.
HIGH-SPEED, ELECTROMECHANICAL GOGGLE. Rept. on Visual Aids and Protection, Contract AF 33(616)5287. May 59, 29p. WADC Technical rept. 59-114; AD-215 828.
Order from OTS $0.75 PB 151 924

High-speed, electromechanical goggles, which were developed and constructed to protect the eyes of the wearer from burns or flashblindness caused by exposure to high-intensity flashes, are described. A signal is generated by a photodetector at the onset of the flash. This signal is amplified by an electronic amplifier and actuates the shutters of the goggles to shut out all light. The goggles are closed in less than 500 microseconds after the flash.

PHYSICS

Cornell U., Ithaca, N. Y.
A STUDY OF A PLATINUM SURFACE USING A MASS SPECTROMETER, by Richard C. Bradley. Technical rept. no. 11 on Theoretical and Experimental Investigations of the Atomic Phenomena Occurring on and near the Surface of Solids, Contract AF 18(600)674. 1 May 59, 58p. 20 refs. AFOSR-TN-59-271; AD-212 705.
Order from LC mi $3.60, ph$9.30 PB 144 215

The mass spectrometric analysis of particles ejected from a metal surface by the impact of inert gas ions provides information on sputtering, on surface and bulk compositions, and on surface and bulk kinetics[1-3]. Formation of PtO_3 on the Pt surface and its subsequent removal, either by evaporation or by ion bombardment.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT NO. XXIV, by A. von Hippel. Rept. on Contracts Nonr-1841(10), AF 30(635)2872, and AT (30-1)1937. Jan 59, 70p. 15 refs.
Order from LC mi$3.90, ph$10.80 PB 144 445

Contents:
Dielectric Spectroscopy
Magnetic Resonance
High Field-Strength Research
High-Pressure Research
Layer and Surface Studies
Semiconductors
Ferromagnetics
Single Crystals
Ceramics

New York U., N. Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Quarterly progress rept. no. 8 (Final) for Nov [56]-Jan [57] on Contract DA 36-039-sc-64526. Apr 57, 55p. 10 refs. AD-129 921.
Order from LC mi$3.60, ph$9.30 PB 137 530

Self-quenching in different types of molecules: The fluorescence of solutions containing 2 solutes of rather similar fluorescent properties and various chemical properties was measured and compared with the fluorescence of each when present alone in solution. Studies were conducted under high-energy excitation. Anthracene and 2 of its derivatives were chosen to check what happens when substances more closely related structurally as well as in fluorescence properties are combined. The results of anthracene combined with 9-methylanthracene and anthracene combined with 2-methylanthracene revealed a difference in behavior in these 2 combinations. Energy transfer in plastics: A 0.12 M quencher of di-p-tolylmercury reduced the fluorescence of a 0.05 M solution of 2,5-diphenyloxazole by a factor of 2. Decay of fluorescence excited by high energy and light: Fluorescence decay times of organic materials of the order of 10^{-9} to 10^{-7} sec were measured. De-excitation investigations on ZnS and ZnCdS phosphors: Experiments were undertaken to examine the effect of $\lambda \geq 7700$ A, heat, and time on the de-excitation process. Exposure to $\lambda \geq 7700$ A or to heat at 100°C for longer than 60 min contributed practically nothing further to the trap emptying process. Uncooled samples reached temperatures as high as 110°C during IR irradiation while cooled samples were maintained at about 10° to 15°C. Heat acts to empty electrons from traps, while IR acts to free positive holes which recombine either with electrons in the conductivity band or in traps. The difference between the so-called quenching and stimulable phosphors is essentially in the nature of the recombination process. (See also PB 135 930)

Acoustics

Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SOUND RADIATION IN A CLOSED SPACE FROM BOUNDARY LAYER TURBULENCE, by Ira Dyer. Rept. on Contract Nonr-2321(00). 12 Feb 58, 47p. 20 refs. Rept. no. 602.
Order from LC mi$3.30, ph$7.80 PB 144 115

A theory of noise generation by the action of boundary layer turbulence on an elastic system has been developed, with particular reference to underwater application. The elastic system considered is a rectangular plate closed off by a rectangular liquid-filled volume. A simple yet physically meaningful form is assumed for the boundary layer pressure correlation. The resulting plate vibration and sound radiation is derived, taking into account coupling between the plate motion and the sound field in the liquid. In the theory coupling is manifested by radiation-induced masses and viscous damping which, in effect, may be added to the mass and damping of the plate considered to be vibrating in vacuo. It is shown that the noise in the closed space decreases with decreasing free-stream speed and boundary layer thickness. Also the noise decreases with increasing mass and damping of the plate, and with increasing distance from the plate. The use of plate damping as a means of noise reduction is predicted to be limited on the one hand by radiation damping, and on the other hand by correlation decay in the assumed turbulence pressure field.

California U., Los Angeles.
ABSORPTION OF ULTRASONIC WAVES IN ROTATIONAL ISOMER LIQUIDS OF THE RING TYPE, by Melvin Eli Pedinoff. Technical rept. no. 14 on Contract Nonr-233(48). Jan 59, 78p. 39 refs.
Order from LC mi$4.50, ph$12.30 PB 144 139

The ultrasonic pulse technique has been extended to lower frequencies by the use of solid dielectric transducers and has been used here for the determination of the anomalous absorption of sound in several organic liquids over a frequency range of approximately 150 to 3,500 kilocycles per second. The principal liquid studied, methylcyclohexane, has a large anomalous sound absorption which can be attributed to the irreversible perturbation of an equilibrium between two of its rotational isomers by the sound wave.

Harris Transducer Corp., Woodbury, Conn.
THE THEORY OF ACOUSTIC REFLECTORS FOR SONAR APPLICATIONS. REPORT 1. RESPONSE OF AN END LOADED CYLINDRICAL RESONATOR, by H. K. Farr. Rept. on Contract Nonr-2720(00). 15 Jan 59, 25p. 1 ref. HTC-73-R1.
Order from LC mi$2.70, ph$4.80 PB 144 398

This report is the first in a program for the study of passive devices for the reflection or scattering of sound energy in deep water. The object of the general program is to develop alternatives to the conventional low density baffle materials (cork, "cell-tite", etc.) which fail at very high hydrostatic pressures. The first device selected for study was a hollow right circular cylinder with a mass attached to each end. A sound wave exerts radial pressure on the walls which induces lengthwise motion of the end masses owing to the so-called Poisson ratio coupling. In the region of resonance such a device offers the possibility of an efficient reflector or scatterer of sound energy.

Electricity and Magnetism

Carnegie Inst. of Tech., Pittsburgh, Pa.
THE TWO HALL EFFECTS OF IRON-COBALT ALLOYS, by Frank P. Beitel, Jr. and Emerson M. Pugh (Summary of Research). Final rept. on Contract Nonr-760(04). 31 Dec 58, 97p. 18 refs.
Order from LC mi$5.40, ph$15.30 PB 143 980

Hall coefficients and resistivities of the Fe-Co alloys measured at 77°K, 169°K, and room temperature using fields up to 3.3 weber/m^2.

Michigan U. Research Inst., Ann Arbor.
GALVANO-MAGNETIC EFFECTS. PART I, by W. Tantraporn and Ernst Katz. Final rept. on Contract AF 49(638)69. Aug 59, 54p. 15 refs. 2613-8-F; AFOSR-TR-59-122, AD-226 081.
Order from LC mi$3.60, ph$9.30 PB 144 121

An historical preface is given. The phenomenological theory, as developed previously, is summarized, with special emphasis on applications to bismuth and gallium. The experimental method of measurement and results for bismuth are described. It is found that all resistivity brackets can be represented by the formula $\{\} = \Gamma_0 T e^{-\beta}\sqrt{T}$, where Γ_0 is a constant different for each bracket and β depends almost exclusively on the order of the bracket. This dependence is roughly given by $\beta_n = 2n/(n+4)$. Results from the literature for gallium are analyzed in terms of our phenomenological constants. The procedure of testing and its complications are sketched, as is the direction in which an entire new series of bracket relations is in process of being discovered by the present analysis. Comparison of limiting low-intensity reciprocity failure slope from sequence loops is made with previous measurements. A study is made of the number of quanta active in the formation of a just developable latent image as a function of grain size, density, and type of development by means of sequence loops. The method of sequence exposures is briefly described along with experimental results. The results confirm qualitatively the trend of the theoretical work but lead to quantitative difficulties, which are discussed. The conclusions are summarized.

Naval Research Lab., Washington, D. C.
RESONANCE ABSORPTION OF MICROWAVE BY PARAMAGNETIC SUBSTANCES, by Chihiro Kikuchi and Walter W. Wada. Final rept. 22 Sep 52, 70p. 31 refs. NRL rept. 4015.
Order from LC mi$3.90, ph$10.80 PB 143 880

A brief theoretical background for the interpretation of one of the most important phenomenon in paramagnetism—namely, resonance absorption of microwaves by paramagnetic salts. The results of these calculations in the case of hyperfine structure and specific heat for cupric salts are compared with experimental observations and found to be in excellent agreement.

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
A SURVEY OF THE RESEARCH OF IONIZED MEDIA, by E. Atlee Jackson. Aug 59, 33p. 167 refs. AFCRC-TR-59-174.
Order from LC mi$3.00, ph$6.30 PB 144 382

The purpose of this article is to survey that literature which sheds light on either the dynamical or equilibrium properties of ionized media. While an attempt has been made to compile a fairly complete listing of the pertinent research, it is not intended to be exhaustive and some important papers may have been inadvertently overlooked. This survey has been arranged in chronological order, to the extent that this does not conflict with the conceptual development of the subject. The early development of this subject lends itself quite well to such an ordering. More recent developments, by their very nature, are more difficult to place in a logical order and are arranged somewhat arbitrarily as to subject matter. The brief discussions of this research attempt to point out some of the areas of controversy, incompleteness, and errors, but definitive conclusions are obviously impossible in many cases.

Case Inst. of Tech., Cleveland, Ohio.
A USE OF THE ANALOG COMPUTER IN ANTENNA PATTERN STUDIES, by Forest E. Brammer and Wen-Hsiung Ko. Scientific rept. no. 6 on Contract AF 19(604)3887. [1959] 24p. 3 refs. AFCRC-TN-59-579.
Order from LC mi$2.70, ph$4.80 PB 144 010

The analog computer is shown to lend itself to an evaluation of the convolution integral that occurs in the Fourier Transform method applied to antenna pattern studies. In the integral

$$g_a(u) = \int_{-\infty}^{\infty} g(u')\, S(u-u')\,du'$$

The scanning function, S(u), is not generated in the conventional sense but is closely approximated by the series of special functions. The method is one of changing the problem from step-by-step integration to one of solving a simple set of differential equations.

Excellent agreement is found between the results of the computer method and those obtained from analytical methods.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ON THE SYNTHESIS OF TIME VARYING LINEAR SYSTEMS, by Jose Benjar Cruz, Jr. Doctoral thesis. Technical note no. 9 on Contract AF 49(638)63. 7 Aug 59, 103p. 41 refs. AFOSR-TN-59-866; AD-226 580.
Order from LC mi$5.70, ph$16.80 PB 144 311

It is shown that any multi-input-multi-output linear system may always be represented by a set of single-input-single-output linear subsystems connected properly. Attention is focused on some properties of single-input-single-output linear systems which are generally time varying. These properties are exploited in developing synthesis procedures for time-varying linear systems with specifications in the time domain, frequency domain, and general λ domains. In connection with synthesis in a general λ domain, compatible systems are defined. The techniques for fixed linear systems in the frequency domain apply to compatible time-varying linear systems in an appropriate λ domain. The characterization or system functions for all the models considered belong to the class of separable functions first treated by Bendat. Necessary and sufficient conditions are derived for the exact realization of certain classes of functions. A much wider class of specified system functions may be expanded in terms of a set of orthogonal and realizable functions. The basic time-varying element used in most of the models is a time-varying gain amplifier. The approximation of the time-varying gain amplifier by periodically operated switches, sinusoidal time-varying amplifiers, and sequentially gated amplifiers is discussed.

Electronics Research Lab., U. of California, Berkeley.
GLOW CATHODES IN PULSED MAGNETIC FIELDS, by E. D. Hoag. Scientific rept. no. 4 on Contract AF 19(604)2270. 15 June 59, 56p. 5 refs. IER Series no. 60, issue no. 239; AFCRC-TN-59-379; AD-217 859
Order from LC mi$3.60, ph$9.30 PB 143 891

An experimental investigation has been carried out to study the microscopic characteristics of the beam in a smooth-bore cylindrical static magnetron with an aluminum secondary-emission cathode and a pulsed magnetic field. Certain curious hysteresis effects were noted that implied that the beam current depended rather sensitively upon the time derivative of the magnetic field; a discussion of the causes of this current, based on the theory of Buneman, is included. In addition, the circulating component of the beam current has been measured and is found to be compatible with the static space-charge distribution upon which Buneman bases his perturbation calculations. An Appendix has been included in which the details of the design work for the field coil and pulse facility are described in some detail.

Hermes Electronics Co., Cambridge, Mass.
THEORY OF ANTENNA PERFORMANCE IN SCATTER-TYPE RECEPTION, by S. Stein, D. E. Johansen and A. W. Starr. Final rept. on Contract AF 19(604)5214. 30 Sep 59, 179p. 26 refs. M-783; AFCRC-TR-59-191.
Order from LC mi$8.10, ph$27.30 PB 144 192

A theoretical investigation is reported which describes fundamental performance characteristics of an antenna system receiving from a distribution of coherent radio sources, such as in encountered in UHF transhorizon propagation. It is shown that to each source configuration, there exists an optimum antenna excitation which maximizes the received power. Assuming that the apparent source distribution is subject to random fluctuations in time, such as occurs in the transhorizon phenomenon, statistical properties of the received power are derived for the continuously optimized antenna. Both probability distributions and associated parameters measuring overall system performance are obtained. Computations are performed both for a small number of independently fluctuating discrete sources and for a smoothly distributed fluctuating source having small spatial correlation. As a basis for comparison, similar properties are then investigated for standard space and angle diversity systems. Initial computations indicate a large "gap" between the performance of existing or contemplated systems and the theoretical optimum.

Hughes Aircraft Co., Culver City, Calif.
A NEW METHOD OF PATTERN SYNTHESIS FOR LINEAR ARRAYS, by H. E. Shanks. Scientific rept. no. 3508/1 on Contract AF 19(604)3508. July 59, 21p. 4 refs. AFCRC-TN-59-568.
Order from LC mi$2.70, ph$4.80 PB 143 970

A unique phase expression is given which allows synthesis of a wide variety of shaped radiation patterns for a linear array. The accompanying amplitude distribution is found by a stationary phase evaluation of the radiation integral and is shown to be functionally related to the desired radiation pattern. Because of the optical type of approximation (stationary phase) used to evaluate the radiation integral, the method is most applicable to antennas with large size-to-wavelength ratios.

Institute of Mathematical Sciences, New York U., N. Y.
THE POTENTIAL AND CHARGE DISTRIBUTION NEAR THE TIP OF A FLAT ANGULAR SECTOR, by Ben Noble. Rept. on Contract AF 19(604)5238. May 59, 18p. 7 refs. Research rept. no. EM-135; AFCRC-TN-59-383; AD-226 497.
Order from LC mi$2.40, ph$3.30 PB 143 969

The calculation of the potential and charge distribution near the tip of a flat angular sector is reduced to the solution of a mixed boundary value problem on the surface of a sphere. A method is developed for finding the lowest eigenvalue and eigenfunction for this mixed problem. If r is the distance from the tip of the sector and the potential varies as r^{μ} when r tends to zero, numerical results are given for μ as a function of the angle of the sector.

Naval Ordnance Lab., White Oak, Md.
FERRITE CORE LOOP ANTENNAE PARAMETERS, by Jack Finkel. 28 July 58, 23p. 1 ref. NAVORD rept. 5764.
Order from LC mi$2.70, ph$4.80 PB 144 047

Analysis of an air-core loop, in terms of its effective height, inductance and equivalent resistance, is extended to include ferrite core antennae. An antenna whose winding is distributed over 80% of the length of the core has greater pickup than one whose winding is concentrated at the center of the core. The measurements indicate that the equivalent resistance, representing the losses in the core, is a linear function of the frequency.

Oklahoma U. Research Inst., Norman.
THEORETICAL INVESTIGATION OF THE COMPLEX INDEX OF REFRACTION OF A PLASMA FOR INFRARED AND VISIBLE RADIATION, by Otto H. Theimer. Final technical rept. on Contract DA 23-072-ORD-1320. 15 Aug 59, 28p. 15 refs. OOR rept. 2233.1-P.
Order from LC mi$2.70, ph$4.80 PB 144 330

The contributions of atoms and ions to the refractivity of plasmas are also discussed.

Stanford Electronics Labs., Stanford U., Calif.
A HOLLOW-BEAM CONDENSER, by R. E. Holaday. Rept. on Contract AF 33(600)27784. 4 June 59, 98p. 14 refs. Technical rept. no. 103-1.
Order from LC mi$5.40, ph$15.30 PB 144 060

A method is here described for condensing a hollow beam of electrons solely by means of a shaped magnetic field. If the field is shaped so that the inertial-overshoot of the electrons is not too severe, the beam follows the flux lines and shrinks in radius and thickness to a final size determined by the ratio of the final value of the magnetic field to its initial value. A theory for the electron trajectories in the absence of space charge is presented, along with the results of the theory that were obtained through use of an analog computer. Experimental results were obtained using a conventional immersed-flow hollow-beam gun placed in a shaped field generated by a series of short solenoids.

Technische Hochschule, Graz (Austria).
THEORETICAL STUDY OF TRIANGULAR APERTURE HORN ANTENNA, by Ernst Ledinegg. Final technical rept. for 1 Aug 58-31 Aug 59 on Contract DA 91-591-EUC-880. 1959, 87p. 13 refs.
Order from LC mi$4.80, ph$13.80 PB 144 376

The main part of the work was devoted to the calculation of the field types in waveguides of arbitrary cross-section. The second section of the report deals with the calculation of the radiation pattern of waveguide antennas. The third section treats the exact theory of the radiation field taking into account the interaction with the waveguide field.

Aeronutronic, Newport Beach, Calif.
EMISSIVITY OF DISPERSED CARBON PARTICLES, by V. Robert Stull and Gilbert N. Plass. Scientific rept. no. 6 on Contract AF 19(604)2166. 29 May 59, 41p. 8 refs. Publication no. U-503; AFCRC-TN-59-450.
Order from LC mi$3.30, ph$7.80 PB 144 414

The emissivity of dispersed spherical carbon particles is calculated from the Mie theory of scattering. A suitable dispersion equation is derived which represents the optical properties of carbon at flame temperatures. A general expression for the emitted radiation including all higher order scattering processes is obtained. The radiation emitted by carbon particles in flames is calculated for a range of particle radii from 50 to 800A and for several different particle size distributions. The shift of the intensity maximum to shorter wavelengths from the blackbody maximum is quantitatively explained.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ASYMMETRIC ROTOR EIGENVALUE TABLE, by T. E. Turner, B. L. Hicks, and G. Reitwiesner. Sep 53, 112p. 8 refs. Rept. no. 878.
Order from LC mi$6.00, ph$18.30 PB 144 079

A table of asymmetric rotor eigenvalues is given for $J = 1(1)12$ and $\chi = 0.00(0.01)1.00$. A brief account of the asymmetric rotor theory is also given to serve both as a ready reference for the users of this table and as a basis for the explanation of the computation. The eigenvalues were computed on the EDVAC and the methods of computation and checking are described.

Cornell U., Ithaca, N. Y.
AN OPTIMIZED METHOD FOR CORRECTING FOR SMEARING ABERRATIONS: COMPLEX X-RAY SPECTRA, by J. O. Porteus and L. G. Parratt. Technical rept. no. 7 on Contract AF 49(638)402. 1 Sep 59, 129p. 40 refs. AFOSR-TN-59-754.
Order from LC mi$6.30, ph$19.80 PB 143 952

A study is made of the true spectrum $T(\nu)$ from the observed spectrum $O(\nu_n)$ which has been recorded with a spectrometer whose smearing or "spectral window" function is $M(\nu_n - \nu)$. The correction involves the convolution or folding integral

$$O(\nu_n) = \int_{-\infty}^{\infty} T(\nu)\, M(\nu_n - \nu)\, d\nu.$$

This problem, with appropriate terminology, arises in almost every facet of experimental science. A mathematically unique solution exists only in case $O(\nu_n)$ and $M(\nu_n - \nu)$ are exactly known for all ν. Many investigators have attacked this problem, and many different "practical solutions" have been proposed. The problem is re-examined from the point of view of correcting x-ray spectra for resolving power, and previous solutions are found to be inadequate. A new optimized solution is proposed. The errors in this solution are discussed in detail. The specific spectral examples to which the new method is applied are the K emission and absorption of crystalline potassium chloride.

Cornell U., Ithaca, N. Y.
THE TEMPERATURE DEPENDENCE OF RAMAN INTENSITIES, by G. W. Chantry. Rept. on Raman Intensities of the A_1 Lines of Oxyanions, Contract AF 49(638)279. 11 Aug 59, 11p. 12 refs. AFOSR-TN-59-743.
Order from LC mi$2.40, ph$3.30 PB 143 997

The trace of the derived polarizability tensor has been measured on an absolute scale for the ions CO_3^{--}, NO_3^-, PO_4^{-3}, SO_4^{-2} and ClO_4^- in aqueous solution. From these and the known normal coordinate matrix elements, the values of the derivative with respect to bond length have been calculated. Results are interpreted in terms of bond order, and indicate appreciable π bonding in the ions NO_3^-, SO_4^{-2} and ClO_4^-. In these cases, as opposed to hydrocarbons a π electron makes a larger contribution to the derived bond polarizability than does a σ electron.

Cornell U., Ithaca, N. Y.
THE TEMPERATURE DEPENDENCE OF RAMAN INTENSITIES, by George W. Chantry and Robert A. Plane. Rept. on Raman Intensities of the A_1 Lines of Oxyanions, Contract AF 49(638)279. 11 Aug 59, 9p. 4 refs. AFOSR-TN-59-807.
Order from LC mi$1.80, ph$1.80 PB 144 013

The temperature dependence of the intensity of the Raman lines of a polyatomic molecule has been investigated. It is shown that, when account is taken of all possible "hot" band transitions as well as fundamental transitions, the temperature dependence of each band is the same as that found for the single band of a diatomic molecule. Degenerate vibrations are also considered and likewise shown to have the same temperature dependence.

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE SPECTRA OF CHROMIUM AND MANGANESE IN THE SPINEL STRUCTURE, by R. Stahl-Brada and W. Low. Technical note no. 8 on Contract AF 61(052)59. June 59, 16p. 20 refs. AFOSR-TN-59-961; AD-226 397.
Order from LC mi$2.40, ph$3.30 PB 143 963

The paramagnetic resonance spectrum of Cr^{3+} was measured on a single crystal of ruby spinel $MgAl_2O_4$ at the wavelengths of 3 cms., 1.2 cm., and 8.6 mm and the paramagnetic spectrum of Mn^{2+} was measured on a single crystal of $ZnAl_2O_4$ at 3 cm.

Institute of Molecular Physics, U. of Maryland, College Park.
INVESTIGATIONS OF INTERMOLECULAR FORCES, by Edward A. Mason. Final rept. for 15 Sep 55-15 Sep 59 on Contract AF 18(600)1562. 15 Oct 59, 34p. 25 refs. AFOSR-TR-59-147.
Order from LC mi$3.00, ph$6.30 PB 144 347

A new phenomenon in gaseous diffusion has been investigated which is the analogue of the Kirkendall effect in solids. The results have been shown to be explainable on the basis of the rigorous kinetic theory of gases. The experimental method appears to be a novel and useful way of measuring gaseous diffusion coefficients. Investigations of molecule-molecule and ion-molecule forces have also been carried out theoretically through studies of scattering and mobility. Applications of the results have included determination of gaseous ion mobilities and of high-temperature gas properties.

Institute of Molecular Physics, U. of Maryland, College Park.
THE KIRKENDALL EFFECT IN GASEOUS DIFFUSION, by Kenneth P. McCarty and Edward A. Mason. Rept. on Contract AF 18(600)1562. 11 Sep 59, 96p. 28 refs. IMP-OSR-13; AFOSR-AFOSR-TN-59-966, AD-226853.
Order from LC mi$5.40, ph$15.30 PB 143 917

The different rates of transfer by random motion of the two gases in binary diffusion tend to build up a hydrostatic pressure in one region of the mixture. This pressure will cause a back flow of the two gases together. The analogous effect in solids, the Kirkendall effect, has been demonstrated experimentally for gases and the results were explained theoretically. The apparatus used to observe the Kirkendall effect in gases was essentially two bulbs connected by a capillary tube and a larger diameter tube. A drop of silicone oil blocked the larger tube. Diffusion of gases through the capillary tube built up a pressure difference that caused the drop to move. The motion of the drop was used to determine the diffusion coefficients for several gas systems after the system He-Ar had been used to calibrate the apparatus.

Kentucky U., Lexington.
SELENIDES PROJECT, by Lee Gildart and D. F. Clifton. Progress rept. no. 1 on Contract AF 49(638)90. 31 July 58, 69p. 7 refs. AFOSR-TN-58-849; AD-203 361.
Order from LC mi$3.90, ph$10.80 PB 138 436

Electrical and optical properties of vacuum-evaporated films
Reversible electrical breakdown in stibnite crystals
Liquid-solid transformations, and structure studies
Other experimental results
Work in progress

Massachusetts Inst. of Tech., Cambridge.
EFFECT OF POISONING ON THE INFRARED SPECTRUM OF CARBON MONOXIDE ADSORBED ON NICKEL, by Carl W. Garland. Technical rept. no. 2 on Contract Nonr-1841(01). 30 Jan 59, 18p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 144 145

The infrared spectrum has been determined for CO adsorbed on both freshly-reduced nickel samples and on a series of nickel samples poisoned by preadsorption of CS_2. The nickel is supported on a high-area

alumina and comprises ten percent of the sample by weight. Spectra were recorded as a function of increasing coverage as CO was adsorbed.

Materials Research Lab., Watertown Arsenal, Mass.
ON THE ROLE OF THE EQUIVALENCE RESTRICTION IN MOLECULAR CALCULATIONS, by A. J. Freeman. Aug 59, 8p. 8 refs. MRL rept. no. 66; AD-225 879.
Order from LC mi$1.80, ph$1.80 PB 144 073

The results of 2 LCAO-SCF treatments of a molecule with a degenerate open shell, OH, are reported and compared. Both procedures are variants of the equivalence and symmetry restriction techniques, as introduced by Nesbet and Roothan, for treating open shell configurations. Values of the total energy, LCAO coefficients, and dipole moment are presented. Comparison shows very good agreement between the results of the 2 calculations.

Minnesota U., Minneapolis.
INITIAL-PERMEABILITY SPECTRA OF MICROSCOPIC IRON-OXIDE PARTICLES, by W. F. Brown, Jr., J. P. Hanton, and A. H. Morrish. Rept. on Contract AF 18(603)113. Oct 59, 10p. 5 refs. AFOSR-TN-59-759.
Order from LC mi$1.80, ph$1.80 PB 143 988

The magnetic resonance of single-domain ferromagnetic particles in zero applied steady magnetic field is studied theoretically and experimentally. The axial ratio of the powder particles deduced from the resonance measurements agrees reasonably well with optical data. This is strong evidence regarding the origin of the observed resonance.

Oregon U., Eugene.
THEORY OF FINE STRUCTURE PRESSURE BROADENING OF THE VIOLET TRIPLET OF MANGANESE, by Makoto Takeo. Interim technical rept. no. 3, 1 July 58-Aug 59, on The Modification of the Shape and Positions of Spectral Lines by Foreign Gases under Well-Defined Conditions of High Pressure and High Temperature, Contract DA 04-200-ORD-713. [1959] 12p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 144 027

A theory of fine structure pressure broadening of a multiplet is applied to manganese triplet lines with and without exchange effect under LS coupling. (See also PB 142 071)

Sloane Physics Lab., Yale U., New Haven, Conn.
ZEEMAN SPLITTING OF EXCITON LINES IN CdS, by R. G. Wheeler and J. O. Dimmock. Rept. on Contract AF 49(638)503. Oct 59, 12p. 10 refs. AFOSR-TN-59-764.
Order from LC mi$2.40, ph$3.30 PB 143 957

Western Ontario U. (Canada).
SHOCK TUBE SPECTROSCOPY. I. THE SHOCK EXCITATION OF POWDERED SOLIDS by W. H. Parkinson and R. W. Nichols. Scientific rept. no. 1 on Contract AF 19(604)4560. 15 July 59, 100p. 45 refs. AFCRC-TN-59-620.
Order from LC mi$5.40, ph$15.30 PB 144 005

Helium driven shock waves in argon were used to excite a number of astrophysically important oxides (CuO, BeO, MgO, CaO, SrO, BaO, H_3BO_3, Al_2O_3, TiO_2, PbO, Pb_3O_4, V_2O_5, Cr_2O_3, $H_2W_4O_{13}$, α-Fe_2O_3, Fe_3O_4, $FeTiO_3$.) In addition to the metallic oxides some hydride compounds (Al + H, CuH) and carbon and cyanide compounds (C, AgCN, $K_3Fe(CN)_6$, $K_3Co(CN)_6$ KCN) were also studied. As an application to meteor physics four samples of meteorite were subjected to shock excitation. The type of spectrum (atomic or molecular) excited in the shock tube can be selected and restricted by suitably adjusting the Mach number (or gas temperature) through the initial pressure ratio and gas parameters. The combined results from the spectroscopic time resolved and microscopic experiments have suggested that on atomic vapour is ablated from the powder particles and excited thermally to luminosity by the argon atoms behind the reflected shock wave. This is followed by recombination of the ablated atoms to form molecules which emit the characteristic band spectrum. Finally as the temperature decreases the vapour condenses on the surfaces of the original powder grains often with the formation of new compounds.

Western Ontario U. (Canada).
SHOCK TUBE SPECTROSCOPY. II. SPECTROSCOPIC TEMPERATURE AND INTENSITY MEASUREMENTS IN A SHOCK TUBE, by W. H. Parkinson and R. W. Nicholls. Scientific rept. no. 3 on Contract AF 19(604)4560. 15 Aug 59, 45p. 26 refs. AFCRC-TN-59-622.
Order from LC mi$3.30, ph$7.80 PB 144 003

Spectroscopic rotational temperature measurements on the (0, 1) band of the CN Violet System have given temperatures which agree with the calculated gas kinetic temperature to about 10 percent. This method has provided a means of inferring a temperature without introducing temperature sensitive devices such as probes in the environment. Rotational intensity measurements on the (0, 0) AlH band of the $A^1\Pi - X^1\Sigma^+$ system has revealed an unusual intensity amomaly which is very pressure sensitive. Experiments in the shock tube at high pressure (7 to 13 atmospheres) and in a discharge tube at low pressure (less than one atmosphere) has suggested the following two possible mechanisms; (a) the presence of pressure sensitive strength factors rather than the usual H onl - London strengh factors, or (b) pressure induced predissociation of the excited $^1\Pi$ state by a postulated $^3\Sigma$ state according to the Kronig selection rules. Similar measurements with the CuH (0, 0) band ($^1\Sigma^+ - ^1\Sigma^+$) have showed that rotational equilibrium is not obtained with this molecule.

Western Ontario U. (Canada).
TRANSITION PROBABILITIES OF MOLECULAR BAND SYSTEMS. XVI. PART I. TRANSITION INTEGRALS WITH TRANSITION MOMENTS OF EXPOTENTIAL FORM. PART II. THE RECURSION RELATION FOR GENERALIZED LAGUERRE POLY-

NOMIALS AND THE REMAINDER FORMULAE FOR OVERLAP INTEGRALS, by G. P. Henderson, W. R. Jarmain, and P. A. Fraser. Scientific rept. no. 2 on Contract AF 19(604)4560. 1 Aug 59, 27p. 19 refs. AFCRC-TN-59-621.
Order from LC mi$2.70, ph$4.80 PB 144 004

This report describes two pieces of work concerned with intensities of diatomic molecular bands. The work was carried out some years ago and now appears to be of more importance. The first part concerns the evaluation of transition integrals involving transition moments of exponential form. The second part contains general proof of results presented in previous reports which were directly calculated only for simpler, but often important, special cases. These earlier results were of such a pattern that it was possible to suggest the general form in each case. (See also PB 139 865)

Optics

Bureau of Ordnance, Dept. of the Navy, Washington, D. C.
DESIGN AND CALIBRATION OF MEDIUM AND HIGH RESOLUTION INFRARED TELESCOPES FOR OBSERVATION OF ATMOSPHERIC RADIATION. 5 Apr 57, 102p. 14 refs. NAVORD rept. 4868; AD-143 654.
Order from LC mi$5.70, ep$18.30 PB 136 474

A report is made of the instrumentation and calibration involved in studies of sky background radiation in the IR region. The region is defined as lying between approximately 0.7 and 30 μ. A detail description is given of the design and calibration of the medium resolution telescopes (for wavelength regions from 3 to 30 μ and from 0.7 to 3.0 μ) and of the high resolution telescope. Particular attention is assigned to the 1.5° telescope for the thermal region designed on a modified Schwarzschild system. An inverted-cone, black-body source is compared with a Bureau of Standards calibrated lamp. The electronic components, consisting of amplifiers for the detectors and control circuits, are described. An explanation is given of the mechanical system for automatically scanning the sky.

Colorado State U., Fort Collins.
STUDIES, RESEARCH AND INVESTIGATIONS OF THE OPTICAL PROPERTIES OF THIN FILMS OF METALS, SEMI-CONDUCTORS AND DIELECTRICS, by Lawrence N. Hadley, Jr. Final rept. for 1 Feb-31 July 57 on Contract DA 44-009-eng-2618. 31 Aug 57, on Contract DA 44-009-eng-2618. 31 Aug 57, 20p.
Order from LC mi$2.40, ph$3.30 PB 144 057

Contents:
Infrared emission, Cu_2O, Sb_2O_3, Sb_2S_3, SiO_2
Experiment to detect exciton emission
Index of refraction of Cu_2O

High Altitude Observatory, Boulder, Colo.
FINAL REPORT, by Robert J. Low. Rept. on Contract AF 19(604)610. 9 July 58, 4p. 1 ref. AFCRC-TR-58-261; AD-206 784.
Order from LC mi$1.80, ph$1.80 PB 137 895

Work was summarized on the construction and assembly of the optical, mechanical, and electronic components of the 16-in. coronagraph for use at the Sacramento Peak Observatory, Sunspot, New Mexico. Other tasks were reported in mechanical and electronic construction and design, and optical construction. The initial planning and preliminary designs for an eclipse triple-spectrograph system were described.

Institute of Mathematical Sciences, New York U., N. Y.
STRUCTURE OF THE ELECTROMAGNETIC FIELD IN THE IMAGE REGION OF AN APLANATIC OPTICAL SYSTEM, by E. Wolf and B. Richards. Rept. on Contract AF 19(604)5238. July 59, 54p. 16 refs. Research rept. no. EM-136; AFCRC-TN-59-390.
Order from LC mi$3.60, ph$9.30 PB 143 890

An investigation is made of the structure of the electromagnetic field near the focus of an aplanatic system which images a point source. The solution is not restricted to systems of low aperture, and the computational results cover, in fact, selected values of the angular semi-aperture α on the image side, in the whole range $0 \leq \alpha \leq 90°$. The results have an immediate bearing on the resolving power of image forming systems; they also help to understand the significance of the scalar diffraction theory, which is customarily employed without proper justification, in the analysis of images in low aperture systems.

Solid State Physics

Air Force Cambridge Research Center, Bedford, Mass.
THE STRUCTURE OF ALUMINUM OXIDE, by F. Euler. Apr 59, 46p. 16 refs. AFCRC-TR-59-141; AD-215 066.
Order from LC mi$3.30, ph$7.80 PB 144 216

After a short survey of the literature, the ionic locations in sapphire (α-Al_2O_3) are discussed. Special interest is devoted to the surroundings of the aluminum ion where six oxygen ions are nearest neighbors, three of them being closer to the aluminum ion but farther apart among themselves than the other three. Distances between nearest neighbors and angles are calculated.

Armour Research Foundation, Chicago, Ill.
EXCESS NOISE IN SEMICONDUCTORS. Rept. no. 4 (Final) for 15 Nov 56-15 Nov 57 on Contract Nonr-1800(00). 4 Dec 57, 41p. 19 refs. AD-150 614
Order from LC mi$3.30, ph$7.80 PB 144 274

An experimental study of excess noise in semiconductors resulted in the discovery of fluctuations in the Seebeck effect, or thermoelectric potential, of semiconductors. The Seebeck noise, caused by fluctuations in the majority carrier concentration, had a 1/f component similar to that measured in current noise in semiconductors. The magnitude of the effect agreed with a straightforward calculation based on the established dependence of the thermal emf in semiconductors on carrier density when the magnitude of carrier density fluctuations was inserted. Results indicated that carrier density fluctuations with a 1/f spectrum existed even in the absence of dc current flow. Preliminary data were obtained concerning the importance of crystalline imperfections in 1/f noise. The 1/f noise level of n-type single crystal silicon decreased with increasing crystalline imperfection density.

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE MEASUREMENT OF SURFACE STRAIN BY MEANS OF BONDED BIREFRINGENT STRIPS: A PRELIMINARY REPORT, by J. Duffy and T. C. Lee. Technical rept. no. 2 on Contract DA 19-020-509-ORD-4674. June 59, 19p. 9 refs. DA-4674/2.
Order from LC mi$2.40, ph$3.30 PB 143 771

A technique for the measurement of surface strains in opaque bodies is described and applied to a study of wave propagation phenomena. Essentially the method is a variation of the birefringent coating technique. The narrow edge rather than the flat face of the plastic strip is cemented to the metal surface and viewing is parallel to this surface in a standard polariscope. In this way the birefringent strip provides a measure of the strain all the way down to the metal surface avoiding the complications due to thickness effects attendant on birefringent coatings.

California U., Los Angeles.
THE EFFECT OF THE ELASTIC INTERACTION ON THE RATE OF CLUSTER GROWTH, by W. Grupen, R. Kikuchi, and George Sines. Rept. on Contract DA 04-495-ORD-1250. Aug 59, 23p. 2 refs. Dept. of Engineering rept. no. 59-37.
Order from LC mi$2.70, ph$4.80 PB 143 834

Diffusion in a solid from a concentration gradient and an energy gradient. Discussion of the magnitude of the elastic interaction.

California U., Los Angeles.
ULTRASONIC ATTENUATION IN METALS AT LOW TEMPERATURES, by Daniel H. Filson. Technical rept. no. 13 on Contract Nonr-233(48). Jan 59, 70p. 27 refs.
Order from LC mi$3.90, ph$10.80 PB 144 140

Low temperature equipment; Acoustical measuring techniques; Techniques for resistance measurement; Low temperature measurements; Aluminum, Tin.

Cornell U., Ithaca, N. Y.
X-RAY REFLECTION STUDIES OF THE ANNEAL AND OXIDATION OF SOME THIN SOLID FILMS, by N. Wainfan and L. G. Parratt. Technical rept. no. 6 on Contract AF 49(638)402. 25 Aug 59, 29p. 23 refs. AFOSR-TN-59-755.
Order from LC mi$2.70, ph$4.80 PB 143 951

The technique of the total reflection of x-rays has been applied to the study of thin vacuum-deposited films of Cu, Ni, Ge, and Se on polished glass substrates. The effects of vacuum anneal and oxidation were studied.

Electron Tube Research Lab., U. of Minnesota, Minneapolis.
STUDIES ON BASE NICKELS FOR OXIDE COATED CATHODES, by W. G. Shepherd. Scientific rept. no. 4, 15 Jan-15 Apr 59, on Contract AF 19(604)3890. [1959] 107p. AFCRC-TN-59-399.
Order from LC mi$5.70, ph$16.80 PB 143 974

A modified circuit for use in the measurement of the saturation pulse emission of oxide-coated cathodes is described. Life tests of cathodes based on 0.22% and 0.08% Al-Ni alloy are presented. Chemical activation of an oxide cathode, under conditions allowing a controlled change in the coating reduction rate is reported. Influence of a heated Ti anode on the properties of an oxide-coated cathode is described. Poisoning of oxide cathodes due to anode bombardment is described. Particular emphasis in these studies is the recovery of emission following poisoning after various periods of cathode operation.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
HIGH PRESSURE EFFECTS ON IMPURITY LEVELS IN SEMI-CONDUCTORS, by Melvin G. Holland. Technical rept. no. HP-4 on Contract Nonr-1866(10). 1 Dec 58, 146p. 84 refs.
Order from LC mi$7.20, ph$22.80 PB 143 852

Effect of high hydrostatic pressure on the impurity levels due to three different impurities in germanium and silicon. The statistics for shallow and deep-lying impurity energy levels in semiconductors are presented, and discussed in terms of an alteration of their position with pressure. Results for silicon with a hydrogen donor atom, arsenic, and two hydrogenic acceptor atoms, aluminum and indium, are discussed. Pressure decreases the ionization energy of the arsenic impurity by about 1% in 10,000 kg/cm^2. Results for both n- and p-type gold-doped germanium where the impurity energy levels are both acceptors. Effect of pressure on minority carrier trapping in p-type manganese-doped silicon.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
NATURE OF THE SINGULARITIES IN THE SPECTRUM OF A ONE-DIMENSIONAL IONIC LATTICE, by Joseph Gillis and George Weiss. Rept. on Contract AF 18(600)1315. Sep 59, 7p. 2 refs. Technical note BN-184; AFOSR-TN-59-931.
Order from LC mi$1.80, ph$1.80 PB 144 312

It is known, by a theorem of van Hove, that regular lattices will have singularities in their frequency spectra, the type of singularity depending on the dimension. Although several studies of the one dimensional lattice with coulomb interactions have appeared, no one yet has succeeded in identifying the type of singularity that appears in addition to the inverse square root singularity, in the frequency spectrum. In this note we establish that for a one-dimensional crystal the singularity is of the form $g(\omega) \sim A[(\omega-\omega_1) \ln 1/(\omega-\omega_1)]^{-1/2}$ where A is a constant and ω_1 is the position of the singularity.

Istituto Elettrotechnico Nazionale Galileo Ferraris (Italy).
OPTICAL MICROSCOPY EXAMINATION OF THE EFFECT OF HIGH ENERGY BOMBARDMENT ON SEMICONDUCTOR SINGLE CRYSTALS, by Guido Bonfiglioli, Andrea Ferro, and Adriana Mojoni. Technical note no. 1 on Contract AF 61(514)1333. [1958] 12p. 4 refs. AFOSR-TN-59-958.
Order from LC mi$2.40, ph$3.30 PB 143 962

Microscopy observations of etching patterns on Ge single crystals. The "primary structure" in etched Ge is due to the progressive rounding off of the etch pits which belonged to dislocations ending on lattice planes already taken away by the etchant.

ITT Labs., Nutley, N. J.
RESEARCH ON GROWING CRYSTALS OF FERRIMAGNETIC OXIDES, by A. J. Marino, Jr. Scientific rept. no. 8 for 1 Jan-31 Mar 59 on Contract AF 19(604)2261. July 59, 10p. 3 refs. AFCRC-TN-59-360; AD-216 817.
Order from LC mi$1.80, ph$1.80 PB 144 043

Crystals of manganese ferrite ($MnFe_2O_4$) have been grown by the flameless fusion technique with annealing during growth. A five-turn helical coil has been added to the conical r-f work coil used in this growth technique. This addition provides a method of keeping the grown crystal hot during the growth process and allows it to be cooled at a uniform rate. This slow cooling, coupled with "annealing" during growth, eliminates, or drastically cuts down, the cracking normally associated with crystals grown by flame fusion. (See also PB 140 063)

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
FIELD-STRENGTH EFFECTS IN CADMIUM SULFIDE SINGLE CRYSTALS, by H. Gildea. Rept. on Contracts Nonr-1841(01) and AT(30-1)1937. Dec 58, 18p. 8 refs, Technical rept. 133.
Order from LC mi$2.40, ph$3.30 PB 144 126

Current-voltage-time characteristics using cadmium sulfide single crystals with d-c and unidirectional pulse voltages at various temperatures. In general the crystals showed a rather high conductivity, which proved essentially independent of temperature in the range from -175°C to 100°C. One type exhibited a low conductivity.

Manufacturing Labs., Inc., Cambridge, Mass.
THE LATTICE STABILITY OF METALS. II. ZINC, COPPER, AND SILVER, by Larry Kaufman. Technical rept. no. 2 on ONR Contract. 1 Jan 59, 44p. 28 refs.
Order from LC mi$3.30, ph$7.80 PB 144 220

An integrated thermodynamic analysis of the f. c. c.(α) and b. c. c. (β) solid solutions of the Ag-Zn and Cu-Zn systems. The differences in free energy between the α, β, and η (h. c. p.) forms of zinc, and the α and β forms of copper and silver have been calculated as a function of temperature. It is possible to calculate the activity of zinc in the α and β phases of Cu-Zn and Ag-Zn over a wide range of temperature and composition.

Materials Research Lab., Watertown Arsenal, Mass.
LONG-RANGE MAGNETIC INTERACTIONS VIA CONDUCTION ELECTRONS, by Arthur Paskin. July 59, 10p. 9 refs. MRL Rept. no. 65; AD-225 568.
Order from LC mi$1.80, ph$1.80 PB 144 072

Yosida [Phys Rev. 106:893, 1957] has shown that the long-range Zener ferromagnetic term [Phys. Rev. 81:440, 1951] arising from the exchange interaction between conduction electrons and unfilled-inner-shell electrons, does not appear explicitly when the calculation is extended to second-order perturbation. The magnetic interaction term to second-order perturbation, decreases rapidly with distance and is short-range relative to the Zener interaction which extends uniformly throughout the solid. Re-examination of the Yosida calculation discloses that the long-range magnetic term disappears because of certain free-electron approximations made for the energy and density of states of the conduction electrons. In a more general formulation of these terms, the Zener interaction does appear with a coefficient proportional to the difference of the density of states and the second-derivative of the number of electrons (of a given spin) with respect to their energy. Using nuclear magnetic resonance data, an estimation is made that the magnitude of the Zener term and the short-range interaction term are the same for the Cu-Mn alloys studied by Yosida.

Miami U., Coral Gables, Fla.
EFFECTIVE MASS OF ELECTRONS IN GALLIUM ARSENIDE, by L. C. Barcus, A. Perlmutter and J. Callaway. Rept. on Contract AF 49(638)62. 5 Mar 58, 9p. 6 refs. AFOSR-TN-58-152; AD-152 178.
Order from LC mi$1.80, ph$1.80 PB 137 659

The effective mass of electrons in a sample of n type gallium arsenide has been measured by determining the reflectivity in the infrared. The value obtained, $0.043 \pm 0.005\ m_o$, supports the hypothesis that the minimum of the conduction band is at the center of the Brillouin Zone.

Michigan U. [Research Inst.] Ann Arbor.
THE USE OF ELECTROLUMINESCENT PHOSPHORS IN THERMAL IMAGING, by Paul A. Silberg. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Oct 57, 16p. 11 refs. 2144-120-T.
Order from LC mi$2.40, ph$3.30 PB 144 129

This report describes two possible ways of using electroluminescent phosphors for thermal imaging. The phosphors may be (1) mixed with a temperature-sensitive dielectric; or (2) deposited as a film on a temperature-sensitive dielectric. A theoretical analysis of each method is provided including an estimate of their respective sensitivities $\left(\frac{1}{B}\frac{dB}{dT}\right)$

Minerals Research Lab., U. of California, Berkeley.
EFFECT OF DILUTE COPPER ALLOYING ON THE ACTIVATION ENERGIES FOR CREEP OF ALUMINUM SINGLE CRYSTALS, by D. Walton, L. Shepard, and J. E. Dorn. Technical rept. no. 7 on Contract Nonr-222(49). 1 Dec 58, 33p. 15 refs. Series no. 103, issue no. 7.
Order from LC mi$3.00, ph$6.30 PB 144 118

The activation energies for creep of single crystals of Al containing up to 0.25% Cu in Alpha solid solution were determined by the effect of small changes in temperature on the creep rate. From 490°K to about 700°K, alpha solid solution alloys of Al containing 0.09% to 0.25% Cu yielded an activation energy of 41,000 cal/mole.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
MICROWAVE CRYSTAL DETERIORATION STUDIES, by P. P. Lombardini. Quarterly progress rept. no. 2, 1 Nov 58-31 Jan 59, on Study of the Deterioration of Microwave Crystal Diodes Exposed to High Level R-F Energy, Contract DA 36-039-sc-78055. 28 Feb 59, 32p. 3 refs. Moore School rept. no. 59-10.
Order from LC mi$3.00, ph$6.30 PB 144 155

During recent experimental investigations, it has been found that the process of temporary deterioration can be effected by the application of short duration d-c pulses to the diode in the negative direction. The effects of d-c and r-f pulses have been compared. The dependence of the phenomena of temporary deterioration upon r-f pulsewidth has been studied for the case of a carrier frequency in the S-band. Limited measurements have been made of the dependence of d-c backward current change on increasing temperature of the diode. These measurements indicate a continuous increase in backward current and a decrease in the percent change of backward current for temperatures above 100°C. (See also PB 142 764)

Naval Ordnance Lab., White Oak, Md.
A NEUTRON DIFFRACTION STUDY OF CHROMIUM-SUBSTITUTED FERRITES, by Stanley J. Pickart. 7 June 58, 83p. 28 refs. NAVORD rept. 6101.
Order from LC mi$4.80, ph$13.80 PB 144 048

The temperature dependence of the individual sublattice magnetizations, as well as the effect of an applied field upon the coherent magnetic intensities, has been determined for several of the compositions studied. The subject of this report is a study of the magnetic and crystallographic properties of mixed ferrite-chromites.

Naval Ordnance Test Station, China Lake, Calif.
SEMINAR ON SOLID-STATE PHYSICS, by R. S. Witte, C. E. Mandeville and others. 24 June 58, 54p. 6 refs. NOTS 2023.
Order from LC mi$3.60, ph$9.30 PB 144 049

Five selected subjects presented at the Seminar are: (1) Statistical Mechanics for Solids; (2) F-Centers and Luminescence; (3) Neutron Diffraction; (4) Electron Resonance in Solids; and (5) Polarons.

Pennsylvania U., Philadelphia.
THE INFLUENCE OF RADIATION INDUCED AND OTHER IMPERFECTIONS ON THE MECHANICAL, THERMAL AND OPTICAL PROPERTIES OF ALKALI HALIDE CRYSTALS by B. R. Russell, P. H. Miller, Jr. and M. E. Caspari. Final rept. on Contract AF 18(600)561. July 59, 58p. 15 refs. AFOSR-TR-59-123.
Order from LC mi$3.60, ph$9.30 PB 144 350

The research can be divided into two separate but somewhat related problems. One of these is concerned with the difference between the thermal expansion of alkali halide crystals when the expansion is measured by macroscopic techniques and when it is measured by determining changes in the lattice constant as a function of temperature by x-ray techniques. The other part of the program was concerned with a study of radiation damage from weak ionizing irradiation in alkali halides, and in particular KCl and NaCl crystals.

Polytechnic Inst. of Brooklyn, N. Y.
COMPOUNDS WITH DEFECT LATTICES, by E. Banks. Progress rept. no. 3, 1 Dec 56-28 Feb 57, on Contract DA 36-039-sc-71242. 29 Mar 57, 64p. 20 refs. AD-132 031.
Order from LC mi$3.90, ph$10.80 PB 138 208

An analysis of the magnetic effects of substitution in single crystals of $BaM_xFe_{(12-x)}O_{19}$ (where M = Al or Ga) suggests that Al enters preferentially in octahedral sites, while Ga shows preference for tetrahedral sites at low concentrations, but substitutes randomly at higher concentrations. Some preparations with zinc and magnesium partially substituted for iron were strongly magnetic. Some progress has been made in the direction of preparation of copper-iron selenides. A study of color centers produced by X-irradiation of CdF_2, containing NaF and/or CeF_3 in solid solution, is reported. (See also PB 138 209)

Polytechnic Inst. of Brooklyn, N. Y.
COMPOUNDS WITH DEFECT LATTICES, by E. Banks. Progress rept. no. 4, 1 Mar-31 May 57, on Contract DA 36-039-sc-71242. 25 June 57, 22p. 2 refs. AD-140 664.
Order from LC mi$2.70, ph$4.80 PB 138 207

Some preparations in the Cu-Fe-Se system have been made at integral ratios of known selenides. $CuFe_2Se_{2.5}$ yielded a weakly magnetic material with an X-ray pattern different from those previously reported. Cu_2FeSe_2 preparation showed some lines of the $CuFeSe_2$-$CuFe_2Se_3$ phase plus many additional lines. On heating WO_3 in vacuo with Ta_2O_5, new tetragonal phases were formed, having patterns similar to those of tetragonal $Na_{0.28}WO_3$. The samples had lost oxygen on heating, and were colored blue to green. A crystal-pulling apparatus was constructed, and some details of its operation are given. (See also PB 138 208)

Raytheon Mfg. Co., Waltham, Mass.
STUDY OF SEMICONDUCTOR MATERIALS AND DEVICES. Final rept. for 1 Oct 55-30 June 57 on Contract NObsr-72537; [Continuation of Contract NObsr-57323. [1957] 95p. 16 refs. AD-141 843.
Order from LC mi$5.40, ph$15.30 PB 137 774

The annealing behavior was studied in crystals which were grown from quartz crucibles and in samples where dislocations were introduced by plastic bending. For a deformed sample with a dislocation density of 10^7/sq cm, the amplitude of the 9-mμ band was reduced appreciably in 15 min at 1000°C; the undeformed sample with a dislocation density of 10^4/sq cm requires about 12 hr. Preliminary light scattering experiments in deformed and annealed samples show a definite anisotropy of the scattered intensity when the light vector is perpendicular or parallel to the dislocation lines. Measurements of surface conductance on germanium and silicon indicated localized surface states at the semiconductor-semiconductor oxide interface. Changes in structure were observed following the application of high electric fields across the oxide film. Control of the diffusion process for device fabrication was improved to yield reproducible values of Co and penetrations of about 4×10^{17}/cc and 0.5 mil, respectively. A new type HF semiconductor amplifying device, the spacistor, is described which utilizes the high field of a reverse biased junction to produce a very short transit time for the injected carriers. The device appeared operable at microwave frequencies.

Rice Inst., Houston, Tex.
ELECTRON EMISSION FROM PLASTICALLY STRAINED ALUMINUM, by W. D. Von Voss and F. R. Brotzen. Technical rept. no. 1 on Contract Nonr-2116(02). 31 Dec 58, 34p. 16 refs. AD-218 857.
Order from LC mi$3.00, ph$6.30 PB 143 929

Aluminum was strained in tension under a Geiger-Müller counter. Both the electron emission associated with plastic deformation and the subsequent delayed emission were observed. An attempt was made to correlate quantitatively the emission rates with the mechanical variables, i.e., strain and rate of deformation. The model used for this correlation links point imperfections formed during deformation with the emission from the oxide surface film.

Stanford Electronics Labs., Stanford U., Calif.
SPIN-LATTICE RELAXATION VIA HARMONIC COUPLING, by W. S. C. Chang. Rept. on Contract AF 33(600)27/84. 27 Aug 57, 18p. 8 refs. Technical rept. no. 156-5; AD-226 020.
Order from LC mi$2.40, ph$3.30 PB 144 062

Substantial experimental evidence was found for a new mechanism of spin-lattice relaxation which is called harmonic cross-relaxation. The relaxation rate of one transition in a multi-level system (ruby in the present instance) is found to be drastically shortened when the frequency of another transition is twice or 3 times the frequency of the first transition. The effect is observed with a traveling-wave-maser apparatus to permit wideband measurements. In one method, the inversion ratio of a 3-level maser pumping on transition 2-4 and amplifying on 2-3 is found to become unusually high when the idle or 3-4 frequency is one third of the 1-3 frequency, and to be small when this is not the case. The idle transition is apparently shorted out by harmonic coupling. In another method, which does not involve any maser action, the recovery of a saturated transition is observed directly at various operating points including ones where harmonic coupling to a transition at twice the frequency is present. With a short saturating pulse, 2 (or more) relaxation times are observed. The results indicate that if harmonic coupling is present, the 2 transitions thermalize with each other at a rapid rate (≈10 msec) and then both together thermalize with the lattice at a slower rate (≈100 msec). A saturating pulse longer than 10 msec brings both transitions to the same temperature and only the long relaxation time is observed.

Westinghouse Research Labs., Pittsburgh, Pa.
PARAMAGNETIC RELAXATION STUDIES IN MASER CRYSTALS, by J. G. Castle, Jr. P. F. Chester, and P. E. Wagner. Quarterly rept. no. 1 on Contract AF 19(604)5589. 8 July 59, 21p. 7 refs. Research rept. 403FD449-R3, AFCRC-TN-59-396.
Order from LC mi$2.70, ph$4.80 PB 144 188

Conclusions are stated concerning spin relaxation effects in dilute potassium chromicyanide.

Yale, U., New Haven, Conn.
LATTICE IMPERFECTIONS IN METALLIC AND IONIC CRYSTALS; AND THE OPTICAL ABSORPTION EDGE OF INSULATING CRYSTALS AT LOW TEMPERATURES, by Arthur S. Nowick and Robert G. Wheeler. Rept. for 1 July 53-28 Feb 59 on Contract AF 18(600)850. 10 Sep 59, 13p. 8 refs. AFOSR-TR-59-142.
Order from LC mi$2.40, ph$3.30 PB 143 955

Experiments on electrical properties, optical properties, internal friction, and elastic modulus of alkali halide and gold crystals.

Theoretical Physics

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
TRANSPORT PROPERTY EQUATIONS FOR PARTIALLY IONIZED GASES, by C. W. Baulknight. Rept. on Contract AF 04(647)269. 18 Sep 59, 15p. 15 refs. Technical Information Series R59SD428.
Order from LC mi$2.40, ph$3.30 PB 144 132

Two types of systems are considered in this theoretical investigation. Type I is a system of charged-charged particles and the Coulombic interaction potential is assumed. In type II, the system is composed of both charged and uncharged particle, i. e. $N^+ + N$, and $\frac{1}{\gamma_4}$ potential is assumed. The $\frac{1}{\gamma_4}$ term is corrected for the polarizabilities. Some typical results are presented for the Diffusion. Viscosity and Thermal Conductivity coefficients for the Charged - change system in the temperature range of 10,000 to 15,000°K.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
INTERACTION OF ELECTROMAGNETIC WAVES WITH IONIZED GASES, by Robert G. Jahn. Technical rept. no. 9 on Contract AF 18(603)02. Aug 59, 54p. 5 refs. AFOSR-TN-59-911; AD-226 365.
Order from LC mi$3.60, ph$9.30 PB 144 321

Possibilities are explored with regard to the use of microwaves as probes to study ionized gas flows. The case is studied where the propagating waves are disturbed by the gas, rather than the gas being disturbed by the wave field. The distinction is mainly implicit in the strength of the impressed signal, and, to a certain extent, in the free charge and total particle densities. Waves of small amplitude are considered; therefore, no component of the gas other than the electrons, both free and bound, is significantly disturbed. As such, the treatment is relevant to such problems as the study of the characteristics of ionized gases by microwave probes, and the problems of electromagnetic communication into and through ionized gas layers. Throughout, the approach is one which starts from the basic field relations and at every opportunity takes the simplest alternatives consistent with physical experience, while attempting to demonstrate the salient features of the interaction with a minimum of mathematical encumbrance.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE PAIR DISTRIBUTION FUNCTION OF A HARD SPHERE BOSE SYSTEM CALCULATED BY THE PSEUDO-POTENTIAL METHOD, by Leopoldo S. Colin. Rept. on Contract AF 18(600)1315. Sep 59, 39p. 7 refs. Technical note BN-185; AFOSR-TN-59-928.
Order from LC mi$3.00, ph$6.30 PB 144 293

The pair distribution function for a system of hard sphere bosons has been performed replacing the hard sphere potential by the so-called pseudo-potential. The problem has been carried through using the quasi-particle formalism of Bogoliubov. In this calculation one considers a system of bosons interacting via the pseudo-potential, which can be regarded as a weak interaction when the system is very dilute. The Hamiltonian of the system is diagonalized by means of a canonical transformation and this has the effect of separating the energy into two parts, one which is the ground state energy and the other one which corresponds to an ideal Bose gas composed of "elementary excitations" or quasi-particles. This formalism was applied to the calculation of the pair distribution function of our system. This quantity was calculated by averaging over a grand canonical ensemble constructed with the total number of quasi-particles. A result which is seen to be valid both for the condensed and gaseous phases of the system and also for any distance r between the particles has been obtained. (See also PB 142 990)

Microwave Lab., Stanford U., Calif.
ACTION-TRANSFER AND FREQUENCY-SHIFT RELATIONS IN THE NONLINEAR THEORY OF WAVES AND OSCILLATIONS, by P. A. Sturrock. Technical note on Contract AF 49(638)415. Sep 59, 21p. 13 refs. M. L. rept. no. 625; AFCRC-TN-59-892.
Order from LC mi$2.70, ph$4.80 PB 144 380

Certain relations which have arisen in the theories of electrical networks, electron tubes, plasma oscillations and particle accelerators are here shown to be special cases of general relations attributable to any system which may be described by a Hamiltonian. If such a system is analyzed into an interacting set of modes (waves or oscillators), we find that the rates of transfer of action to or from members of a group of interacting modes are in integral ratios, the integers being determined by the interaction, and are related in magnitude to the energy associated with the interaction. We find furthermore a conjugate set of relations which lead to the following statement: the fractional shifts in frequency of members of a group of interacting modes, when multiplied by the energies in those modes, are in integral ratios, the integers being determined by the interaction, and are related in magnitude to the energy associated with the interaction.

Microwave Lab., Stanford U., Calif.
THE EXCITATION OF PLASMA OSCILLATIONS, by P. A. Sturrock. Technical note on Contract AF 49(638)415. Sep 59, 15p. 12 refs. M. L. rept. no. 610; AFCRC-TN-59-891.
Order from LC mi$2.40, ph$3.30 PB 143 994

The theory of Bohm and Gross and the experiments of Looney and Brown upon the excitation of plasma oscillations by the two-stream mechanism, which appear superficially to be in disagreement, are here shown to be compatible with each other and with related experiments.

Stanford Electronics Labs., Stanford U., Calif.
THE BENNETT PINCH, by O. Buneman. Rept. on Contract AF 19(604)1847. 17 June 59, 33p. 13 refs.

Technical rept. no. 104-2; AFCRC-TN-59-555.
Order from LC mi$3.00, ph$6.30 PB 143 972

A fully covariant description of the Bennett Pinch is given, valid even for relativistic temperatures, and a rigorous procedure for testing its stability with respect to all kinds of perturbation is outlined.

University Coll. of North Staffordshire (Gt. Brit).
QUANTUM MECHANICS OF ATOMS, MOLECULES AND CRYSTALS. Annual technical rept. ATR no. 1, 1 Oct 58-30 Sep 59, on Molecular Quantum Theory, Contract DA 91-508-EUC-390. 30 Oct 59, 41p. 24 refs.
Order from LC mi$3.30, ph$7.80 PB 144 469

Progress has been made in the following fields: The Water Molecule. The Graphite Layer. Many-Electron Quantum Mechanics (General Theory). Automatic Computation. Three- and Four- Electron Systems.

Thermodynamics

Armour Research Foundation, Chicago, Ill.
THE MECHANICAL PROTECTION OF THE W/Ir THERMOCOUPLE, by Gary Steven and Walter C. Troy. Rept. no. 22, 5 Sep-7 Oct 49. 13 Oct 49. 7p. NEPA 1185-ARM-23; AD-206 716.
Order from LC mi$1.80, ph$1.80 PB 138 452

Two zirconia tube shielded W/Ir thermocouples and an Ir/60% Rh, 40% Ir thermocouple were tested at 2000°C in oxidizing surroundings. The W/Ir thermocouples were operated in neutral atmospheres. Both ceramic tubes failed during the heating period of the furnace. A recalibration of the Ir/60% Rh, 40% Ir thermocouple after a 17-hour campaign at high temperature showed only a slight loss in thermal emf output. Furthermore, the weight loss at 2000°C in moderately oxidizing atmosphere was of a magnitude that would permit 100 hours of service at temperature. Safety equipment was added to the furnace set-up. Alimina and beryllia protected W/Ir thermocouples are now ready for high temperature stability tests. (See also PB 138 456)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONDUCTION OF HEAT IN ONE-DIMENSIONAL MANIFOLDS WITH ARBITRARY INTERNAL HEAT SOURCES, by John F. Detlef. May 56, 19p. 2 refs. Rept. no. 980.
Order from LC mi$2.40, ph$3.30 PB 144 083

The general problem of heat conduction in one-dimensional manifolds composed of two substances of different conductivities and with arbitrary internal heat sources is here formulated and a general formal solution to the problem is obtained by operator methods. Of the several special cases discussed the most general is that of internal sources of exponential type. An existence theorem for one aspect of the general problem is included.

Brown U. Div. of Applied Mathematics, Providence, R. I.
TRANSIENT THERMAL STRESSES IN A SEMI-INFINITE SLAB, by Walter Jaunzemis (Pennsylvania State U.) and Eli Sternberg. Technical rept. no. 5 on Contract Nonr-562(25). Jan 59, 43p. 9 refs. 562(25)/5.
Order from LC mi$3.30, ph$7.80 PB 144 404

This investigation is concerned with the transient temperature and thermal-stress distribution generated in a semi-infinite slab if a finite segment of its edge is subjected to a sudden uniform change in temperature. The slab is supposed to be free from external loads and its faces are assumed to be insulated. Exact solutions in series form are obtained both for the heat-conduction problem and for the associated thermoelastic problem. The latter is treated quasi-statically within the classical two-dimensional theory of elasticity. The thermal stresses appropriate to the generalized plane-stress solution vanish identically in the limit as time tends to infinity. (See also PB 140 512)

Columbia U., New York.
TRANSPORT PROPERTIES OF GASES AT HIGH TEMPERATURES, by Charles F. Bonilla. Final rept. on Contract Nonr-266(11). 10 Feb 58, 2p. CU-20-58-Nonr-266(11)-Ch. E; AD-153 026.
Order from LC mi$1.80, ph$1.80 PB 138 328

The following technical activities were completed: (1) a mathematical analysis of the temperature fluctuations of a hot-wire surrounded by a gas and heated with alternating current superimposed on direct current, including amplitude and phase lag of the temperature wave behind the power wave, as a function of the thermal diffusivity of the surrounding gas; (2) construction and testing of a tungsten hot-wire cell, and the circuitry required to carry out the determination experimentally; (3) the viscosities of argon, steam, and heavy-water vapor were measured in a capillary efflux viscometer at atmospheric pressure up to 1600°C; and (4) the viscosities of steam-nitrogen mixtures were measured in a modified capillary efflux viscometer at atmospheric pressure from 350° to 860°C.

Illinois U. Engineering Experiment Station, Urbana.
EFFECT OF HEAT TRANSFER ON FLOW FIELD AT LOW REYNOLDS NUMBERS IN VERTICAL TUBES, by Edward M. Rosen and Thomas J. Hanratty. Technical rept. no. 8 on Contract DA 11-022-ORD-1707. Oct 59, 248p. 61 refs.
Order from LC mi$11.10, ph$41.10 PB 144 030

Variation of density and viscosity with temperature may cause distortions in the flow field and affect the rate of heat transfer to fluids flowing in vertical tubes. Under relatively mold conditions of heating and cooling with a constant temperature wall these distortions may be large enough to change the parabolic velocity profile associated with isothermal flow to such an extent that the flow becomes unstable and breaks down into turbulence. For heating in upflow it was found experimentally that unstable flows exist when the center line velocity drops to zero (inversion point) and

may even exist under milder conditions. For cooling in upflow unstable flows appeared to arise under only slightly more severe conditions than are necessary to cause the velocity gradient at the wall to go to zero. (See also PB 142 059)

Institute of Flight Structures, Columbia U., New York.
HEAT CONDITION IN A MELTING SLAB, by Stephen J. Citron. Technical rept. no. 15 on Contract Nonr-266(20). Jan 59, 96p. 28 refs. CU-15-59-ONR266(20)-CE.
Order from LC mi$5.40, ph$15.30 PB 144 260

The behavior, after the initiation of melting, of a slab insulated on one side and subjected to a heat input varying arbitrarily with time on the other is studied. A method of successive approximations is developed which requires the solution of an ordinary non-linear differential equation. Curves of melt-thickness versus time are presented for a constant heat input and for a typical heat input incurred by a body descending through the atmosphere.

Mellon Inst., [of Industrial Research] Pittsburgh, Pa.
ON THE THERMOSTATICS OF CONTINUOUS MEDIA, by Bernard D. Coleman and Walter Noll (Carnegie Inst. of Tech.). Rept. on Contract AF 49(638)541 and NSF-G 5250. July 59, 77p. 15 refs. AFOSR-TN-59-852; AD-225 435.
Order from LC mi$4.50, ph$12.30 PB 144 320

Contents:
Mechanical preliminaries
Thermomechanic states
The caloric equation of state
The isotropy group
Forces, stresses, and work
Definition of thermal equilibrium
Conditions for thermal equilibrium
The fundamental postulates
An alternative axiomatization
Infinitesimal deformations from an arbitrary state
Simple fluids
Isotropic materials
The free energy
Thermal stability
Mechanical stability
Gibb's thermostatics of fluids

Michigan U. Research Inst., Ann Arbor.
AN EXPERIMENTAL INVESTIGATION OF THE POSSIBILITY OF ACHIEVING A STANDING DETONATION WAVE, by J. A. Nicholls, E. K. Debora, and R. S. B. Ong. Final rept. 2284-23-F; AFOSR-TR-59-132; AD-226 658.
Order from LC mi$2.70, ph$4.80 PB 143 908

The properties of gaseous detonation waves and the conditions that must be met to generate stable waves are described and discussed, as is the experimental facility which evolved as a result of these considerations. Preliminary experiments leading to the first known case of a stabilized detonation wave (probably very close to the Chapman-Jouguet case) are also described. In these experiments an ignition time delay has been detected between the shock wave and onset of combustion. It appears that this experimental technique has great potential in the study of chemical kinetics as well as in the study of stabilized detonation waves. Preliminary analytical work on the stability of a plane detonation wave is discussed.

Midwest Applied Science Corp., Lafayette, Ind.
PERIODIC TEMPERATURE DISTRIBUTION IN LAMINATED SOLIDS, by Richard J. Grosh. Rept. on Research on Application of the Theory-Practice of Electric Circuits to the Study of Transients in Thermal Insulation, Contract AF 33(616)5623. July 59, 29p. 37 refs. WADC Technical note 59-185.
Order from OTS $0.75 PB 161 292

Periodic heat conduction in plane, cylindrical, and spherically laminated solids is considered. Attention is given to cases of isotropic laminates, with constant product of density and specific heat and space varying thermal conductivity, after the transient period state has disappeared. Special attention is paid to treating these problems by matrix methods as suggested by the analogy of this problem with electrical four terminal networks. Finally, these mathematical methods are used to study the distributed parameter approximation of a plane laminated solid and in this way give some indication of the differences between steady state and transient measurements of thermal properties for porous insulating materials. The results indicate that, to a first approximation, a definite difference exists. The magnitude of the difference depends on the difference in thermal properties for the matrix and interstice material and the type transient. Nusselt's idealization of porous thermal insulation, a parallel fissured body, was used throughout the calculations.

Naval Ordnance Lab., White Oak, Md.
A METHOD FOR THE RAPID NUMERICAL SOLUTION OF THE HEAT CONDUCTION EQUATION FOR COMPOSITE SLABS, by Julius W. Enig. 20 Aug 59, 22p. 2 refs. NAVORD rept. 6666.
Order from LC mi$2.70, ph$4.80 PB 144 193

Two boundary conditions encountered in the heating of one-dimensional double slabs are the following: the heat flux is given at the inner surface and (a) the heat flux or (b) the temperature is prescribed at the outer surface. In this paper, a method is developed which permits the rapid calculation of (1) any given interior point temperature, and (2) the outer surface temperature or flux for (a) or (b) respectively, without computing other interior point temperatures. The partial differential equations are integrated in terms of an arbitrary outer surface temperature, the solution joined to the remaining boundary condition, and the resulting integral equation evaluated for the outer surface temperature or flux by a simple numerical scheme. The method performs an exact integration over the space dimension. Hence, once the outer surface temperature is determined, the interior temperatures are computed by exact formulae. Numerical solutions are compared to an exact solution for accuracy and to other numerical schemes for speed.

Naval Ordnance Test Station, China Lake, Calif.
DESIGN AND USE OF FINE WIRE THERMOCOUPLES FOR RESEARCH, by Maynard H. Hunt. Sep 59, 37p. 17 refs. NOTS TP 1919; NAVORD rept. 5828.
Order from LC mi$3.00, ph$6.30 PB 144 481

The work of several investigators in the field of heat transfer to fine wires in air is summarized, and empirical relationships established. The construction of fine thermocouples is described, with emphasis on the practical aspects of the problem, and several specialized probes are described.

Wave Propagation

[American Radio Relay League, West Hartford, Conn.]
A STUDY OF TRANSEQUATORIAL SCATTER PROPAGATION. Final rept. on Contract AF 19(604)2171. [1959] 27p. 5 refs. AFCRC-TR-59-262.
Order from LC mi$2.70, ph$4.80 PB 144 235

The ARRL-IGY Propagation Research Project was organized to collect and utilize observations by amateur radio operators in the very high frequency range. Bands available to them are one or more of the following (depending on location): 50-54, 70-72, 144-148, 220-225 and 420-450 Mc. The large number of such stations and their considerable activity more than offset the inability to make precise quantitative measurements. The well-known enthusiasm of the "hams" insured full cooperation from a network of observers not economically possible to duplicate in any other manner.

Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INPUT IMPEDANCE OF A BEAM COUPLED TO A PLATE, by George L. Lamb, Jr. Rept. on Contract Nonr-2322(00). 19 Dec 58, 31p. Rept. no. 603.
Order from LC mi$3.00, ph$6.30 PB 143 979

The present report analyzes the motion of an infinite elastic beam attached to an infinite elastic plate, and excited by a localized harmonic force. The interesting physical features of the bar-plate problem are illustrated in a simplified manner by considering first an infinite string attached to an infinite membrane. The results for the beam-plate system may be expressed in terms of two parameters, k_bL and r. The parameter k_bL describes the frequency dependence and degree of coupling of the beam to the plate, increasing with increasing frequency and with decreasing degree of coupling. At very low forcing frequencies, the plate stiffness combines with the bar mass to reduce the input impedance of the coupled system. At higher frequencies the impedance is essentially that of an uncoupled bar. The parameter r is the ratio of wavelength on the plate to wavelength on the bar.

Brown U. Div. of Engineering, Providence, R. I.
A LINE SOURCE ON AN INTERFACE BETWEEN TWO MEDIA, by V. M. Papadopoulos. Scientific rept. no. 5 on Research Directed Toward the Study of Radiation of Electromagnetic Waves, Contracts AF 19(604)4561 and Nonr-562(24). July 59, 16p. 8 refs. AF-4561/5; AFCRC-TN-59-564.
Order from LC mi$2.40, ph$3.30 PB 144 011

The velocity and pressure field of an unsteady line source is calculated by a similarity method when its strength is taken to have a step-function time dependence. The acoustic approximation is used in the case when the source lies on the stationary plane interface between homogeneous fluids of different density; the velocity of sound in each fluid is also different. The time derivative of the solution in section 1 of this acoustic problem gives the velocity potential when an acoustic line pulse occurs in the surface of, say, a deep sea. This is a first order solution in which the interaction of the acoustic disturbance above and below the interface is examined. The solution in section 1 is also of direct application in electromagnetic theory. This is discussed in section 3.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
THE NATURE OF FADING PATTERNS OF OBLIQUE INCIDENCE RADIO SIGNALS RECEIVED AT MIDDLE LATITUDES DURING CERTAIN IONOSPHERIC DISTURBANCES, by Peter Ford Nicholson. Technical rept. no. 47 on Studies on Propagation in the Atmosphere, Contract DA 36-039-sc-74903. 18 Aug 58, 92p. 24 refs. Research rept. EE 372.
Order from LC mi$5.40, ph$15.30 PB 144 175

The fading of tone modulated CW transmissions from Ottawa, Canada, and Washington, D. C., have been recorded for a period of approximately two years. A close inspection of these records has been executed with the particular intention of arriving at some explanation for the fast-flutter fading observed during disturbed periods. It was found that on a qualitative, as well as on a statistical basis, the fading of the received signal varied with both type and intensity of disturbance. In the presence of an aurorally disturbed ionosphere, the character of fading was described as peaky random. Fading during spread F is again of the fast-flutter type. If sporadic E is the predominating disturbance, an important feature of the fading is the presence of large variations in signal strength. Distortion of voice modulated signals in the high frequency band may be described qualitatively as ranging from a slight tremolo during a mild disturbance to almost complete unreadability for severe conditions. In the present experiment if was found that distortion increased with both the amplitude of components in the fading spectrum and the extent to which higher components were present. The relationship between fading rate and transmission frequency has been investigated, and the results given. A relatively simple derivation for the frequency independence of the forward scattering is found in Appendix II.

Electrical Engineering Research Lab., U. of Texas, Austin.
REFLECTION OF CENTIMETER AND MILLIMETER RADIO WAVES FROM THE SURFACE OF A SMALL LAKE, by A. W. Straiton, J. R. Gerhardt and others. Rept. on Contract Nonr-375(01).

15 May 52, 26p. 5 refs. Rept. no. 63; ATI-194 010.
Order from LC mi$2.70, ph$4.80 PB 144 370

Reflection from the surface of a small lake was measured at wavelengths of 9, 3.2 and 0.86 centimeters with wind speeds over the lake ranging from four to twenty miles per hour. The path length used was 1430 feet and grazing angles up to 3 degrees were reached. Both horizontal and vertical polarizations were used. The nine and three centimeter fields at a given height fluctuated less than one decibel with time and their height-gain curves were easily identified with those predicted by the interference of a direct and a surface reflected wave. The characteristics of the eight and six tenths millimeter waves varied considerably with the degree of surface roughness. On the calmest day, the time variation of the signal at a maximum on the height-gain run was less than one decibel. The same variation increased to one and one-half decibels when the wind speed was thirteen miles per hour and to ten decibels when the wind was twenty miles per hour. The reflection coefficient curves for the various wavelengths and wind conditions are shown in the report.

Electrical Engineering Research Lab., U. of Texas, Austin.
STUDIES OF 2.15mm PROPAGATION AT AN ELEVATION OF 4 Kms AND THE MILLIMETER ABSORPTION SPECTRUM, by C. W. Tolbert, A. W. Straiton, and J. H. Douglas. Rept. on Contracts Nonr-375(01) and Nonr-375(07). 1 Nov 58, 18p. 6 refs. Rept. no. 104.
Order from LC mi$2.40, ph$3.30 PB 144 074

The water vapor losses at a wavelength of 2.15 millimeters were found to be 0.12 db/km/gram/m^3 at an elevation of 4 kilometers. Oxygen losses at the 4 km elevation were unmeasureably small and the scintillation of the signal over a 1.73 km path was less than 0.2 decibel. A calculated water vapor and oxygen absorption spectrum of the millimeter wavelengths, using the Van Vleck-Weisskopf equation and line breadth constants of 0.27 cm^{-1} and 0.02 cm^{-1}, respectively, was found to fit the measured values of absorption at wavelengths of 8.6, 4.3, 3.35 and 2.15 mm much better than do the normally accepted line breadths of 0.1 cm^{-1} for water vapor and 0.02 cm^{-1} for oxygen.

Institute of Mathematical Sciences, New York U., N. Y.
FIELDS IN THE NEIGHBORHOOD OF A CAUSTIC, by Irvin Kay. Rept. on Contract AF 19(604)3495. Sep 59, 23p. 4 refs. Research rept. no. EM-138; AFCRC-TN-59-567.
Order from LC mi$2.70, ph$4.80 PB 143 971

Starting with Picht's solution of the wave equation in the form of an integral of plane waves over a caustic we derive expressions for the solution which depend entirely on the geometry of the problem. An asymptotic evaluation of Picht's integral for high frequencies gives the desired result which can have a number of different forms depending on the precise region where the field is being observed. In particular, a change in the asymptotic field occurs in going from the regular ray field to the caustic or from a regular part of the caustic to a cusp.

Michigan U. Research Inst., Ann Arbor.
A THEORETICAL METHOD FOR THE CALCULATION OF THE RADAR CROSS SECTIONS OF AIRCRAFT AND MISSILES, by J. W. Crispin, Jr., R. F. Goodrich, and K. M. Siegel. Rept. on Contract AF 19(604)1949. July 59, 414p. 143 refs. 2591-1-H; AFCRC-TN-59-774.
Order from LC mi$11.10, ph$63.60 PB 144 373

The problem of characterizing the radar properties of complex targets is such as to forbid a precise delineation of the methods. That this obtains will be made clear below as we point out the methods by means of examples. We will find that, although the formal solutions are known, the application of them to a given radar target usually leads to such complicated and involved treatments as to render these formal solutions practically useless. What is necessary is to first approximate the complex target by a collection of simple shapes, to next find appropriate methods of characterizing the radar properties of the simple shapes, and finally to recombine the simple shapes along with their radar characteristics to give a useful radar description of the original complex target.

Raytheon Mfg. Co., Wayland, Mass.
IONOSPHERE PROPAGATION STUDIES, by Leonard C. Edwards and D. E. Lindsay. Scientific rept. no. 2-7, 15 Sep 58-15 Mar 59, on Contract AF 19(604)2246. 15 Apr 59, 36p. 2 refs. AFCRC-TN-59-559.
Order from LC mi$3.00, ph$6.30 PB 144 379

The material in this report comprises the start of the third consecutive year of measurements over this HF forward scatter link. The results of the measurements indicate very little change in the signal levels for corresponding periods during the three years. During the early part of this period, changes were being incorporated into the Grand Bahama Island station and recording of the Greencastle signal there was not possible. Some measurements were made during February and March, but the signal to noise ratio was very poor. There is some indication, as there was in the case of 29 mc operation, that the signal level on 22 mc is about 10 db higher than expected. Confirmation of this would be dependent on a better knowledge of the gain realizable for the antennas being used for the two links being compared.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A MEASURE OF THE EFFORT REQUIRED TO INCREASE RELIABILITY, by Arthur Albert. Technical rept. no. 43 on Contract N6onr-251(40). 5 Nov 58, 15p.
Order from LC mi$2.40, ph$3.30 PB 144 317

In this case, failures in the system occur because so many components are involved. The results are therefore not necessarily applicable to the case where the system is unreliable because a few constituent components are highly unreliable. A compromise method would consist of estimating the reliability of sub-systems. In order to arrive at a good experimental design, some method for judging the effort involved in improving the reliability of a sub-system should be defined. For the sake of a preliminary study, we shall consider the simplest possible system, the so-called series system.

Naval Research Advisory Committee, Department of the Navy, Washington, D. C.
BASIC RESEARCH IN THE NAVY. A REPORT TO THE SECRETARY OF THE NAVY, by Arthur D. Little, Inc. Rept. on Contract Nonr-2516(00). 1 June 59, 2 vols. 57 refs.
Order from OTS $7.00(2 vols.) PB 151 925

Contents:
Volume I. Principal findings
Chap. 1. Introduction
Chap. 2. Navy dependence on technology - a brief history: A new era; Rise of the Office of Naval Research
Chap. 3. Basic research - an orientation: What is basic research? The shock wave - a case history; Strength in science indicated by Nobel prizes
Chap. 4. The relation of basic research to the missions of the Navy: Radar - a case history; The transistor - a case history; Importance of the competent man; Requirements for coupling between segments of the research process; Supplementary benefits of Navy basic research; Fields of science related to the missions of the Navy
Chap. 5. An approach to establishing a proper level of Navy participation in basic research: Comparison of Navy and industry basic research allocations; Some of the problems of increasing Navy basic research; A proposed mathematical model of the research process
Volume II. Memoranda
A. Method of Approach
B. Mathematical model
C. Manpower studies
D. Chronology of naval technical developments
E. References and source material

New York U., N. Y.
A STUDY OF CYRILLIC PRINTING TYPES IN RUSSIAN TECHNICAL LITERATURE, WITH SPECIAL REFERENCE TO THEIR APPLICABILITY TO SYSTEMS OF AUTOMATIC PRINT READING, by Charles Boni. Rept. on Russian Type Study, Contract AF 30(602)1824. 28 Apr 59, 190p. RADC-TR-59-35; AD-211 938.
Order from LC mi$8.40, ph$28.80 PB 143 945

An investigation of Russian type styles was conducted on recent and current printing of Russian technical literature to gather data of potential significance in the design of a character-discriminating device for scanning that literature. The following subject areas were selected for investigation and study: (1) physical characteristics of Russian publications, with special reference to papers and inks; (2) formal characteristics of the Cyrillic types used in current Russian publications, including a comparison with Latin alphabet characters; (3) light-reflectance properties of pages of Russian publications according to the imprint patterns left by the inked type on the paper; (4) typographic characteristics of Russian technical printing; (5) Russian proofreading, with special reference to typographic errors and such linguistic errors as misspellings and transpositions; and (6) trends and developments in print of Russian Technical publications.

Office of Ordnance Research, Durham, N. C.
PROCEEDINGS OF THE CONFERENCE [NO. 4] ON THE DESIGN OF EXPERIMENTS IN ARMY RESEARCH, DEVELOPMENT, AND TESTING SPONSORED BY THE ARMY MATHEMATICS STEERING COMMITTEE CONDUCTED AT THE QUARTERMASTER RESEARCH AND ENGINEERING CENTER 22-24 OCTOBER, 1958. Aug 59, 241p. 36 refs. Rept. no. 59-2.
Order from LC mi$11.10, ph$37.80 PB 143 833

Contents:
Errors of the third kind in statistical consulting
The AASHO road test as an example of large scale tests
Multiple correlation of mechanical with ballistic properties of armor plate
Analysis of cathode interface resistance equipment
Experimental designs for bio-assay with Pathogens
The application of experimental designs to radar systems data
Effects of ballistic and meteorological variations on the accuracy of artillery fire
Characteristics of various methods for collecting sensitivity data
Establishing and testing criteria for trajectory smoothing
Evaluation by indirect means of effects of bacteria on an unchallenged host
Determination of performance criteria for Quartermaster corps functions
Program for the interlaboratory determination of compression set of elastomers at low temperatures
An appraisal of sequential analysis under conditions restricted by the requirements for advanced scheduling and programming
Simplified computational procedures for estimating parameters of a normal distribution from restricted samples
Statistical problems associated with missile testing
Application of sequential type design and analysis to field tests
A discourse on a sequential observational program used in a study of a response surface for a complex weapons system
Some statistical aspects of preference and related tests
Statistical methods applied to the textile industry

Syracuse U. Research Inst., N. Y.
MULTIDIMENSIONAL INFORMATION THEORY, by Walter R. Baum and Stanford Goldman. Annual rept. no. 1 through 1 July 58 on Contract Nonr-669(10). Dec 58, 11p. 1 ref. Rept. no. EE494-5812A.
Order from LC mi$2.40, ph$3.30 PB 144 288

The principal purpose of the investigation is to develop an information theory which actually elucidates and makes full use of the multidimensional aspects of multidimensional information. A further purpose of the investigation is to exploit methods or results developed in the course of the work by application to other sciences. The general plan of attack has been along two different lines, both of which are continuing. The first line of attack has been along the line of pure mathematics. This work has included a study of the properties of functionals of multidimensional figures and a generalization of Crofton's ideas of geometric probability. It has also included the application of various advanced mathematical methods to the problem of finding a suitable measure theory for multidimensional figures. The second line of attack has been a study of the use of information in biological systems with the expectation that this will throw light on the salient characteristics of information and its use.

SOCIAL SCIENCES

Stanford U., Calif.
ON THE STABILITY OF DYNAMIC PROCESSES, by Hirofumi Uzawa. Technical rept. no. 61 on Contract N6onr-21533. 28 Nov 58, 16p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 144 165

In economic analysis the question is raised whether or not the values of the prices or quantities changing subject to economic laws approach equilibrium values. With respect to the price mechanism of the competitive market, the stability problem has been extensively investigated and the price mechanism formulated as a system of differential equations. In the theory of optimum resource allocation, various dynamic processes which represent the competitive price mechanism are also formulated as systems of differential equations and it is questioned whether or not the optimum activity levels are stable. In the present note a system of differential equations is considered which represents a general dynamic process, and gives a sufficient condition for the stability of the system.

Wisconsin U., Madison.
HIGH LATITUDE FRONTIER SETTLEMENT, by Kirk H. Stone. Annual rept. on Contract [Nonr-1202(05)]. 1 Dec 58, 14p. U. of Wis. no. 484:2439.
Order from LC mi$2.40, ph$3.30 PB 143 859

The chief objective is to determine the planning procedures which will insure the maximum degree of permanence of present and future frontier settlement in the North American Subarctic and Arctic. This research is limited to people of races which are primarily mid-latitude inhabitants and does not include more than general consideration of native high latitude groups like the Eskimo, Indian, and Same (Lapp). In order to accomplish the chief objective it is essential to determine methods by which the permanence of frontier settlement may be measured. A secondary objective is to establish what the basic characteristics are of all high latitude frontier settlement by non-indigenous races in order to classify such settlement for analysis regarding social, economic, and military significance. Another secondary objective is to train Scandinavian and American graduate geographers in frontier settlement research so as to accelerate such study as well as to promote closer professional and personal relations between the countries involved.

Documentation

Armed Services Technical Information Agency, Arlington, Va.
AUTOMATION OF ASTIA: A PRELIMINARY REPORT, by William A. Barden, William Hammond, and J. Heston Heald. Dec 59, 55p. AD-227 000.
Order from OTS $1.25 PB 161 306

Early considerations in automation: The history of ASTIA's experience in planning and implementing the automation of its functions is presented. Different ideas were examined and discarded in a search for a more efficient method of indexing and retrieving information. In 1953 a preliminary study based on a systems concept embracing all the functions and services of the Agency was conducted, but a full scale study was not possible until 1958. When the final selection of the Remington Rand USS-90 (Univac Solid State Computer) was made, the ASTIA staff devised methods for making optimum use of the equipment in both the business-type and information retrieval functions. Automation program: The pre-automation and automated processing of reports through ASTIA and validation of requests of military contractors is described. The three stages by which the automatic data processing system will be put into operation are examined, and the process of compiling mechanized cumulative indexes to the Technical Abstract Bulletin is presented. Creation of a Thesaurus of Scientific Descriptors: The main objectives of Project MARS (Machine Retrieval System) are: (1) to prepare a Thesaurus of descriptors; and (2) to assign these descriptors to all AD numbered reports in the ASTIA collection. The ASTIA subject headings and subdivisions were overhauled and the list reduced from 70,000 to about 7,000 headings, now termed descriptors. The scope of subject coverage was divided into about 290 generic categories called display schedules. Procedures were established for the assignment of retrieval terms, both standard descriptors from the Thesaurus and "open-ended terms" which will not appear in the Thesaurus but will provide additional retrieval access points in the form of project names, equipment nomenclature, trade names, etc.

Case Inst. of Tech., Cleveland, Ohio.
AN OPERATIONS RESEARCH STUDY OF THE DISSEMINATION OF SCIENTIFIC INFORMATION, by Michael H. Halbert and Russell L. Ackoff. 14 Feb 58, 62p.
Order from LC mi$3.90, ep$12.30 PB 144 328

Columbia U. Bureau of Applied Social Research, N. Y.
THE FLOW OF INFORMATION AMONG SCIENTISTS; PROBLEMS, OPPORTUNITIES, AND RESEARCH QUESTIONS, by Charles Y. Glock, Herbert Menzel and others. May 58, 208p. 3 refs.
Order from LC mi$9.30, ph$31.80 PB 144 390

David Taylor Model Basin, Washington, D. C.
STANDARDIZATION REQUIREMENTS FOR TECHNICAL REPORTS, by Robert E. Lord. Rev. ed. Feb 59, 42p. Rept. 1010.
Order from LC mi$3.30, ph$7.80 PB 144 372

This report presents the technical report standards established by the Bureau of Ships for its various laboratories and defines the different kinds of BuShips reports. It also outlines the procedures to be followed by the David Taylor Model Basin in the preparation and publication of technical reports consistent with BuShips policy.

Rutgers State U., New Brunswick, N. J.
PILOT STUDY ON THE USE OF SCIENTIFIC LITERATURE BY SCIENTISTS, by Ralph R. Shaw. Rept. on National Science Foundation Grant G-536. 21 Nov 56, 104p. 33 refs.
Order from LC mi$5.70, ep$18.30 PB 144 327

ATOMIC ENERGY COMMISSION REPORTS

Reports may be purchased in accordance with instructions on the inside front cover of the U. S. GOVERNMENT RESEARCH REPORTS. As PB numbers are not indicated, order by series and number These reports may also be consulted at any AEC Depository Library. A list of these libraries may be obtained from the U. S. Department of Commerce. Office of Technical Services, Washington 25, D. C.

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Biology and Medicine

The toxicity of indium, by W. L. Downs, J. K. Scott, L. T. Steadman, and E. A. Maynard. The University of Rochester. Atomic Energy Project. Radiation Chemistry and Toxicology Division, Rochester, N. Y. Nov 59. Contract W-7401-eng-49. 57p. Order from OTS. $1.75. UR-558

Studies on the toxicity of thorium nitrate, by W. L. Downs, J. K. Scott, E. A. Maynard, and H. C. Hodge. The University of Rochester. Atomic Energy Project, Radiation Chemistry and Toxicology Division, Rochester, N. Y. Dec 59. Contract W-7401-eng-49. 35p. Order from OTS. $1.00. UR-561

The phospholipide and phospholipide-fatty-acid composition of human serum lipoprotein factors, by G. J. Nelson and H. K. Freeman. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Oct 59. Contract W-7405-eng-48. 23p. Order from OTS. 75 cents. UCRL-8930

Chemistry—General

Thermochemical studies of organic fluorine compounds. Final report. Univ. of Colorado. Boulder, Colo. (nd). Contract AT(11-1)-168. 72p. Order from LC. Mi $4.50, ph $12.30. AECU-4201

The aqueous solubility of UF_4, by A. W. Savage, Jr., and J. C. Browne. Los Alamos Scientific Lab., Los Alamos, N. Mex. [1958?]. Contract W-7405-eng-36. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4244

Correlation of polarographic data with structure. Use of the Hammett-Taft relation. Report no. 48, by P. J. Elving and J. M. Markowitz. Univ. of Michigan, Ann Arbor, Mich. Sep 58. Contract AT(11-1)-70. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4254

Determination of hydrogen in solid hydride compounds by use of induction heating, by R. A. Dunleavy, M. R. Menke, and E. W. Rebol. General Electric, Atomic Products Div., Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Jan 56. Contracts AT(11-1)-171 and AF 33(600)-38062. 7p. Order from OTS. 50 cents. APEX-243

Methods for the study of gas-metal reactions in ultra-high vacuum, by G. R. Love. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 33p. Order from LC. Mi $3.00, ph $6.30. CF-58-9-93

Spectrographic analysis of normal human tissue from Richmond, Virginia, by I. H. Tipton, M. J. Cook, J. M. Foland, J. Rittner M. Hardwick, and K. K. McDaniel. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. 52p. Order from LC. Mi $3.60, ph $9.30. CF-59-8-106

Equilibrium calculation in the system: Uranyl nitrate, nitric acid, water, TBP, and kerosene diluent using the oracle digital computer, by S. H. Jury and M. E. Whatley. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. Contract W-7405-eng-26. 28p Order from LC. Mi $2.70, ph $4.80. CF-59-8-122

An automatic water deaeration system, by J. R. Raymond. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Apr 59. Contract W-31-109-Eng-52. 7p. Order from LC. Mi $1.80, ph $1.80. HW-60058

Sequential separation of some actinide elements by anion exchange, by F. P. Roberts and F. P. Brauer. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 9p. Order from LC. Mi $1.80, ph $1.80. HW-60552

A remote phase separation bulb for highly radioactive sample analyses, by M. H. Campbell. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. 12p. Order from LC. Mi $2.40, ph $3.30. HW-61179

Reliability of mass spectrometric determination of boron isotope abundance, by W. O. Haas, Jr., F. M. Rourke, J. L. Mewherter, and P. H. McDonald. General Electric Co., Knolls Atomic Power Lab., Schenectady, N. Y. Oct 59. Contract W-31-109-Eng-52. 19p. Order from OTS. 75 cents. KAPL-2062

The density of liquid plutonium metal, by C. E. Olsen, T. A. Sandenaw, and C. C. Herrick. The University of California. Los Alamos Scientific Lab., Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 14p. Order from OTS. 75 cents. LA-2358

Uses of depleted uranium, by J. E. Donahue and A. E. Higinbotham. Massachusetts Institute of Technology. Engineering Practice School, Oak Ridge, Tenn. Nov 59. Contract W-7405-eng-26. Subcontract 70. 32p. Order from OTS. $1.00. MIT-OR-5

Effect of a thermal gradient on the hydrogen distribution in a metal. Application to the sodium reactor experiment, by G. G. Libowitz. Atomics International. A Division of North American Aviation, Inc. Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 20p. Order from OTS. 75 cents. NAA-SR-4194

Semiannual progress report for the period January 1959 through June 1959, by C. J. Rodden and others. New Brunswick Laboratory, New Brunswick, N. J. Oct 59. 63p. Order from OTS. $1.75. NBL-156

Particle size reduction during ultrasonic precipitation of thorium oxalate, by J. L. Straughn and W. B. Tarpley. Aeroprojects, Inc., West Chester, Pa. June 59. Contract AT(30-1)-1836. 51p. Order from LC. Mi $3.60, ph $9.30. NYO-7935

Measurement of radiative lifetimes. I. An apparatus for measurement of millimicrosecond radiative lifetimes of gas-phase molecules. II. The radiative lifetime of the $B\,^3O_u^+$ state of I_2 by two absolute absorption methods. Thesis, by F. E. Stafford. Appendix: Description of electronic system, by J. M. Sakai and F. E. Stafford. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 128p. Order from OTS. $2.75. UCRL-8854

Charged-particle-induced fission: A mass spectrometric yield study. Thesis, by Y. Y. Chu. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Nov 59. Contract W-7405-eng-48. 75p. Order from OTS. $2.00. UCRL-8926

Bio-organic chemistry quarterly report for June, July, August 1959. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 58p. Order from OTS. $1.50. UCRL-8961

Chemistry—Radiation and Radiochemistry

Concentration and final purification of neptunium by anion exchange, by J. L. Ryan. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 18p. Order from OTS. 75 cents. HW-59193 REV

Radioisotopes in industry. Report by National Industrial Conference Board, Inc. (nd). Con-AT(30-1)-2135. 136p. Order from OTS. $2.75. NYO-2977

Chemistry—Separation Processes for Plutonium and Uranium

Total cross sections of tritium hydrogen, and helium for fast neutrons, by J. H. Coon, R. O. Bondelid, and D. D. Phillips. Los Alamos Scientific Lab., Los Alamos, N. Mex. Oct 52. Decl. with deletions May 12, 1955. Contract W-7405-eng-36. 12p. Order from LC. Mi $2.40, ph $3.30. AECD-4284

Activation analysis of trace cobalt in tissue using 10.5-minute cobalt-60m, by D. G. Kaiser and W. W. Meinke. Univ. of Michigan. Ann Arbor, Mich. 1959. 13p. Order from LC. Mi $2.40, ph $3.30. AECU-4289

A study of equilibria involved between Darex off-gases and solutions. Annual report no. 1 for December 1, 1958 through July 31, 1959, by C. Orr, Jr., M. C. Kordecki, J. K. Gladden, and C. T. Young. Georgia Institute of Technology. Engineering Experiment Station, Atlanta, Ga. 1959. Contract W-7405-eng-26. 39p. Order from LC. Mi $3.00, ph $6.30. AECU-4304

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Solids accumulation and fission heating in the HRT Chemical Plant underflow pot (Co-op report, fall quarter, 1958), by W. E. Dunn. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 14p. Order from LC. Mi $2.40, ph $3.30. CF-59-6-121

Decontamination of the PRFR Pilot Leaching Plant--Preliminary process design, by H. A. McLain. Oak Ridge National Laboratory, Oak Ridge, Tenn. July 59. Contract W-7405-eng-26. 9p. Order from LC. Mi $1.80, ph $1.80. CF-59-7-75

Reprocessing of ARE fuel, volatility Pilot Plant runs E-3 through E-6, by C. L. Whitmarsh. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. 39p. Order from LC. Mi $3.00, ph $6.30. CF-59-8-73

Additional information on Eurochemic air sampling system, by E. M. Shank. Oak Ridge National Laboratory, Oak Ridge, Tenn. Sep 59. 2p. Order from LC. Mi $1.80, ph $1.80. CF-59-9-44

Estimate of potential fuel reprocessing, revision no. 29--Part A, by J. W. Ullmann. Oak Ridge National Laboratory, Oak Ridge, Tenn. Sep 59. 9p. Order from LC. Mi $1.80, ph $1.80. CF-59-9-51

Dissolution of thorium in mixtures of HNO_3 and HF, by D. G. Karraker and others. E. I. du Pont de Nemours & Co. Explosives Dept. Atomic Energy Div., Technical Div., Savannah River Lab., Aiken, S. C. Sep 59. Contract AT(07-2)-1. 16p. Order from OTS. 50 cents. DP-399

Reprocessing of power reactor fuels. Eighth quarterly progress report, July 1, 1959 to October 1, 1959, by E. S. Occhipinti and others. E. I. du Pont de Nemours & Co. Explosives Div., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Nov 59. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-439

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Preliminary cost estimates. Technical report no. 47, Chapter 600, O. Jenne, E. Lüscher, M. Lung, F. Marcus, and A. Redon. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1957?] 5p. Order from LC. Mi $1.80, ph $1.80. NP-7853

Instrumentation: Principles, Specifications, flow sheets, data sheets, electrical equipment. Technical report no. 53. Chapter 220, by R. Winckler. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 35p. Order from LC. Mi $3.60, ph $9.30. NP-7862

Chemical process flowsheets. Technical report no. 49, Chapter 140, by E. Detilleux, M. Lang, E. L. Nicholson, and A. Redon. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 55p. Order from LC. Mi $4.40, ph $12.30. NP-7866

Layout principles of main plant building. Technical report no. 46, Chapter 400, by E. Lüscher. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 3p. Order from LC. Mi $1.80, ph $1.80. NP-7867

Routine analytical laboratory requirements. Technical report no. 36, Chapter 410, by K. Samsahl and W. Schüller. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. [1959]. 11p. Order from LC. Mi $2.40, ph $3.30. NP-7868

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Fuel element investigation compilation of data. Report ED-C Rev., Chapter 110. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 24p. Order from LC. Mi $2.70, ph $4.80. NP-7872

Chemical engineering. Technical report no. 41, Chapter 210. Appendix includes 37 drawings. European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium. 1959. 10p. Order from LC. Mi $11.10, ph $93.60. NP-7881

Sulfex process: Depassivation of stainless steel, by T. A. Gens. Oak Ridge National Laboratory, Chemical Technology Div., Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 13p. Order from OTS. 50 cents. ORNL-2785

Controlled Thermonuclear Processes

Little pig plasma experiment. University of California. Radiation Laboratory, Livermore, Calif. Oct 58. 6p. Order from LC. Mi $1.80, ph $1.80. AECU-4309

Controlled Thermonuclear Research quarterly report, March, April, May 1959. University of California. Lawrence Radiation Laboratory, Berkeley and Livermore, Calif. June 59. Contract W-7405-eng-48. 102p. Order from OTS. $2.50. UCRL-8775

Criticality Studies

Multiplication measurements with highly enriched uranium metal slabs, by J. T. Mihalczo and J. J. Lynn. Oak Ridge National Laboratory, Oak Ridge, Tenn. July 59. Contract W-7405-eng-26. 35p. Order from LC. Mi $3.00, ph $6.30. CF-59-7-87

Isolation thicknesses of water for UO_2F_2 solution systems, by C. L. Schuske and A. N. Nickel. The Dow Chemical Company. Rocky Flats Plant, Denver, Colo. Dec 59. Contract AT(29-1)-1106. 11p. Order from OTS. 50 cents. RFP-169

SS Materials Management Meeting, May 25-28, 1959. United States Atomic Energy Commission, Nuclear Materials Management Div., Oak Ridge, Tenn. Nov 59. 227p. Order from OTS. $2.25. TID-7581

Health and Safety

Proceedings of the Second Industrial Medical Conference, Carbide and Carbon Chemicals Corporation, held at K-25 Plant Dispensary, Oak Ridge, Tennessee, August 18-20, 1948. Carbide and Carbon Chemicals Corp., K-25 Plant, Oak Ridge, Tenn. 119p. Order from LC. Mi $6.30, ph $19.80. AECU-4277

Special report on operation of KIWI-A reactor. Period covered: May, June, July, 1959, by O. R. Placak. Atomic Energy Commission. Nevada Test Organization, Off-site Radiological Safety Activities. July 59. 34p. Order from LC. Mi $3.00, ph $6.30. AECU-4294

The scattering of thermal radiation into open underground shelters, by T. P. Davis, N. D. Miller, T. S. Ely, J. A. Basso, and H. E. Pearse. University of Rochester, Atomic Energy Project, Rochester, New York. Oct. 59. 23p. Order from OTS. 75 cents. CEX-58.2

High-altitude sampling techniques. Progress report. University of Chicago, Chicago Midway Labs., Chicago, Ill. July 59. Contract AT(11-1)-508. 9p. Order from LC. Mi $1.80, ph $1.80. CML-SR-M-124-7

A proposed nuclear safety indicator for contact maintenance purposes, by G. M. Muller and N. Ketzlach. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct 55. Decl. Apr. 2, 1959. 3p. Order from LC. Mi $1.80, ph $1.80. HW-39433

A personnel film badge neutron dosimeter, by F. Swanberg, Jr. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 59. Contract W-31-109-Eng-52. 16p. Order from LC. Mi $2.40, ph $3.30. HW-56827 (Rev.)

Health physics semiannual report for January-June 1959, by W. H. Truran. Knolls Atomic Power Lab., Schenectady, N. Y. 1959. Contract W-21-109-Eng-52. 20p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-HP-1

Problems of air-borne contamination in handling PuF_4 powders, by W. R. Kennedy, A. Dumrose, and A. Ludwig. Los Alamos Scientific Lab., Los Alamos, N. Mex. July 47. Decl. Apr. 27, 1959. 18p. Order from LC. Mi $2.40, ph $3.30. LAMS-596

Soil sampling program for determining world-wide distribution of strontium 90. Summary of remarks to be made by L. T. Alexander to the Conference on the Passage of Fission Products through Food Chains at Harwell, England. Department of Agriculture. Soil Survey Labs., Beltsville, Md. Sep 58. 13p. Order from LC. Mi $2.40, ph $3.30. M-7089

Analysis of stratospheric strontium-90 measurements, by L. Machta and R. J. List. Weather Bureau, Washington, D. C. Mar 59. 22p. Order from LC. Mi $2.70, ph $4.80. M-7090

Field trial of treatments affecting strontium uptake. Department of Agriculture. 1954. 8p. Order from LC. Mi $1.80, ph $1.80. M-7123

High-level spill at the Hilac, by N. B. Garden and C. Dailey. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 40p. Order from OTS. $1.25. UCRL-8919

Radioactivity of thorium and feasibility of in vivo thorium measurements, by R. E. Cofield. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Nov 59. Contract W-7405-eng-26. 25p. Order from OTS. $1.00. Y-1280

Instruments

Medium low-level soft-beta counting equipment, by J. E. Lewis. Radiochemistry, Inc., Louisville, Ky. June 59. Contract AT(11-1)-530. 35p. Order from LC. Mi $3.00, ph $6.30. AECU-4232

Upper atmosphere monitoring program. Report no. 1907. Progress report no. 7. Covering period February 1, 1959 through April 30, 1959, by J. Baumstark, S. Jones, R. Olson, A. Schekman, S. Stern, L. Torgeson, and W. Zeller. General Mills, Inc., Minneapolis. July 59. Contract AT(11-1)-401. 74p. Order from LC. Mi $3.90, ph $10.80. AECU-4280

Centrifuge for radiochemical processing. Little (Arthur D.) Inc., Cambridge, Mass. Sep 55. Contract W-7405-eng-26. 35p. Order from LC. Mi $3.00, ph $6.30. ALI-C-59535

An improved nuclear density gauge. Period covered June 1 to July 1, 1959, by G. M. Burgwald and

C. A. Stone. Illinois Institute of Technology. Armour Research Foundation, Chicago, Ill. June 59. Contract AT(11-1)-745. 4p. Order from LC. Mi $1.80, ph $1.80. ARF-1152-1

An improved nuclear density gauge. Period covered July 1 to August 1, 1959, by G. M. Burgweld. Illinois Institute of Technology. Armour Research Foundation, Chicago, Ill. Aug 59. Contract AT(11-1)-745. 4p. Order from LC. Mi $1.80, ph $1.80. ARF-1152-2

The effect of freon-114 on space recorders, by W. E. Hensel, Jr. Goodyear Atomic Corp., Portsmouth, Ohio. Apr 58. Decl. with deletions July 23, 1959. Contract AT(33-2)-1. 14p. Order from LC. Mi $2.40, ph $3.30. GAT-232(Del.)

Ring gasket punch guide, by K. B. Booth. Goodyear Atomic Corp., Portsmouth, Ohio. Dec 57. Contract AT(33-2)-1. 2p. Order from LC. Mi $1.80, ph $1.80. GAT-L-431

Factors affecting power transformer failure. A bibliography, by R. D. Hamilton. Goodyear Atomic Corp., Portsmouth, Ohio. Sep 59. Contract AT(33-2)-1. 25p. Order from LC. Mi $2.70, ph $4.80. GAT-T-574

Critical incident alarm--Model I: Instruction and maintenance manual, by P. R. Kelly. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 59. 14p. Order from LC. Mi $2.40, ph $3.30. HW-60320

Conversion of mica-window G-M tube lead-pig counters to scintillation detection, by W. G. Spear and G. D. Crouch. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 59. 8p. Order from LC. Mi $1.80, ph $1.80. HW-60338

An eddy current channel spacing gage, by A. C. Lind. Knolls Atomic Power Lab., Schenectady, N. Y. June 59. Contract W-31-109-Eng-52. 37p. Order from LC. Mi $3.00, ph $6.30. KAPL-M-ACL-1

Elements of fuel contamination control by alpha counting, by P. L. Eisenacher. Knolls Atomic Power Lab., Schenectady, N. Y. Aug 59. Contract W-31-109-Eng-52. 15p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-PLE-2

A graphite-CO_2 ionization chamber instrument for gamma ray dose rate measurements with a six decade range, fast response and remote recording, by F. C. V. Worman and P. S. Harris. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 18p. Order from OTS. 75 cents. LA-2361

A coil type level gauge for high temperature liquid metals, by G. E. Turner. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 25p. Order from OTS. 75 cents. NAA-SR-4195

Improved alpha spectroscopy using a modified frisch grid ionization chamber and a 256-channel analyzer, by T. B. Crockett, T. T. McMillan, and J. W. Crowe. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Jan 60. Contract AT(11-1)-GEN-8. 22p. Order from OTS. 75 cents. NAA-SR-4433

A transistorized six-channel airborne strain gage calibrator and excitation unit, by R. H. Gablehouse and C. E. Erickson. Sandia Corp., Albuquerque, N. Mex. Nov 59. 22p. Order from OTS. 75 cents. SCR-128

Flying spot scanner investigation, by E. J. Bernard and E. L. Checketts. Sandia Corp., Albuquerque, N. Mex. June 59. 32p. Order from LC. Mi $3.00, ph $6.30. SCTM-120-59(15)

Transistorized audio amplifier PA-2W-1A, by M. H. Brock. Sandia Corp., Albuquerque, N. Mex. May 59. 10p. Order from LC. Mi $1.80, ph $1.80. SCTM-164-59-52

Power supply, by M. H. Brock. Sandia Corp., Albuquerque, N. Mex. May 59. 10p. Order from LC. Mi $1.80, ph $1.80. SCTM-165-59-(52)

Reliability considerations in circuit design, by A. M. Breipohl. Sandia Corp., Albuquerque, N. Mex. July 59. 21p. Order from LC. Mi $2.70, ph $4.80. SCTM-226-59-(15)

A large bakeable vacuum valve, by R. H. Batzer. University of California. Lawrence Radiation Lab., Livermore, Calif. Aug 59. Contract W-7405-eng-48. 13p. Order from LC. Mi $2.40, ph $3.30. UCRL-5649

Liquid-hydrogen target, by D. D. Newhart, V. Perez-Mendez, and W. L. Pope. University of California, Lawrence Radiation Lab., Berkeley, Calif. Aug 59. Contract W-7405-eng-48. 15p. Order from OTS. 75 cents. UCRL-8857

Isotopes-Industrial Technology

Expanding the utilization of radioisotopes and nuclear techniques in food toxicology and processing, by J. H. Rust. Massachusetts Institute of Technology, Dept. of Food Technology, Cambridge, Mass. Nov 59. Contract AT(30-1) 2309. 61p. Order from OTS. 75 cents. AECU-4327

Radioisotopes at work for agriculture, by A. G. Homan and R. R. Tarrice. Stanford Research Institute, Menlo Park, Calif. Oct 59. Contract AT(04-3)-115. 198p. Order from OTS. $3.50. SRIA-9

Radiation application and fission product utilization. A bibliography of selected unclassified literature, by G. A. Young. U. S. Atomic Energy Commission, Office of Isotopes Development, Washington, D. C. July 59. 187p. Order from OTS. $1.75. TID-3046 (Suppl. 2)

Industrial applications of radioisotopes and associated techniques. A literature search, by R. L. Scott. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Nov 59. 30p. Order from OTS. 75 cents. TID-3539

Metallurgy and Ceramics

The determination of the equilibrium phase diagram, zirconium-niobium. Period covered: July 1 to August 1, 1959, by C. E. Lundin. University of Denver, Denver Research Institute, Denver, Colo. Aug 59. Contract AT(11-1)-752. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4284

Study of factors influencing ductility of iron-aluminum alloys. Period covered: March 15, 1959 to March 15, 1960, by F. C. Perkins and J. F. Nachman. University of Denver. Denver Research Institute, Denver, Colo. Aug 59. Contract AT(11-1)-742. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4290

Adsorption of silicic acid on thoria-determined by infrared spectroscopy. Technical report no. V, by G. J. Spaepen, R. T. Wimber, and M. E. Wadsworth. University of Utah. Institute of Metals and Explosives Research, Salt Lake City, Utah. June 59. Contract W-7405-eng-26. 38p. Order from LC. Mi $3.00, ph $6.30. AECU-4299

Bonding uranium carbide to tantalum, by M. G. Bowman. Los Alamos Scientific Lab., Los Alamos, N. Mex. May 59. 2p. Order from LC. Mi $1.80, ph $1.80. AECU-4303

Ultrasonic power requirements for processing LMFR blanket to produce equiaxed thorium bismuthide particles, by W. B. Tarpley, C. D. McKinney, Jr., and J. G. Thomas. Aeroprojects, Inc., West Chester, Pa. Apr 59. Contract AT-30-2-GEN-16. 47p. Order from LC. Mi $3.30, ph $7.80. AECU-4333

Measurements of mechanical properties of pure and uranium-loaded graphites at elevated temperatures. Final report for June 27, 1957 through December 15, 1958, by L. Green, Jr., M. L. Stehsel, and C. E. Waller. Aerojet-General Corp., Azusa, Calif. Dec 58. [Sub] contract CTU-86039-1. 145p. Order from LC. Mi $7.20, ph $22.80. AGC-1537

Irradiation of extrusion-clad uranium-2 w/o zirconium alloy for EBR-1, Mark III, by J. H. Kittel. Argonne National Laboratory, Lemont Ill. Oct 59. Contract W-31-109-eng-38. 18p. Order from OTS. 75 cents. ANL-5918

Modification of CP-5 fuel assemblies for fuel capsule irradiation experiments, by W. N. Beck, J. H. Kittel and F. L. Brown. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 24p. Order from OTS. 75 cents. ANL-6041

Examination of jacketed uranium slugs from the Los Alamos fast reactor "Clementine", by S. H. Paine, W. F. Murphy, and F. L. Brown. Argonne National Laboratory, Lemont, Ill. Oct 59. Contract W-31-109-eng-38. 17p. Order from OTS. 75 cents. ANL-6048

Examination of irradiated experimental NRU fuel rods, by S. H. Paine and W. F. Murphy. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 26p. Order from OTS. 75 cents. ANL-6059

Experimental and theoretical studies of the solidification of uranium castings, by E. L. Foster, Jr., B. L. Fletcher, C. K. Franklin, A. Lechler, and R. F. Dickerson. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 61p. Order from OTS. $1.75. BMI-1390

Metallurgical studies of niobium-uranium alloys, by J. A. DeMastry, F. R. Shober, and R. F. Dickerson. Battelle Memorial Institute,

Columbus, Ohio. Dec 59. Contract W-7405-eng-92. 44p. Order from OTS. $1.25. BMI-1400

Metallographic examination of L6Z-114 in-pile autoclave pins, by A. E. Richt. Oak Ridge National Laboratory, Oak Ridge, Tenn. Feb 58. Contract W-7405-eng-26. 10p. Order from LC. Mi $1.80, ph $1.80. CF-58-2-15

Application of electroless-nickel brazing to tubular fuel elements for the N. S. Savannah. Status report, by J. T. Lamartine and W. C. Thurber. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 31p. Order from LC. Mi $3.00, ph $6.30. CF-59-6-55

Run 300A-8 initial slurry run of 300A pump and loop, by J. C. Moyers. Oak Ridge National Laboratory, Oak Ridge, Tenn. July 59. Contract W-7405-eng-26. Order from LC. Mi $1.80, ph $1.80. CF-59-7-35

Secondary-side water treatment for corrosion control in aluminum heat exchangers: Practices and results at the Oak Ridge Research Reactor, by P. D. Neumann. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 59. Contract W-7405-eng-26. 19p. Order from LC. Mi $2.40, ph $3.30. CF-59-8-50

Corrosion in hydrogen sulfide-water systems, by J. A. Snyder and D. Warren. Du Pont de Nemours (E. I.) & Co., Engineering Research Laboratory, Wilmington, Del. Oct 55. Decl. Mar. 7, 1957. Contract AT(07-2)-1. 240p. Order from LC. Mi $11.10, ph $37.80. DP-96

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Examination of welds in hafnium "wye" control rods, by A. C. Cooley and W. E. Ray. Knolls Atomic Power Laboratory, Schenectady, N. Y. Aug 59. Contract W-31-109-Eng-52. 16p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-ACC-3

Swaged metal fiber-UO_2 fuel element. First quarterly progress report. From December 22, 1958 to March 15, 1959, by L. Sundquist. Martin Company, Nuclear Division, Baltimore, Md. Apr 59. Contract AT(30-1)-2220, Task III. 37p. Order from OTS. $1.00. MND-SF-1714

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Scoping studies on electrolytic reduction of magnesium fluoride, by R. B. Steck and V. G. Minutolo. National Lead Company of Ohio. Technical Division, Cincinnati, Ohio. Jan 60. Contract AT (30-1)-1156. 26p. Order from OTS. $1.00. NLCO-796

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The corrosion resistance of several alloys in an HF-H_2O atmosphere at high temperatures, by C. F. Ritchie and E. K. Teter. Mallinckrodt Chemical Works, St. Louis, Mo. Jan 52. Decl. June 19, 1959. 15p. Order from LC. Mi $2.40, ph $3.30. NYO-1330

Study of the films formed on zirconium-niobium alloys in oxygen atmospheres. Final report, by O. Zmeskal and M. L. Brey.. University of Florida. Engineering and Industrial Experiment Station, Gainesville, Fla. June 59. Contract AT(40-1)-1826. 106p. Order from LC. Mi $5.70, ph $16.80. ORO-204

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Graphite. A literature search, by T. F. Davis. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Oct 59. 82p. Order from OTS. $2.25. TID-3532

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Technical progress report. Part I. High-speed computer program. Part II. Mathematical methods. Part III. Illiac use and operation. Part IV. IBM 650 use and operation. Part V. General laboratory information. University of Illinois. Digital Computer Lab., Urbana, Ill. Mar 59. Contract AT(11-1)-415. and Contract Nonr-1834 (15). 24p. Order from LC. Mi $2.70, ph $4.80. AECU-4235

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Nuclear excursion analysis on the IBM 650 (Early code), by E. M. Reiback and C. J. Stueck. Alco Products, Inc., Schenectady, N. Y. Feb 59. Rev. July 1959. 16p. Order from LC. Mi $2.40, ph $3.30. APAE-Memo-177(Rev.)

The determination of the diffusion coefficient of a gas-metal system, by V. L. Gelezunas. General Electric Co. Atomic Products Division, Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Sep 57. Contracts AF 33(600)-38062 and AT(11--1)-171. 16p. Order from OTS. 50 cents. APEX-409

An IBM 704 program report, Aircraft Nuclear Propulsion shielding program 10-0, by J. W. Haffner, J. J. Loechler, and J. E. MacDonald. General Electric Co., Atomic Products Division, Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Mar 1958. Contracts AF 33(600)-38062 and AT(11-1)-171. 36p. Order from OTS. $1.25. APEX-503

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Reactor kinetics. A bibliography, by M. Bloomfield and F. G. Bennett IV. Atomics International, A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 56p. Order from OTS. $1.50. NAA-SR-3808

Neutron flux distributions in organic moderated reactor cores, by V. A. Swanson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 21p. Order from OTS. 75 cents. NAA-SR-4184

Tolerance comparator, by P. A. Nicovich. Sandia Corporation, Albuquerque, N. Mex. Aug 59. 4p. Order from OTS. $5.25. SCR-112

Isotopic power and thermionic conversion. A literature search, by R. L. Scott. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Dec 59. 12p. Order from OTS. 50 cents. TID-3540

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Progress Reports

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Radiation Effects on Materials

Radiation effects on selected structural metals. A literature search, by W. E. Bost. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Nov 59. 17p. Order from OTS. 50 cents. TID-3538

Radiochemistry of the PWR fuel material cycling tests (WAPD-29-1 and -2) in the WAPD-29 VH-3 loop of the materials testing reactor, by R. Ehrenreich. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Nov 59. Contract AT-11-1-GEN-14. 21p. Order from OTS. 75 cents. WAPD-TM-159

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Circulating loops for testing organic coolants. Survey and status, by J. G. Carroll. California Research Corp., Richmond, Calif. June 59. Contract AT(11-1)-174. 74p. Order from LC. Mi $4.50, ph $12.30. AECU-4326

Shock impingement experiments on crushable solids, by P. Lieberman. Illinois Institute of Technology, Armour Research Foundation, Technology Center, Chicago, Ill. June 59. Contract AT(11-1)-528. 98p. Order from OTS. $2.50. ARF-4132-10

Studies of reactor containment. Summary report no. 1 for February 1, 1959 to July 31, 1959, by T. A. Zaker. Illinois Institute of Technology. Armour Research Foundation, Technology Center, Chicago, Ill. Aug 59. Contract AT(11-1)-528. 80p. Order from OTS. $2.25. ARF-4132-11

Final report on design tests PR-50 and PR-51 reactor piping seal testing and reactor piping structural integrity, by P. M. Jackson. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 61p. Order from OTS. $1.75. HW-60899

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MTR-ETR Technical Branches quarterly report. Period ending June 30, 1959, by J. R. Huffman and others. Phillips Petroleum Company, Atomic Energy Division, Idaho Operations Office, Idaho. Nov 59. Contract AT(10-1)-205. 77p. Order from OTS. $2.00. IDO-16561

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Nuclear reactor simulation by analog computer. A literature survey, by R. J. Allen, F. G. Bennett, IV, and R. N. Cordy. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 56p. Order from OTS. $1.75. NAA-SR-3708

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Sodium reactor experiment (SRE) shielding evaluation for thermal neutron streaming at reactor vessel coolant pipe penetrations, by F. D. Anderson and others. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Oct 59. Contract AT(11-1)-GEN-8. 56p. Order from OTS. $1.50. NAA-SR-3990

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Design of chemical processing plant for homogeneous reactor test, by A. M. Rom and H. O. Weeren. Oak Ridge National Laboratory, Chemical Technology Division, Process Design Section, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 105p. Order from OTS. $2.50. ORNL-2784

Gas-cooled reactors. Bibliography, by W. H. Richardson and F. Strachwitz. Sandia Corporation, Albuquerque, N. Mex. Sep 59. 216p. Order from OTS. $3.50. SCR-86

Containment of fragments from runaway reactor, by G. B. Huber and N. R. Zabel. Stanford Research Institute, Menlo Park, Calif. June 59. Contract AT(04-3)-115. 86p. Order from OTS. $2.25. SRIA-10

Reactor safety. A literature search, by R. J. Smith. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Nov 59. 41p. Order from OTS. $1.25. TID-3525(Rev. 1)

The calculation of pressure drop and flow distribution within a reactor vessel in a pressurized water nuclear reactor system, by J. S. Busch, L. L. Lynn, and C. F. Bonilla. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Aug 59. Contract AT-11-1-GEN-14. 43p. Order from OTS. $1.25. WAPD-217

Multi-region reactor lattice studies. Quarterly progress report for the period June 1 to September 30, 1959, by I. H. Coen. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh, Pa. Oct 59. Contract AT(30-1)-2176. 23p. Order from OTS. 75 cents. WCAP-1404

Reactors—Power

Pathfinder Atomic Power Plant radiation shielding study, by R. Corcoran, H. C. Crumpacker, and D. M. Leppke. Allis-Chalmers Mfg. Co., Atomic Energy Div., Milwaukee, Wis. June 59. Contract AT(11-1)-589. 44p. Order from LC. Mi $3.30, ph $7.80. ACNP-5912

Pathfinder Atomic Power Plant measurements of nuclear parameters of boiler and superheater lattices, by A. Jacobs and R. H. Vollmer. Pennsylvania State University, University Park, Pa., and Allis-Chalmers Mfg. Co., Atomic Energy Div., Milwaukee, Wis. Aug 59. Contract AT(11-1)-589. 27p. Order from LC. Mi $2.70, ph $4.80. ACNP-5918

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Safety radiation level survey. Section II. Fourth performance. Duquesne Light Co., Shippingport, Pa. June 59. 7p. Order from LC. Mi $1.80, ph $1.80. AECU-4258

Intercalibration of nuclear instrumentation. Section IV. Second performance. Duquesne Light Co., Shippingport, Pa. June 59. 6p. Order from LC. Mi $1.80, ph $1.80. AECU-4259

Measurements of coefficients of reactivity. Section I. 300 EFPH. Third performance. Duquense Light Co., Shippingport, Pa. June 59. 42p. Order from LC. Mi $3.30, ph $7.80. AECU-4260

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Safety radiation level survey. Section II. Second performance. Duquesne Light Co., Shippingport, Pa. June 59. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4262

Core instrumentation calibration. Section V. Fifth performance. Duquesne Light Co., Shippingport, Pa. June 59. 14p. Order from LC. Mi $2.40, ph $3.30. AECU-4263

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Governor performance tests. Section IV. Third and fourth performance. Duquesne Light Co., Shippingport, Pa. July 59. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4269

Xenon transient. Section I. 145.4 EFPH. First performance. Duquesne Light Co., Shippingport, Pa. July 59. 16p. Order from LC. Mi $2.40, ph $3.30. AECU-4270

Loss of AC power following power operation. Section I. First performance. Duquesne Light Co. Shippingport, Pa. July 59. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4275

Status of pressurized water reactor reactivity accident analysis, by L. Geller, J. Cagnetta, and R. Dobbs. Vitro Engineering Co., New York, N. Y. Mar 58. Subcontract 73(14-1025). 19p. Order from LC. Mi $2.40, ph $3.30. AECU-4312

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SEARCHING THE LITERATURE FOR TRANSDUCER INFORMATION. PART I. A GUIDE TO THE LITERATURE, by J. Pearlstein. 15 Oct 59, 61p. TR-753.
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This report provides a guide to the technical literature on transducers, including a classification of the related phenomena, principles, and materials which must be considered in any broad and systematic research and development program on these devices.

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GRATING RESOLUTION AT 6.3 MICRONS IN THE SOLAR-TELLURIC SPECTRUM, by Arthur Adel. Scientific rept. HB-7 on Infrared Spectroscopy of the Sun, Moon and Earth, Contract AF 19(604)2177. 10 Aug 59, 37p. AFCRC-TN-59-465.
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The ephemeral atmospheric window at 6.3 microns has been observed with grating resolution. Twenty-five spectra of the region 6.150 mu - 6.350 mu are reproduced. (Author)

Carter Observatory (New Zealand).
OBSERVATIONS OF THE AURORA AUSTRALIS 1955 AND 1956, by G. W. McQuistan and B. L. Frankpitt. Scientific rept. no. 6 on Contract AF 64(500)04. 1 Mar 57, 42p. AFCRC TN-58-215; AD-146 866.
Order from LC mi$3.30, ph$7.80 PB 138 236

Visual observations of the Aurora Australis collected in New Zealand and adjoining regions over the period 1955 and 1956 are here recorded in a form suitable for further researches. (See also PB 138 689)

Geophysical Inst., U. of Alaska, College.
PHOTOMETRIC STUDIES OF AURORAL LUMINOSITY AND ITS CONNECTION WITH SOME ATMOSPHERE IONIZATION PHENOMENA, by W. B. Murcray. Scientific rept. no. 2 on Contract AF 19(604)1859. Sep 58, 20p. 12 refs. AFCRC-TN-58-386; AD-160 839.
Order from LC mi$2.40, ph$3.30 PB 137 890

The auroral radiation, 3914 Å, received from the entire sky on a horizontal diffusing plate was monitored continuously during the nights of 1955-56 and 1956-57. The 1955-56 data and part of the 1956-57 data were used to obtain a diurnal curve for the sky luminosity in this wavelength. The auroral light increases to a broad maximum which lasts from magnetic midnight till dawn. The luminosity was found to correlate fairly well with absorption as inferred from F-min values and with $(F\ E_s)^2$ and very well with the magnetic K indices.

High Altitude Observatory, Boulder, Colo.
FLARE-ASSOCIATED BURSTS AT 18 Mc/s, by C. Warwick and J. W. Warwick. Scientific rept. no. 3 on Contract AF 19(604)3872. 14 May 59, 13p. 10 refs. AFCRC-TN-59-364; AD-217 075.
Order from LC mi$2.40, ph$3.30 PB 144 430

Burst data are described resulting from continuous operation of an SCNA (sudden cosmic noise absorption) recorder since December, 1955. Bursts occur frequently in close time connection with flares but may appear before, during, or after the flare. On several occasions, these bursts can be directly identified as the low-frequency tail of type II bursts observed at higher frequencies. On less well-observed occasions, the low-frequency bursts do not appear to have higher frequency counterparts.

High Altitude Observatory, Boulder, Colo.
THE IONIZATION CROSS-SECTION OF FeXIV IN THE SOLAR CORONA BY ELECTRON COLLISION AND ITS RELATIONSHIP TO THE TEMPERATURE OF THE CORONA, by Sanford B. Schwartz. Doctoral thesis. Rept. on Contract Nonr-393(04). Jan 59, 81p. 33 refs.
Order from LC mi$4.80, ph$13.80 PB 144 455

The general problem of determining an estimate of the temperature of a quiet region of the solar corona is discussed.

Maryland U., College Park.
TRAPPED RADIATION IN THE EARTH'S MAGNETIC FIELD, by S. F. Singer. Scientific rept. no. 2 on Contracts AF [illegible] and AF 19(604)5575. Aug 59, 8p. 17 refs. Physics Dept. Technical rept. no. 153. AFCRC-TN-59-765; AFCRC-TN-59-1028.
Order from LC mi$1.80, ph$1.80 PB 144 416

The purpose of this paper is to look at a topic in astrophysics from the point of view of the laboratory. We will therefore not be concerned very much with the geophysical significance of trapped radiation.

BEHAVIORAL SCIENCES

Personnel and Training

Adjutant General's Office, Washington, D. C.
DEVELOPMENT OF A PROVISIONAL BATTERY FOR SELECTING ARMY HELICOPTER PILOT TRAINEES, by Nathan Rosenberg, Harold Martinek, and Alan A. Anderson. June 59, 34p. 4 refs. PRB Technical research note 104; AD-226 801.
Order from LC mi$3.00, ph$6.30 PB 144 671

A six-test battery to predict pass versus fail in training at the U. S. Army Primary Helicopter School was derived from valid tests in each of 4 batteries administered to 4 samples of helicopter pilot trainees. The tests selected were administered to a fifth sample to obtain measures of their intercorrelation essential to application of a test selection procedure. Thus, validity coefficients based on different samples were used in conjunction with intercorrelation coefficients in yet another sample to derive a new battery. Granting the experimental weakness of this procedure, the estimated validity of the resulting battery was higher than that of either of the 2 batteries which have been in operational use. (Author)

Bucknell U., Lewisburg, Pa.
SELF-INSTRUCTIONAL DEVICES: A REVIEW OF CURRENT CONCEPTS, by William J. Carr. Rept. on Human Factors in the Design of Training Equipment, Contract AF 33(616)6526. Aug 59, 29p. 37 refs. WADC Technical rept. 59-503.
Order from OTS $0.75 PB 161 339

A selective review of the literature on self-instructional devices is presented, with emphasis on those studies which provide for a functional analysis of such devices. Three major classes of variables which influence the effectiveness of learning by means of self-instructional devices are: characteristics of the device, characteristics of the program, and characteristics of the learner. Major attention is devoted to an analysis of the process of programming, or the arrangement of the materials to be learned in proper sequence which maximizes rate of learning and degree of retention. Discussion is focussed on a number of variables of which the effectiveness of the process of programming might be a function. Some of these variables have not yet been subjected to experimental analysis. A working model is presented, based upon the familiar processes of conditioning. (Author)

Courtney and Co., Philadelphia, Pa.
EVALUATION OF A SHIPBOARD SUPERVISORY TRAINING PROGRAM FOR PETTY OFFICERS, by Myron A. Fischl and Douglas Courtney. Technical rept. on Contract Nonr-2212(00), 31 Dec 57, 82p. 13 refs. Rept. no. 19; AD-151 959.
Order from LC mi$4.80, ph$13.80 PB 137 993

A description is given of the measures of [illegible]

mentation and additional research are made. The over-all conclusion is that the program efficiently and effectively increased knowledge of principles and practices in on-the-job training, and it elicited favorable attitudes from the trainees.

Human Resources Research Office, George Washington U., Washington, D. C.
DEVELOPMENT AND EVALUATION OF AN IMPROVED FIELD RADIO REPAIR COURSE, by George H. Brown, Wesley C. Zaynor and others. [Rept. on Contract DA 49-106-qm-1.] Sep 59, 89p. 5 refs. Technical rept. 58.
Order from OTS $2.25 PB 161 321

The objective of this study was to assist the U. S. Army Signal School in the development and experimental evaluation of an improved training course for Field Radio Repairmen, MOS 296.1. Graduates of the experimental course were significantly superior to the standard course graduates on four of the seven tests in the battery -- the Trouble Shooting, Test Equipment, Repair Skills, and Achievement tests. The groups did not differ significantly on the remaining tests -- the Alinement, Manuals, and Schematics tests.

Institute of Personality Assessment and Research, U. of California, Berkeley.
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. PART II: DESCRIPTION OF THE ASSESSED SAMPLE, by Harrison G. Gough and Irving Krauss. Rept. on Contract AF 18(600)8. Sep 58, 31p. 9 refs. WADC-TR-58-91, Pt. 2; AD-208 700.
Order from LC mi$3.00, ph$6.30 PB 144 605

An extensive psychological assessment of a group of Air Force captains is described. It presents sociological and psychological descriptions of the sample of 343 captains participating in the field-testing phase of the assessment. The typical member may be characterized as being a reserve officer who entered the service during World War II as an elisted man and who received his commission through flying school. He is eligible for promotion to the grade of major. He is married and desires an Air Force career. His intelligence score is above the mean for the general adult population, but below the level defined by Terman and others as superior. His personal adjustment and psychiatric stability are judged to be excellent. In social technique he is characterized by factors of leadership and dominance, capacity for status, and achievement motivation. Tests of social acuity and social insight place him in an average rank among groups of equivalent education or occupational status. His vocational interest profile is basically a military officer profile similar to the pattern observed in other studies of military officers. (Author) (See also PB 142 096)

Maryland U., College Park.
[illegible] VARIABLES IN THE PREDICTION OF RECRUITMENT, by Ray C. Hackman. Final rept. on Contract Nonr-2141(00). Oct 57, 36p. 3 refs.

This study investigated the relationship between the United States Navy's 1955 recruiting rate and forty-three variables describing the demographic characteristics of 40 of the 43 cities designated as main recruiting stations for the Navy. Fifteen of these measures correlated significantly with recruiting rate. A set of five of these variables correlated .79 with the criterion. The general pattern of relationships suggests that recruitment is more effective in less densely populated and less highly industrialized cities.

Naval Ordnance Lab. [White Oak, Md.]
SOLID BLAST PROTECTIVE DEVICES FOR SHIPBOARD PERSONNEL, PRELIMINARY EVALUATION OF MATERIALS FOR, by F. R. Barnet. 29 July 47, 20p. 3 refs. Naval Ordnance Lab Memo. 9147.
Order from LC mi$2.40, ph$3.30 PB 145 084

During sea battle personnel are subject to high velocity shock waves traveling through the ship's structure due to explosions aboard the ship or in close proximity to it. The effects of this "Solid blast" or "Deck heave" are such that persons may suffer serious injuries such as broken or crushed bones in the ankle, leg or spine, or severe blows due to being thrown against bulkheads or projections. In carrying out research work on protective devices, materials such as plastic foams or cellular structures, collapsible metal rings and rubber mats and rubber shoe soles were investigated. The rubber mats and shoe soles appeared to be the most satisfactory in every respect of the experimental devices considered. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
EVALUATION OF AN ADVANCED COURSE FOR FIRE CONTROL TECHNICIANS, by Norman M. Labbe and Kalmer E. Stordahl. June 59, 40p. 3 refs. BuPers Technical Bulletin 59-16.
Order from LC mi$3.00, ph$6.30 PB 144 536

In this study, two groups, a group taking the experimental course and a group taking the regular Class B training were compared after the training on their demonstration of the fundamental skills and knowledge required to maintain unfamiliar fire control equipments. It was found that the students in the experimental group exceeded the students in the regular Class B training only in the extent of their mastery of mathematics, but not in their mastery of other maintenance requirements for the unfamiliar fire control equipment.

Naval Personnel Research Field Activity, San Diego, Calif.
NAVAL KNOWLEDGE AS PREDICTOR OF CAREER MOTIVATION AND ACADEMIC PERFORMANCE IN THE NROTC PROGRAM, by Bernard Rowland. June 59, 36p. 10 refs. BuPers Technical Bulletin 59-12; AD-227 793
Order from LC mi$3.00, ph$6.30 PB 144 537

Correlations between No. [illegible] scores and first semester [illegible] were found to be about .10 for

PHYSICS (con.)

Tables of thermodynamic properties of air including dissociation and ionization from 1500°K. Dec 59. 147p. (PB 161 311) $2.75 433
Temperature conversion tables. Nov 59. 85p. (PB 161 354) $2.25 424

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OFFICE OF TECHNICAL SERVICES

Vol. 33, No. 4 Pp. 349-444 April 15, 1960

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Diamond Ordnance Fuze Labs., Washington, D. C.
SEARCHING THE LITERATURE FOR TRANSDUCER INFORMATION. PART 1. A GUIDE TO THE LITERATURE, by J. Pearlstein. 15 Oct 59, 61p. TR-753.
Order from OTS $1.75 PB 161 320

This report provides a guide to the technical literature on transducers, including a classification of the related phenomena, principles, and materials which must be considered in any broad and systematic research and development program on these devices.

Patent Office, Washington, D. C.
PATENT CLASSIFICATION MICROFILM. [1960]
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Reel no. 3, Patent Classes 121-180
Reel no. 4, Patent Classes 181-249
Reel no. 5, Patent Classes 250-346 /
Cross Reference Classification
Reel no. 6, Patent Classes 1-70
Reel no. 7, Patent Classes 71-140
Reel no. 8, Patent Classes 141-210
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ASTRONOMY

Astrophysics

Arizona State Coll., Flagstaff.
GRATING RESOLUTION AT 6.3 MICRONS IN THE SOLAR-TELLURIC SPECTRUM, by Arthur Adel. Scientific rept. HB-7 on Infrared Spectroscopy of the Sun, Moon and Earth, Contract AF 19(604)2177. 10 Aug 59, 37p. AFCRC-TN-59-465.
Order from LC mi$3.00, ph$6.30 PB 144 583

The ephemeral atmospheric window at 6.3 microns has been observed with grating resolution. Twenty-five spectra of the region 6.150 mu - 6.350 mu are reproduced. (Author)

Carter Observatory (New Zealand).
OBSERVATIONS OF THE AURORA AUSTRALIS 1955 AND 1956, by G. W. McQuistan and B. L. Frankpitt. Scientific rept. no. 6 on Contract AF 64(500)04. 1 Mar 57, 42p. AFCRC TN-58-215; AD-146 866.
Order from LC mi$3.30, ph$7.80 PB 138 236

Visual observations of the Aurora Australis collected in New Zealand and adjoining regions over the period 1955 and 1956 are here recorded in a form suitable for further researches. (See also PB 138 689)

Geophysical Inst., U. of Alaska, College.
PHOTOMETRIC STUDIES OF AURORAL LUMINOSITY AND ITS CONNECTION WITH SOME ATMOSPHERE IONIZATION PHENOMENA, by W. B. Murcray. Scientific rept. no. 2 on Contract AF 19(604)1859. Sep 58, 20p. 12 refs. AFCRC-TN-58-386; AD-160 839.
Order from LC mi$2.40, ph$3.30 PB 137 890

The auroral radiation, 3914 Å, received from the entire sky on a horizontal diffusing plate was monitored continuously during the nights of 1955-56 and 1956-57. The 1955-56 data and part of the 1956-57 data were used to obtain a diurnal curve for the sky luminosity in this wavelength. The auroral light increases to a broad maximum which lasts from magnetic midnight till dawn. The luminosity was found to correlate fairly well with absorption as inferred from F-min values and with $(F\ E_s)^2$ and very well with the magnetic K indices.

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Order from LC mi$2.40, ph$3.30 PB 144 430

Burst data are described resulting from continuous operation of an SCNA (sudden cosmic noise absorption) recorder since December, 1955. Bursts occur frequently in close time connection with flares but may appear before, during, or after the flare. On several occasions, these bursts can be directly identified as the low-frequency tail of type II bursts observed at higher frequencies. On less well-observed occasions, the low-frequency bursts do not appear to have higher frequency counterparts.

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The general problem of determining an estimate of the temperature of a quiet region of the solar corona is discussed.

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TRAPPED RADIATION IN THE EARTH'S MAGNETIC FIELD, by S. F. Singer. Scientific rept. no. 2 on Contracts AF 49(638)530 and AF 19(604)5575. Aug 59, 8p. 17 refs. Physics Dept. Technical rept. no. 153; AFCRC-TN-59-765; AFOSR-TN-59-1028.
Order from LC mi$1.80, ph$1.80 PB 144 416

The purpose of this paper is to look at a topic in astrophysics from the point of view of the laboratory. We will therefore not be concerned very much with the geophysical significance of trapped radiation. Rather, we want to examine what nature can tell us about the confinement of particles.

BEHAVIORAL SCIENCES

Personnel and Training

Adjutant General's Office, Washington, D. C.
DEVELOPMENT OF A PROVISIONAL BATTERY FOR SELECTING ARMY HELICOPTER PILOT TRAINEES, by Nathan Rosenberg, Harold Martinek, and Alan A. Anderson. June 59, 34p. 4 refs. PRB Technical research note 104; AD-226 801.
Order from LC mi$3.00, ph$6.30 PB 144 671

A six-test battery to predict pass versus fail in training at the U. S. Army Primary Helicopter School was derived from valid tests in each of 4 batteries administered to 4 samples of helicopter pilot trainees. The tests selected were administered to a fifth sample to obtain measures of their intercorrelation essential to application of a test selection procedure. Thus, validity coefficients based on different samples were used in conjunction with intercorrelation coefficients in yet another sample to derive a new battery. Granting the experimental weakness of this procedure, the estimated validity of the resulting battery was higher than that of either of the 2 batteries which have been in operational use. (Author)

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SELF-INSTRUCTIONAL DEVICES: A REVIEW OF CURRENT CONCEPTS, by William J. Carr. Rept. on Human Factors in the Design of Training Equipment, Contract AF 33(616)6526. Aug 59, 29p. 37 refs. WADC Technical rept. 59-503.
Order from OTS $0.75 PB 161 339

A selective review of the literature on self-instructional devices is presented, with emphasis on those studies which provide for a functional analysis of such devices. Three major classes of variables which influence the effectiveness of learning by means of self-instructional devices are: characteristics of the device, characteristics of the program, and characteristics of the learner. Major attention is devoted to an analysis of the process of programming, or the arrangement of the materials to be learned in proper sequence which maximizes rate of learning and degree of retention. Discussion is focussed on a number of variables of which the effectiveness of the process of programming might be a function. Some of these variables have not yet been subjected to experimental analysis. A working model is presented, based upon the familiar processes of conditioning. (Author)

Courtney and Co., Philadelphia, Pa.
EVALUATION OF A SHIPBOARD SUPERVISORY TRAINING PROGRAM FOR PETTY OFFICERS, by Myron A. Fischl and Douglas Courtney. Technical rept. on Contract Nonr-2212(00). 31 Dec 57, 82p. 13 refs. Rept. no. 19; AD-151 939.
Order from LC mi$4.80, ph$13.80 PB 137 993

A description is given of the measures of workability and the fleet tryout, and recommendations for implementation and additional research are made. The over-all conclusion is that the program efficiently and effectively increased knowledge of principles and practices in on-the-job training, and it elicited favorable attitudes from the trainees.

Human Resources Research Office, George Washington U., Washington, D. C.
DEVELOPMENT AND EVALUATION OF AN IMPROVED FIELD RADIO REPAIR COURSE, by George H. Brown, Wesley C. Zaynor and others. [Rept. on Contract DA 49-106-qm-1.] Sep 59, 89p. 5 refs. Technical rept. 58.
Order from OTS $2.25 PB 161 321

The objective of this study was to assist the U. S. Army Signal School in the development and experimental evaluation of an improved training course for Field Radio Repairmen, MOS 296.1. Graduates of the experimental course were significantly superior to the standard course graduates on four of the seven tests in the battery -- the Trouble Shooting, Test Equipment, Repair Skills, and Achievement tests. The groups did not differ significantly on the remaining tests -- the Alinement, Manuals, and Schematics tests.

Institute of Personality Assessment and Research, U. of California, Berkeley.
AN ASSESSMENT STUDY OF AIR FORCE OFFICERS. PART II: DESCRIPTION OF THE ASSESSED SAMPLE, by Harrison G. Gough and Irving Krauss. Rept. on Contract AF 18(600)8. Sep 58, 31p. 9 refs. WADC-TR-58-91, Pt. 2; AD-208 700.
Order from LC mi$3.00, ph$6.30 PB 144 605

An extensive psychological assessment of a group of Air Force captains is described. It presents sociological and psychological descriptions of the sample of 343 captains participating in the field-testing phase of the assessment. The typical member may be characterized as being a reserve officer who entered the service during World War II as an elisted man and who received his commission through flying school. He is eligible for promotion to the grade of major. He is married and desires an Air Force career. His intelligence score is above the mean for the general adult population, but below the level defined by Terman and others as superior. His personal adjustment and psychiatric stability are judged to be excellent. In social technique he is characterized by factors of leadership and dominance, capacity for status, and achievement motivation. Tests of social acuity and social insight place him in an average rank among groups of equivalent education or occupational status. His vocational interest profile is basically a military officer profile similar to the pattern observed in other studies of military officers. (Author) (See also PB 142 096)

Maryland U., College Park.
DEMOGRAPHIC VARIABLES IN THE PREDICTION OF RECRUITMENT, by Ray C. Hackman. Final rept. on Contract Nonr-2141(00). Oct 57, 39p. 3 refs. AD-146 702.
Order from LC mi$3.00, ph$6.30 PB 138 223

This study investigated the relationship between the United States Navy's 1955 recruiting rate and forty-three variables describing the demographic characteristics of 40 of the 43 cities designated as main recruiting stations for the Navy. Fifteen of these measures correlated significantly with recruiting rate. A set of five of these variables correlated .79 with the criterion. The general pattern of relationships suggests that recruitment is more effective in less densely populated and less highly industrialized cities.

Naval Ordnance Lab. [White Oak, Md.]
SOLID BLAST PROTECTIVE DEVICES FOR SHIPBOARD PERSONNEL, PRELIMINARY EVALUATION OF MATERIALS FOR, by F. R. Barnet. 29 July 47, 20p. 3 refs. Naval Ordnance Lab Memo. 9147.
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During sea battle personnel are subject to high velocity shock waves traveling through the ship's structure due to explosions aboard the ship or in close proximity to it. The effects of this "Solid blast" or "Deck heave" are such that persons may suffer serious injuries such as broken or crushed bones in the ankle, leg or spine, or severe blows due to being thrown against bulkheads or projections. In carrying out research work on protective devices, materials such as plastic foams or cellular structures, collapsible metal rings and rubber mats and rubber shoe soles were investigated. The rubber mats and shoe soles appeared to be the most satisfactory in every respect of the experimental devices considered. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
EVALUATION OF AN ADVANCED COURSE FOR FIRE CONTROL TECHNICIANS, by Norman M. Labbe and Kalmer E. Stordahl. June 59, 40p. 3 refs. BuPers Technical Bulletin 59-16.
Order from LC mi$3.00, ph$6.30 PB 144 536

In this study, two groups, a group taking the experimental course and a group taking the regular Class B training were compared after the training on their demonstration of the fundamental skills and knowledge required to maintain unfamiliar fire control equipments. It was found that the students in the experimental group exceeded the students in the regular Class B training only in the extent of their mastery of mathematics, but not in their mastery of other maintenance requirements for the unfamiliar fire control equipment.

Naval Personnel Research Field Activity, San Diego, Calif.
NAVAL KNOWLEDGE AS PREDICTOR OF CAREER MOTIVATION AND ACADEMIC PERFORMANCE IN THE NROTC PROGRAM, by Bernard Rimland. June 59, 34p. 10 refs. BuPers Technical Bulletin 59-12; AD-227 793
Order from LC mi$3.00, ph$6.30 PB 144 537

Correlations between NKT scores and first semester grade point average were found to be about .10 for both Contract (N=2562) and Regular (N=1433) students.

NKT did not contribute to the multiple correlation of other tests with first semester grades. Correlations between NKT scores and first semester Naval Science Grades were found to be about .40 for Contract students and about .30 for Regulars. When the NKT was added to the combined mental ability test and high school records now used for prediction, the battery validity was raised from about .40 to .50 for Contract students and from about .37 to .45 for Regular students. No further work appears warranted in attempting to predict career motivation or grade-point average by use of the NKT.

Naval Personnel Research Field Activity, Washington, D. C.
PREDICTION OF OFFICER CANDIDATE MILITARY APTITUDE GRADES AND PEER RATINGS, by Rosemary Cliff and David Kipnis. June 59, 17p. 12 refs. BuPers Technical Bulletin 59-11; AD-227 794
Order from LC mi$2.40, ph$3.30 PB 144 538

This study was designed to develop tests which could be used in initial selection to predict military aptitude grades, peer ratings of officer candidates, and ultimately junior officer performance as evaluated by Fitness Reports. The Biographical Information Blank and the Risk Scale were found to be valid in predicting military aptitude grades and peer ratings. The results of the study indicate that officer selection for military aptitude can be improved by the use of some of the experimental instruments considered in this study.

Naval Personnel Research Field Activity, Washington, D. C.
THE VALIDITY OF THE BASIC TEST BATTERY AT NUCLEAR PROPULSION SURFACE SCHOOL, by Leonard Wollack. July 59, 16p. 5 refs. BuPers Technical Bulletin 59-17.
Order from LC mi$2.40, ph$3.30 PB 144 535

This study presents current information on the effectiveness of the Basic Test Battery (BTB) in selecting enlisted personnel for the Nuclear Power (NP) Surface School training program and the validity of the BTB in "fast" and "slow" training sections. Among the tests of the BTB, Arithmetic (ARI) was the best single predictor of school performance. Mechanical Comprehension (MECH) was the poorest. The MECH score added to either the General Classification Test (GCT) or ARI tended to lower prediction. Three of the Arco tests (Pre-Engineering, Mathematics, and Physics) gave predictions in this sample superior to that obtained with BTB scores. Tests of the BTB and the Arco achievement tests gave better prediction of school performance in the fast sections than in the slow sections. While the differences in prediction of fast and slow sections were not statistically significant, with the exception of the Physics test, the direction of the correlative differences was consistent with previous research findings.

Teachers Coll., Columbia U., New York.
PROBABILITY AND STATISTICS IN ITEM ANALYSIS AND CLASSIFICATION PROBLEMS; OPTIMAL TEST DESIGN IN A SPECIAL TESTING SITUATION, by Rosedith Sitgreaves. Sep 57, 36p. 5 refs. AFSAM-57-117; AD-157 698.
Order from LC mi$3.00, ph$6.30 PB 144 788

This paper considers a slightly different and more restricted model for tests of a single ability Y than the model formulated in an earlier study. It is assumed that all test items measure the same underlying variable X which has a correlation $(\rho^*)1/2$ with Y. An index h, defined as one minus the minimum expected squared error of estimate of Y attainable with a given test, is adopted as a measure of the "goodness" of the test. For a given k-item test, the estimation procedure with minimum squared error of estimate is found, and the value of h is determined. Various properties of h are demonstrated, and values of the test parameters which maximize this index are found. (Author)

Psychology

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
STUDIES IN RESEARCH METHODOLOGY. I. COMPATIBILITY OF PSYCHOLOGICAL MEASUREMENTS WITH PARAMETRIC ASSUMPTIONS, by James V. Bradley. Rept. on Contract AF 33(616)3404. Sep 59, 26p. 5 refs. WADC Technical rept. 58-574(I).
Order from OTS $0.75 PB 161 335

The compatibility of typical psychological measurements with the assumptions of common, parametric, statistical tests is examined. Empirically obtained distributions of time scores and mathematically derived error distributions are used to illustrate conditions which give rise to serious violation of assumptions. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
NOTE ON RELATIVE EFFICIENCY OF TESTS, by Colin R. Blyth. Technical rept. no. 16 on Contract Nonr-225(21). 27 Nov 57, 13p. 6 refs. AD-149 891.
Order from LC mi$2.40, ph$3.30 PB 137 997

This note is concerned with possible definitions of relative efficiency for two sequences of tests of the same hypothesis. For two examples of one kind of definition, relative efficiences of the Student test and sign test against normal alternative are calculated for fixed sample size and asymptotically.

Applied Psychological Services, Wayne, Pa.
TECHNIQUES FOR EVALUATING OPERATOR LOADING IN MAN-MACHINE SYSTEMS: A DESCRIPTION OF A MODEL AND THE RESULTS OF ITS FIRST APPLICATION, by Arthur I. Siegel and J. Jay Wolf. Rept. on Contract Nonr-2492(00). Feb 59, 104p. 12 refs.
Order from LC mi$5.70, ph$16.90 PB 144 790

A "model" was synthesized which may permit an improved analysis and prediction of the effectiveness of man-machine systems. The model was then applied to the pilots' task in landing an F4D aircraft on an aircraft carrier. The predictions from the model, presented and evaluated in this report, generally conform with reality, are generally reasonable, and indicate that many conditions necessary to the eventual fruition of a final model have been met. It further seems possible that the model may be effectively used at the present time for comparative evaluation of alternative designs. (Author)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
AN EXPLORATORY STUDY INTO THE EFFECTS OF LOW BLAST PRESSURE ON BEHAVIOR IN RHESUS MONKEYS, by John Romba and Paul Martin. Oct 59, 21p. 24 refs. Technical Memo. 11-59.
Order from LC mi$2.40, ph$3.30 PB 144 713

Four psychological-test-sophisticated Rhesus monkeys were exposed to 90 shots of 5-7 pounds per square inch blast peak overpressures and changes in behavioral phenomena were noted. Interference with performance improvement on learning tests was apparent. Selective decrements in motor coordination were also noted. No locomotor activity changes were observed. The changes, however, cannot be interpreted as only blast pressure effects. The psychological experience of the blast situation to the animals must also be considered as a contributing factor. The elimination or reduction of confounding factors will be attempted in the next series of experiments. (Author)

Hearing and Communication Lab., Indiana U., Bloomington.
RECOGNITION MEMORY AND THE OPERATING CHARACTERISTIC, by James P. Egan. Technical note on Research Concerning the General Problem of Information Reception by Means of Speech Communication, Contract AF 19(604)1962. 15 June 58, 56p. 11 refs. AFCRC-TN-58-51; AD-152 650.
Order from LC mi$3.60, ph$9.30 PB 137 944

The present study, undertaken in the spirit of an exercise, attempts to show how the operating characteristic may be applied in the investigation of recognition memory.

Massachusetts Mental Health Center, Boston.
STUDIES IN HUMAN ISOLATION, by Sanford J. Freedman and Milton Greenblatt. Rept. for 15 Apr 58-14 Apr 59 on Biophysics Research, Contract AF 33(616)5663. Sep 59 54p. 34 refs. WADC Technical rept. 59-266.
Order from OTS $1.50 PB 161 349

Thirty normal college-age subjects were run in eight-hour experimental sessions involving (a) non-patterned visual and auditory input combined with social isolation, (b) visual deprivation (blackout) combined with auditory non-patterning and social isolation, and (c) social isolation alone. Perceptual and cognitive distortions and disorientations differentially induced by these conditions are described. Six additional somewhat "deviant" subjects were run under (a). A good quantitative measure of perceptual distortion was developed. Both perceptual and cognitive effects occur with either non-patterning or blackout of the visual field, but social isolation subjects experience essentially no effects. There is no consistent relationship between the two kinds of effects. The visual imagery reported strongly resembles hypnagogic imagery and this experience is related to a history of hypnagogic imagery. A theoretical formulation is proposed which would attribute the perceptual distortions to the organism's continuous automatic search for order in a non-ordered perceptual environment. (Author)

Mississippi Southern Coll., Hattiesburg.
MULTIDIMENSIONAL SCALING APPROACH TO THE DETERMINATION OF BASIC PSYCHOLOGICAL PARAMETERS FOR PURE TONES, by Robert W. Peters. Rept. on Research on Psychological Parameters of Sound, Contract AF 33(616)3644. Apr 59, 42p. 12 refs. WADC Technical rept. 59-201.
Order from OTS $1.25 PB 161 316

The multidimensional scaling model of successive intervals was applied to investigate the dimensionality of auditory perception of pure tones. The stimuli consisted of 16 pure tones. Thirty-nine observers made distance judgments of similarity between stimuli. These inter-stimuli distances were analyzed mathematically to reveal the minimum number of dimensions necessary to account for the distances between stimuli. The results of the analysis indicated that there were two dimensions, pitch and loudness. The purpose of the study was to evaluate the multidimensional scaling method for use in auditory areas where the dimensions are not well known, and, since the two anticipated dimensions, pitch and loudness, were revealed, proposed use of the model in other auditory areas is supported. (Author)

Naval Research Lab., Washington, D. C.
DECISION-MAKING STUDIES. PART 1. THE TRADE-OFF OF VARIABLES IN DECISION MAKING, by J. R. Hayes and Elizabeth C. Smith. 6 Jan 60, 9p. 13 refs. NRL rept. 5418.
Order from OTS $0.50 PB 161 052

Subjects were required to make tactical decisions based on three variables (speed, distance, and number of airplanes) in a simulated air-defense situation. The experimentally varied factors were: (a) the amount of trade-off required for decision (correlation), (b) the adequacy of the forces available to the decision maker (adequacy), and (c) the form in which the information was displayed (arrangement). The dependent factor was decision time. It was shown that at least some properties of complex decisions can be described without recourse to economic theory. (Author)

Princeton U., N. J.
A REVIEW OF FACTORS IN LEARNING EFFICIENCY, by Robert M. Gagne and Robert C. Bolles (U. of Pennsylvania). Nov 58, 31p. 58 refs. AFOSR-TN-58-924; AD-162 275.
Order from LC mi$3.00, ph$6.30 PB 137 897

The main body of this report deals with principles derived from laboratory findings and theoretical writings that seem relevant to the problem of promoting efficient learning. In describing these factors and their origin, we have not attempted to provide a detailed review containing all relevant references. Instead, reference is usually made to a key paper, set of studies, or to an authoritative work summarizing the field. Consideration is given to the kind of evidence which exists, the suggestions it has for learning efficiency, and its adequacy in dealing with this problem. Some conclusions are drawn regarding the present state of knowledge of these principles and the research questions which appear to be in need of investigation.

Research Center for Human Relations, New York U., N. Y.
CONDITIONS AFFECTING COOPERATION. SECTION I: FACTORS RELATED TO THE INITIATION OF COOPERATION. SECTION II: TRUST AND COOPERATION, by Morton Deutsch (Bell Telephone Labs.) Final technical rept. on Contract Nonr-285(10). Feb 57, 129p. 22 refs. AD-124 701.
Order from LC mi$6.30, ph$19.80 PB 144 604

This report presents in final summary the theoretical thinking and the research studies done on conditions affecting cooperation. The work proceeded in two phases. In the first phase a series of studies was conducted under the general framework of a theoretical outline concerning the factors which influence the initiation of cooperation. In the second phase, the focus of theorizing and research centered upon some of the unique social psychological factors involved in the initiation of cooperation - namely, the factors related to the development of mutual trust.

Willow Run Labs., U. of Michigan, Ann Arbor.
THE BEHAVIORS OF MEMBERS OF PROBLEM-SOLVING GROUPS, by L. R. Hoffman and C. G. Smith. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 59, 31p. 8 refs. 2144-364-T.
Order from LC mi$3.00, ph$6.30 PB 144 548

This report investigates the variables determining the individual behaviors of members of 4-person problem-solving groups on 4 different problems, as derived from postmeeting ratings of their behaviors. A complex analysis-of-variance design is used to test for the effects of group type (homogeneity vs heterogeneity of member personalities), problems, and between-group and between-individual differences. Problem differences proved to be a major source of variance for all behaviors studied, with some problems eliciting task-directed behaviors and others more socio-emotional behaviors. Between-group differences and interactions between problems and groups were also large sources of variance. The only significant difference bewteen the homogeneous and heterogeneous groups was that the homogeneous groups engaged more in promoting personal relations. Results are discussed, and some basic propositions of group interaction are suggested. (Author)

Pennsylvania State U. [University Park].
BIOLOGICAL EFFECTS OF NOISE IN VERTEBRATE ANIMALS, by Adam Anthony and Eugene Ackerman. Rept. for 1 June 54-30 Sep 57 on Generation, Propagation, Action and Control of Acoustic Energy, Contract AF 33(616)2505. Nov 57, 128p. 54 refs. WADC Technical rept. 57-647; AD-142 078.
Order from LC mi$6.30, ph$19.80 PB 144 606

This report deals with the stress effects of noise on bodily functions other than hearing. It includes physiological, biochemical and behavioral effects of intense acoustic noise at low and high frequencies. Specific approaches employed are as follows: (1) flame spectrophotometric analyses of serum electrolytes, (2) serum ascorbic acid and blood sugar changes, (3) changes in adrenal and plasma cholesterol, (4) behavioral changes in noise exposed rats, mice and guinea pigs, (5) relationship of seizure-susceptibility to noise stimulation and (6) design and construction of a corona speaker for use in bioacoustic studies. It was demonstrated that short daily exposures to intense noise of about 132-140 db pressure levels can act as a physiological stress to which rats, mice and guinea pigs can satisfactorily adapt. These studies have also helped clarify the nature of the normal physiological defense mechanisms to excessive noise stimulation. By investigating the factors determining the severity of noise as a stress stimulus and using objective measures of the limits of endurance of animals to different types of intense noise situations, one can more intelligently cope with the problem of preventing noise from becoming a serious health menace to man. (Author)

Vermont U., Burlington.
THE METABOLISM OF CONNECTIVE TISSUE, by William v. B. Robertson. Final rept. on Contract N9onr-82800. [1953] 4p. 7 refs. AD-23 248.
Order from LC mi$1.80, ph$1.80 PB 137 884

A bibliography of published manuscripts on (1) the chemical structure and physical properties of connective tissue constituents such as hyaluronic acid complexes, (2) the formation and destruction of collagen as affected by vitamins and hormones, and (3) the mechanism of formation of collagen and the role of ascorbic acid and hyaluronate in this process.

Anatomy and Physiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE ANALYTICAL MECHANICS OF RATE OF ONSET, by Sigurd Hoyer (Potter Instrument Co.). Oct 59, 66p. 5 refs. AFMDC-TN-59-26.
Order from LC mi$3.90, ph$10.80 PB 144 424

The system investigated in Part I consists of a mass connected by a linear spring to a moving frame. One calculation also includes the effect of a Newtonian dashpot connected to oppose relative motion between the mass and the frame. The force in the coupling spring is determined as a function of the motion of the frame. The force depends on the acceleration of the frame, and on higher derivatives of the position of the frame with respect to time. We are here particularly interested in the effect on spring force of the rate of onset of acceleration of the frame. It is shown that the spring force may depend on the rate of onset of acceleration only. The purpose of Part II is to present the results of an investigation of the behavior of certain models when these models are subject to accelerated motion. The models treated here consist of a rigid frame holding either a frictionless compressible fluid, an elastic solid, or a visco-elastic solid. Equations which describe the behavior of the models are developed. Solutions of these equations are given for some particular cases. It is hoped that the results obtained will be of use in determining factors which cause damage to living organisms during periods of severe acceleration. Such periods of severe acceleration may, for example, occur in a plane crash, or in a rocket-powered flight with living passengers. (See also PB 142 846)

Albany Medical Coll., N. Y.
RENAL CLEARANCE OF GLUCOSE IN HYPOTHERMIC DOGS, by G. S. Kanter. July 59, 15p. 10 refs. AFSAM rept. 59-37; AD-227 573.
Order from LC mi$2.40, ph$3.30 PB 144 688

The quantitative alterations in both glomerular filtration rate (GFR) and tubular reabsorption of glucose, before, during, and after onset of hypothermia were investigated. With the development of hypothermia a progressive fall in glomerular filtration rate was observed (78 ± 5 ml/min. at control rectal temperature to 30 ± 5 ml/min. at RT of 25° C). Hypothermia has a twofold effect on renal function — physically via the cardiovascular system, resulting in a falling GFR, and chemically via the tubular reabsorption processes, resulting in a decreased glucose reabsorption. To study the kinetics of this decreased glucose reabsorption, the glucose Tm was investigated.

Dayton U., Ohio.
A MINIATURIZED OPERANT CONDITIONING CHAMBER FOR BEHAVIORAL RESEARCH IN THE UPPER ATMOSPHERE, by Frederick H. Rohles, Jr. (Aero Medical Lab.) and Richard Coy. Rept. on Human Performance in Advanced Systems, Contract AF 33(616)6264. July 59, 13p. 3 refs. WADC Technical note 59-261.
Order from OTS $0.50 PB 161 333

A miniaturized operant conditioning chamber for a mouse was designed for behavioral research in the upper atmosphere. It requires the animal to press a lever on a fixed ratio schedule of 25:1 for 20 minutes out of every 6 hours for food reward. The chamber utilizes mechanical power, and response recording is compatible with telemetry systems. The unit is 3.5 inches in diameter, 6.5 inches long, and weighs approximately 2.25 pounds. (Author)

Virginia U., Charlottesville.
BIOLOGICAL PAYLOADS IN SPACE FLIGHT, by Frank W. Banghart. Rept. on Contract AF(600)1792. Nov 58, 49p. ARDC-TR-58-58; AD-204 761.
Order from LC mi$3.30, ph$7.80 PB 144 586

An experimental program is proposed to determine the feasibility of manned space flight by means of a series of experiments designed to furnish the maximum amount of information, in progressive steps, from lower animal species to the ultimate manned flight. The basic instrumentation problem involves obtaining highly reliable and information-rich data from a space vehicle which may not be recovered, using minimum instrumentation weight. It is proposed that a storage-dumping procedure be used where the data are taped and stored and are dumped at the command of the monitoring station. The basic ecological problem consists of determining and controlling the environment in which a living organism is to be sent into space. The basic physiological problems considered are the specific areas of gravity and radiation.

Biochemistry

Army Chemical Warfare Labs., Army Chemical Center, Md.
SOME ASPECTS OF THE CHEMISTRY AND BIOCHEMISTRY OF DECABORANE, by David L. Hill. Nov 58, 11p. 10 refs. CWL Special pub. 2-15.
Order from LC mi$2.40, ph$3.30 PB 138 343

Part of report has been published.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
CHANGE IN PLASMA TRANSAMINASE ACTIVITY OF RHESUS MONKEYS AFTER EXPOSURE TO VIBRATION, ACCELERATION, HEAT ON HYPOXIA, by Freeman W. Cope and B. David Polis. Rept. no. 5 on Proj. NM 11 01 12.7. 11 Dec 57, 10p. 8 refs. NADC-MA-5718; AD-209 173.
Order from LC mi$1.80, ph$1.80 PB 144 717

Significant increases in plasma glutamic-oxalacetic transaminase levels were observed in monkeys exposed to vibration, acceleration, heat, hypoxia, or noise and confinement stress. In all but 1 of 17 animals, no specific tissue damage was evident. The increase in plasma transaminase is interpreted as a non-specific stress effect. The data suggest that caution should be exercised in basing clinical judgements on serum transaminase levels. (Author)

Botany

Arizona U. Coll. of Agriculture, Tucson.
PHOTOGRAPHIC DOCUMENTATION OF VEGETATIONAL CHANGES IN AFRICA OVER A THIRD OF A CENTURY, by H. L. Shantz and B. L. Turner.

Rept. on Contract [Nonr-2173(01)] Aug 58, 173p. 6 refs. Rept. 169.
Order from LC mi$8.10, ph$27.30 PB 143 349

The present photographic study has been to document the changes which have taken place at a particular site over a specified time. The area covered is large enough so that broad generalities might be drawn. The facts are presented from which each worker can draw his own conclusions. The duplicated pictures and discussions have been arranged in accordance with the broad vegetational belts or formations.

Syracuse U., N. Y.
CONTROL OF WOOD-ROTTING FUNGI, by M. W. Johnson. Technical rept. no. 9, 1 Jan-31 Dec 58, on Contract Nonr-669(06). [1958] 11p.
Order from LC mi$2.40, ph$3.30 PB 144 686

Abstracts of results are given on studies: (a) on utilization of isomers of amino acids; (b) on vitamin; (c) on polysaccharide production; and (d) on marine fungi.

Medical Specialties and Equipment

Electrical Engineering Research Lab., U. of Illinois, Urbana.
THE REALIZATION OF BIOLOGICAL COMPUTERS. Quarterly rept. no. 4 (Annual) on Contract Nonr-1834(21). 15 Jan 59, 69p. 6 refs.
Order from LC mi$3.90, ph$10.80 PB 144 682

The following topics are covered: Sec. 1. Some mathematical aspects of the analysis and synthesis of biological computers, Sec. 2. Biological computer general neuron circuitry, and Sec. 3. On the design of artificial nerve nets.

School of Aviation Medicine, Brooks AFB, Tex.
A STANNOUS FLUORIDE-SILEX-SILICONE DENTAL PROPHYLAXIS PASTE WITH ANTICARIOGENIC POTENTIALITIES, by Vincent A. Segreto, Norman O. Harris, and Warren R. Hester. Nov 59, 7p. 8 refs. Rept. 60-11; AD-227 574.
Order from LC mi$1.80, ph$1.80 PB 144 687

A stannous fluoride-silex-silicone dental prophylaxis paste was developed and tested in vitro for anticariogenic potentialities. The active ingredient is stannous fluoride; the silex acts as the abrasive, and the silicone-petrolatum dilution acts as the moistening agent. Flavoring agents consist of oil of orange, oil of anise, and Sucaryl. Data indicate that the prophylaxis paste is more effective in preventing acid decalcification of enamel than a 10 percent topical application of aqueous stannous fluoride. (Author)

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
CUTANEOUS APPLICATION OF 1.1% MALATHION POWDER TO VOLUNTEERS, by Philip J. Gutentag. July 59, 11p. 11 refs. CWLR-2290.
Order from LC mi$2.40, ph$3.30 PB 144 668

A pilot study is described to determine the safety with which 1.1% malathion powder can be used when dusted over a person's entire body. The study also attempts to evaluate troop reaction to frequent dustings. During the entire study, consisting of eight complete cutaneous dustings in a 15-day period, there was no significant cholinesterase depression which could be ascribed to the malathion and there was no evidence of toxicity as determined by daily examination of the men. Troop acceptances of the powder throughout the experiment was good and there was no evidence that nonpowdered personnel objected to the presence of the powdered volunteers. From these studies, it appears that 1.1% malathion could safely be used on a large-scale field trial. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECT OF HEF-3 ON LUNG TISSUE, by Edmund F. Murtha, David L. Hill and others. Preliminary rept. Apr 58, 6p. 2 refs. Technical memo. no. 26-7.
Order from LC mi$1.80, ph$1.80 PB 144 666

Army Chemical Warfare Labs., Army Chemical Center, Md.
INHALED GB RETENTION STUDIES IN MAN AT REST AND DURING ACTIVITY, by Fred W. Oberst, James W. Crook and others. Aug 59, 26p. 15 refs. CWLR-2296.
Order from LC mi$2.70, ph$4.80 PB 144 684

Resting men were exposed to GB vapor by the oral and nasal routes. Exercising men also received GB vapor by the oral route. The experiment was designed to measure the retained dose of inhaled GB and relate this with RBC-ChE inhibition. The inhibition of RBC-ChE was measured in each man after the exposure from which the ChE50 dose was calculated. (Author)

Kettering Lab., U. of Cincinnati, Ohio.
TOXICITY OF BERYLLIUM, by J. Cholak, L. H. Miller, and Frank Princi. Quarterly progress rept. on Contract AF 33(600)37211. 28 Jan 59, 30p. 50 refs. AMC Technical rept. 7-665.
Order from OTS $0.75 PB 161 319

This report, based upon current knowledge and experience, has been prepared as a review and as a preliminary guide for use by individuals who have the responsibility for protecting the health of personnel engaged in operations in which beryllium is used. It includes descriptions of the effects of the absorption of beryllium and specific measures designed to prevent illness and maintain health among persons who work with beryllium. A proper recognition of the hazardous potentials of this material and an understanding of the basic hygienic principles described herein should result in safe handling and the avoidance of illness. (Author)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
BERYLLIUM TOXICITY LECTURE, by A. H. Holland, Jr. [1948] 9p. AD-206 718; ATI-181 247.
Order from LC mi$1.80, ph$1.80 PB 138 454

Radiobiology

Army Medical Research Lab., Fort Knox, Ky.
MASSIVE DOSE IRRADIATION OF THE MAMMALIAN CENTRAL NERVOUS SYSTEM, by Jack M. Ginsburg and David D. Ulmer. Rept. on Biological and Medical Aspects of Ionizing Radiation. 29 May 58 21p. 27 refs. Rept. no. 339; AD-160 343.
Order from LC mi$2.70, ph$4.80 PB 144 714

5000 r of Cobalt 60 gamma rays delivered to the canine head caused a decrease in the cerebral cortex potassium content. Irradiated animals failed to show significant differences in sodium, chloride, and water content of the brain and in the dextrose, gases, and electrolyte content of blood entering and leaving the brain when compared to a control group of sham-irradiated dogs. (Author)

George Washington U., Washington, D. C.
PROCEEDINGS OF TRI-SERVICE CONFERENCE ON BIOLOGICAL HAZARDS OF MICROWAVE RADIATION, 15-16 JULY 1957, ed. by Evan G. Pattishall (U. of Virginia). Rept. on Contract AF 18(600)1180. [1957] 127p. 245 refs. ARDC-TR-58-51; AD-115 603.
Order from LC mi$6.30, ph$19.80 PB 144 603

Contents:
A summary of the SAMUSAF program for research on the biomedical aspects of microwave radiation
Future microwave radiation hazards
High power microwave facilities
Program for the investigation of the biological effects of electromagnetic radiation at the Rome Air Development Center
Summary of talk on hazards of electromagnetic radiation to ordnance
Summary of talk on exposure of Air Force personnel to ionizing radiation produced by radio frequency generators
The physiological basis of RF-injury
Heating characteristics of laboratory animals exposed to 10-centimeter microwaves
Summary of remarks on RF measurement
Microwave exposure discussion

CHEMISTRY

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
PERARYLATED SILANES. IDENTIFICATION BY X-RAY DIFFRACTION POWER PATTERNS, by Frank L. Chan and Leonard Spialter. Rept. on Analytical Chemistry of Special Alloy Chemicals. Sep 59, 37p. 13 refs. WADC Technical rept. 59-512.
Order from OTS $1.00 PB 161 312

X-ray powder diffraction data are presented for twenty arylsilanes in various forms of graphic presentation for ease in identification, characterization, and analysis. These include the actual pictorial diffraction patterns, extended listings of d-spacings with relative intensities, and a Hanawalt-type index identifying the catalogued compounds by means of all combinations of the three most intense lines. Purity of silanes is stressed to minimize confusion and errors arising from impurities and polymorphic forms. To insure accuracy in measuring distances and intensities of lines on the diffraction plates, recordings of their microphotometer traces were taken and precisely read. A surprising similarity of d-spacings had been observed for the most intense line, but not for those of lesser intensity, in the powder pattern of each of these compounds. This suggests a possible correlation between this pattern component and a basic element of molecular structure in a class of compounds.

New York U. Coll. of Engineering, N. Y.
RESEARCH ON THE PREPARATION OF PURE METALS, by Charles J. Marsel and Walter Brenner. Scientific rept. no. 3 for 15 Dec 58-31 Aug 59 on Contract AF 19(604)4124. 1959, 47p. 17 refs. AFCRC-TN-59-190; AD-215 624.
Order from LC mi$3.30, ph$7.80 PB 144 572

The preparation of pure tin was investigated via the decomposition of stannane. The preparation of pure gallium was first investigated via the reduction of gallium trichloride with lithium aluminum hydride in diethyl ether as a solvent. A more promising approach has now been developed which is centered on the preparation of lithium gallium hydride. Exploratory investigations were carried out on the preparation and the subsequent decomposition of antimony hydride for the preparation of the pure metal. (See also PB 142 291)

Wisconsin U., Madison.
BINARY NITROGEN COMPOUNDS OF THE ELEMENTS: A LITERATURE SURVEY, by Rosemary G. Ehl, Rodney J. Sime, and John L. Margrave. Rept. on Contract AF 33(616)3023. June 59, 81p. 832 refs. WADC Technical note 59-115.
Order from OTS $2.25 PB 161 315

A literature survey has disclosed the existence of more than 195 binary compounds of nitrogen with the other elements of the periodic system. About 80% of the known binary nitrogen compounds are nitrides while the rest are azides. Combinations with at least 75 elements are reported. In this report are presented a comprehensive bibliography and a set of tables designed to make it convenient for a researcher to locate preparative, crystallographic, or thermodynamic data. Miscellaneous references are also listed. (Author)

Organic Chemistry

Frick Chemical Lab., Princeton U., N. J.
THE EXPECTED SQUARE OF THE LENGTH OF A HYDROCARBON CHAIN, by Arthur V. Tobolsky. Rept. on Contract Nonr-1858(07). 29 Jan 59, 8p. 3 refs. ONR Technical rept. RLT-29.
Order from LC mi$1.80, ph$1.80 PB 144 143

Three successive bonds along a hydrocarbon chain may be in a planar trans configuration or in two nonplanar gauche configurations. The energy of the trans configuration is taken as zero and the energies of the two gauche configurations are each taken as ε (per mole). The mean square length of a hydrocarbon type chain of n links each of length l_o is shown to be $\bar{r}^2 = (2+6a)/(3-3a)\, nl_o^2$, where $a = 1/[1+2\exp(-\varepsilon/RT)]$. The problem of excluded volume is not here considered.

Rochester U., New York.
THE FLUORESCENCE AND PHOTOLYSIS OF ACETONE AND ACETONE-BIACETYL MIXTURES, by Julian Heicklen and W. Albert Noyes, Jr. Rept. on Contract AF 18(600)1528. 12 Sep 58, 24p. 15 refs. AFOSR-TN-58-845; AD-203 335.
Order from LC mi$2.70, ph$4.80 PB 138 347

The photolysis of acetone has been redone to very low conversions. Also the fluorescence and photolysis of acetone-biacetyl mixtures have been studied. This paper presents the results of these studies.

Physical Chemistry

[Arkansas U., Fayetteville].
PHOTOLYSIS OF AMORPHOUS LEAD AZIDE, by [Herbert M. Dumas, Jr.] Rept. on Contract DA 44-009-eng-2439. 31 Aug 56, 52p. 32 refs. AD-124 361.
Order from LC mi$3.60, ph$9.30 PB 137 724

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECT OF POLYMERIC MODIFIERS ON THE BREAKUP OF DROPS BY HIGH-VELOCITY AIR STREAMS, by J. D. Wilcox, R. K. June and others. Rept. for Mar 56-July 58 on Agent Physicochemical Research. Sep 59, 22p. 24 refs. CWLR 2309.
Order from LC mi$2.70, ph$4.80 PB 144 740

The breakup of liquids was studied with a miniature shock tube, simulating conditions that occur in spraying from high-speed aircraft and in explosive dissemination. Investigated was the breakup of drops of agent simulants (Newtonian liquids) and of polymer solutions in agent simulants (non-Newtonian viscoelastic liquids), when subjected to a high-velocity air stream. It was found that polymeric modifiers which produce viscoelastic properties retard the breakup of the liquid.

Avco-Everett Research Lab., Everett, Mass.
NUMERICAL CALCULATION OF ABSOLUTE BREMSSTRAHLUNG INTENSITY FOR A FULLY IONIZED FULLY DISSOCIATED HYDROGENIC GAS, by G. Sargent Janes and Harold E. Koritz. Rept. on Contract AF 49(638)61. Sep 59, 16p. 4 refs. Research rept. 70; AFOSR-TN-59-1076.
Order from LC mi$2.40, ph$3.30 PB 144 345

Using the approximate relationships of Kirkpatrick and Weidmann for bremsstrahlung intensities, numerical calculations have been made on the IBM 650 at the Avco-Everett Research Laboratory for a fully ionized, fully dissociated hydrogenic gas. The intensities are given in terms of a quantity having the units ergs per sec per unit frequency interval per steradian per cubic centimeter as a function of $h\nu$, (from 0.5 to 4.0 electron volts) and kT (from 4 to 200 electron volts). A calibration method has been devised for measurement of absolute bremsstrahlung intensities, which continually compensates for the errors present in most calibration procedures.

Eagle-Picher Research Labs., Miami, Okla.
STUDY OF THE PHYSICAL CHEMISTRY AND METALLURGY OF SEMI-CONDUCTING MATERIALS, by K. E. Bean, W. E. Metcalf, and R. J. Starks. Quarterly rept. no. 11, 14 Sep-14 Dec 57, on Contract DA 36-039-sc-74890. [1957] 40p. 14 refs. AD-154 771.
Order from OTS $1.00 PB 161 353

A method was developed for the deposition of crystalline bars of silicon on a tantalum filament in such a manner as to allow the filament to be pulled out of the bar. Absorption of impurities from trichlorosilane using a quartz column containing freshly produced silica reduced the boron content of the silicon produced. Coordination compounds of BCl_3 were produced in crude $SiHCl_3$ using (1) octyl alcohol and (2) triphenylchloromethane to reduce the boron content of the silicon prepared therefrom. Floating zone studies were carried out on the silicon bars which had been pulled directly from the filaments. The symmetry of the bars made them zone more easily and retain their shape more readily than was the case of bars cut from grown crystals of silicon.

Horizons, Inc., Cleveland, Ohio.
ELECTRODE REACTIONS IN TITANIUM FUSED SALT ELECTROLYSIS, by A. J. Kolk. Final rept. on Contract Nonr-1178(00). 1 Aug 56, 150p. 20 refs.
Order from LC mi$7.20, ph$22.80 PB 138 422

Constant current voltammetry in molten salts is discussed as well as various phenomena associated with crystal growth during electrodeposition in molten salts. These include kinetics of cathodic deposition electrical double layers and transference in molten salts. Experimental data is presented on polarization curves of potassium fluotitanate in sodium chloride, the reduction of various titanium compounds to titanium, anodic and cathodic polarization curves of some titanium compounds. The appendix contains translations of articles on the electrochemistry of potassium fluotitanate.

Illinois U., Urbana.
ANODIC BEHAVIOR OF COPPER IN HYDROCHLORIC ACID AND IN PHOSPHORIC ACID (INCLUDING SCIENTIFIC REPORT ABOUT INTERNATIONAL SYMPOSIUM ON PASSIVITY, DARMSTADT, 1957) by J. H. Bartlett, R. S. Cooper and others. Technical rept. no. 5 (Final) on Contract DA 11-022-ORD-939. 30 Sep 57, 20p. 8 refs. AD-145 599.
Order from LC mi$2.40, ph$3.30 PB 144 563

An experimental study of the behavior of copper anodes in hydrochloric acid and in phosphoric acid, in order to learn more about how layers are formed and removed from electrodes. This is of fundamental importance in electrolytic rectification, electropolishing, prevention of corrosion, and the understanding of nerve conduction.

Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain).
AEROTHERMOCHEMISTRY, by Gregorio Millan. Rept. on Contract AF 61(514)441. Jan 58, 584p. 252 refs. AFOSR TR-58-27; AD-152 202.
Order from LC mi$11.10, ph$89.40 PB 133 766

Based on the course conducted by Prof. Theodore von Kármán at the University of Paris.

Chap. 1. Thermochemistry
Chap. 2. Transport phenomena in gas mixtures
Chap. 3. General equations
Chap. 4. Combustion waves
Chap. 5. Structure of the combustion waves
Chap. 6. Laminar flames
Chap. 7. Turbulent flames
Chap. 8. Ignition, flammability and quenching
Chap. 9. Flow with combustion waves
Chap. 10. Aerothermodynamic field of a stabilized flame
Chap. 11. Similarity in combustion applications
Chap. 12. Diffusion flames
Chap. 13. Combustion of liquid fuels. Appendix: Application of Probert's method for the combustion of fuel sprays

Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain).
DISTRIBUTION OF RADICALS IN LAMINAR FLAMES. I. CRITERIUM OF VALIDITY OF THE STEADY STATE ASSUMPTION, by G. Millan, and I. Da Riva. Rept. on Contract AF 61(514)997. 31 Jan 59, 38p. 14 refs. AFOSR-TN-59-626; AD-217 811.
Order from LC mi$3.00, ph$6.30 PB 143 173

The determination of the distribution of the chemical radicals in the sine of the flames constitutes one of the basic problems in the study of these. Von Karman and Penner [Selected Combustion Problems, pp. 5-41. Butterworth's Scientific Publications, 1954] have proposed for it the extension to this case of the steady state assumption, used with success in other problems of chemical kinetics. However, a proper criterium, making it possible to determine in what cases the above assumption can be applied with sufficient guarantee, is not yet available. In this work it is demonstrated that the applicability of the assumption depends on the value of a certain dimensionless parameter, in which the effects of reaction and diffusion of the radicals are combined. Besides, a method of recurrence is developed which enables successive approximations for the distribution of the radicals to be obtained from that corresponding to the steady state. Finally a study is made of a mathematical model which, preserving all the properties of the flame, enables an easy comparison of the exact solution with the approximate ones obtained by means of the proposed methods. (Author)

Instituto Nacional de Technica Aeronautica Esteban Terradas (Spain).
DISTRIBUTION OF RADICALS IN LAMINAR FLAMES. 2. APPLICATION OF THE CRITERIUM OF VALIDITY OF THE STEADY STATE ASSUMPTION TO SEVERAL FLAMES, by I. Da Riva and G. Millan. Rept. on Contract AF 61(514)997. 31 Jan 59, 54p. 11 refs. AFOSR-TN-59-627; AD-217 812.
Order from LC mi$3.60, ph$9.30 PB 143 172

The object is to apply the criterium on the validity of the steady state assumption [PB 143 173] to various cases corresponding to flames studied by different authors. For it, the differential equation deduced for the concentration of the radical is integrated by means of the perturbation method set out in the above mentioned reference. With a view to simplifying the numerical calculation, the concentration of the principal species and of the radicals distinct from that under consideration, if existent, have been approximated by means of appropriate functions. The two first perturbations were normally sufficient to evaluate the accuracy with which the steady state assumption enables the concentration of the radicals to be calculated. The criterium set out makes it possible to prove that the steady state assumption is sufficiently approximate to calculate the concentration of the radicals in the following cases: Ozone flame, Hydrogen radical in the Hydrogen-Bromine flame and, Hydrogen flame. On the contrary, in the case of the Bromine radical in the Hydrogen-Bromine flame and particularly in the Hydrazine flame, the parameter for the validity of the assumption is very small and consequently the method

of perturbations does not converge and the steady state assumption for the concentration of the radicals gives large deviations with respect to their actual distributions. (Author)

Johns Hopkins U., Baltimore, Md.
A MASS SPECTROSCOPIC APPEARANCE POTENTIAL STUDY OF SOME BORON TRIHALIDES, by W. S. Koski, Joyce J. Kaufman and C. F. Pachucki. Technical note no. 8 on Contract AF 18(600)1526. Oct 58, 23p. 24 refs. AFOSR-TN-58-855; AD-203 497.
Order from LC mi$2.70, ph$4.80 PB 137 994

The appearance potentials of the positive ion fragments from BCl_3, BBr_3 and BI_3 were measured mass spectroscopically. These measurements permitted a determination of the average B-I bond dissociation energy in BI_3.

Laval U. (Canada).
KINETICS OF THE THERMAL REACTION OF HYDROGEN PEROXIDE WITH HYDROGEN, by Wendell Forst. Rept. on Contract AF 18(600)492. 25 Nov 58, 21p. 20 refs. AFOSR-TN-58-1070; AD-207 230.
Order from LC mi$2.70, ph$4.80 PB 138 351

The reaction proceeds with a pressure increase at constant volume and is thus accessible to study by the static method. At the pressures used the rate of activation is rate-determining in the unimolecular decomposition of hydrogen peroxide. When experimental results are corrected for activation by hydrogen, the reaction is found to be first order in both hydrogen and peroxide. Experimental evidence points to a low value for rate constant k_3. The significance of these results is briefly discussed in connection with the kinetics of the nitric oxide-hydrogen reaction.

National Research Labs., Ottawa (Canada)
THE SOLUTION OF AN EIGENVALUE PROBLEM (RATE OF EVAPORATION AND DECOMPOSITION OF A DROPLET OF AN OZONE-OXYGEN MIXTURE) BY MEANS OF ANALOGUE AND DIGITAL COMPUTERS, by R. Sandri. Aug 59, 18p. 1 ref. Mechanical Engineering rept. MB-15.
Order from LC mi$2.40, ph$3.30 PB 144 509

The rate of evaporation and decomposition of a droplet of a 50-50 mole percent mixture of liquid ozone and oxygen in a hot oxygen atmosphere at 20 atmospheres pressure was computed for different sizes of the droplet radius. This is an eigenvalue problem which could be solved with an accuracy of about 2 percent on the PACE analogue computer. As an accuracy check, the one-dimensional problem (rate of evaporation of a large drop) was solved also on the Bendix digital computer. The result differed by 2.2 percent from that obtained on the analogue computer. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
TRI-DIMENSIONAL EXAMINATION OF CHEMICAL SYSTEMS IN GEL MEDIA, by L. H. Gevantman, R. C. Chandler, and J. F. Pestaner. 29 May 57, 31p. 16 refs. Research and development technical rept. USNRDL-TR-163; AD-143 510.
Order from LC mi$3.00, ph$6.30 PB 144 728

The present study describes a technique for the colorimetric measurement of tri-dimensional reaction product distributions in firm aqueous gels. Two chemical systems are employed. These systems contain agar (1 per cent by weight) in combination with low concentrations of either KI-starch or trichloroethylene-bromcresol purple. The change in the KI system, colorless to deep blue, results from the radiation-induced oxidation of I^- to I_2. The change in the trichloroethylene-bromcresol purple system, purple to yellow, is caused by the production of HCl. The gels are irradiated in square tubes with X rays from a Van de Graaff accelerator and a 250-KVP X-ray machine. After irradiation they are sliced and examined in detail. The color distribution throughout the reaction zone is measured photometrically with a recording microphotometer. Depth-dose plots for the two systems are shown. (Author)

Naval Research Lab., Washington, D. C.
MICELLAR PROPERTIES OF OIL-SOLUBLE SOAPS AND THEIR SIGNIFICANCE IN DETERGENCY, by W. D. Bascom, S. Kaufman and C. R. Singleterry. Interim rept. 13 Jan 60, 19p. 39 refs. NRL Rept. 5422.
Order from OTS $0.50 PB 161 067

Oil-soluble soaps in hydrocarbon solvents have been shown to form small and approximately isodimensional micelles. Under suitable conditions, some metal carboxylates form extended structures as well. Coordinate bonding is an important factor contributing to the stability of both types of structure. Micelles are in equilibrium with nonmicellar soap in the solvent so that the system behaves as a dilute but saturated soap solution in equilibrium with a finely divided saturating phase. This situation favors rapid and extensive adsorption on polar surfaces to effect detergency or rust inhibition. The presence of micelles facilitates the dissociation of oil-soluble soaps to produce stable micellar ions and to impart a stabilizing charge to polar particles suspended in the system. The solubilization of polar molecules in oil-soluble soap micelles involves coordination and sometimes hydrogen bonding. It provides a mechanism for the segregation of corrosive acids and of acidic precursors of sludge or lacquer. Solubilization of water by such micelles promotes dissociation of ion pairs in the micelle to form micellar ions and free anions. Water solubilization also allows secondary solubilization of inorganic salts not otherwise taken up by the micelle. Addition of excess water may lead to the formation of a stable water-saturated micelle or to the separation of a soap-rich liquid-crystalline phase. (Author)

Ohio State U. Research Foundation, Columbus.
RARE EARTH OXIDES. I. THE VAPORIZATION OF NEODYMIUM SESQUIOXIDE, Nd_2O_3. DISSOCIATION ENERGY OF NdO AND TaO, by Patrick N. Walsh and David White. Technical note 1 on Contract AF 18(600)1545. Jan 58, 19p. 24 refs. AFOSR-TN-58-291; AD-154 196.
Order from LC mi$2.40, ph$3.30 PB 144 643

The vaporization of Nd_2O_3 has been studied by the Knudsen effusion method in the temperature range 2040 to 2450°K. The dissociation energies for TaO and NdO is calculated to be $D_o^o(NdO) = 7.34 \pm 0.2$ e. v.

Ohio State U. Research Foundation, Columbus.
RARE EARTH OXIDES. II. THE VAPORIZATION OF LANTHANUM SESQUIOXIDE, La_2O_3, AND YTTRIUM SESQUIOXIDE, Y_2O_3; DISSOCIATION ENERGIES OF LaO, YO, AND TaO, by Patrick N. Walsh and David White. Technical note 2 on Contract AF 18(600)1545. Feb 58, 22p. 15 refs. AFOSR-TN-58-382; AD-154 289.
Order from LC mi$2.70, ph$4.80 PB 144 642

The vaporization of La_2O_3 and Y_2O_3 from tungsten and tantalum refractories has been studied by the Knudsen effusion method in the temperature ranges 2000-2450°K, and 2000-2700°K, respectively. The sesquioxides decompose to the corresponding monoxides and oxygen on vaporization from tungsten cells. The dissociation energies of the monoxides are $D_o^o(LaO) = 8.02 \pm 0.17$ e. v., and $D_o^o(YO) = 7.25 \pm 0.3$ e. v. LaO(g) and TaO(g) are the principal products formed in the vaporization of La_2O_3 from a tantalum effusion cell. Y_2O_3 also reacts with tantalum, yielding a mixture of YO(g), Y(g), and TaO(g). From the determination of the heats of these reactions, the dissociation energy of TaO(g) is found to be $D_o^o(TaO) = 9.34 \pm .06$ e. v. A method is described for deriving equilibrium concentrations and heats of formation from Knudsen effusion data when more than one reaction occurs in the Knudsen cell. (Author) (See also PB 144 643)

Plasmadyne Corp., Santa Ana, Calif.
AN EXPERIMENTAL STUDY OF SPARK STABILIZATION BY A GAS VORTEX, by Christopher Cobb and Vernon H. Blackman. Rept. on Contract AF 49(638)334. 28 Aug 59, 23p. 3 refs. T-3TN099-334; AFOSR TN-59-925.
Order from LC mi$2.70, ph$4.80 PB 144 768

For several years, pressure gradients in a gas flow have been used to stabilize an electric discharge. This work has been concerned mainly with a vortex flow in which the low density channel along the axis of the vortex can be used to confine an electric arc. It was decided to investigate transient discharges, i. e., sparks, in the presence of a gas flow. Since the vortex geometry is of great interest for arc applications, the work was oriented toward the discharge of sparks along the axis of a vortex, with the feeling that a time resolved photographic study of spark stabilization and growth in a vortex channel could shed information on the stabilization of arcs by the vortex motion.

Purdue U., Lafayette, Ind.
THE THERMOCHEMISTRY OF RHENIUM COMPOUNDS, by James P. King (Doctoral thesis). Rept. on Contract AF 18(600)1525. 26 Oct 59, 148p. 81 refs. AFOSR-TN-59-1164.
Order from LC mi$7.20, ph$22.80 PB 144 741

Mostly covers the following: The potential of the ReO_3/ReO_4^- electrode and the thermodynamics of rhenium trioxide. The heats of formation of rhenium trichloride and rhenium tribromide. The heat of formation of the hypochlorite ion. The entropy and structure of rhenide ion.

University of Southern California, Los Angeles.
PHOTOIONIZATION ANALYSIS BY MASS SPECTROSCOPY, by G. L. Weissler, J. A. R. Samson and others. Technical rept. no. 3 on Contract AF 19(604)2049. 1 Aug 58, 50p. 64 refs. AD-202 792.
Order from LC mi$3.30, ph$7.80 PB 137 534

A vacuum ultraviolet monochromator has been combined with a mass spectrometer similar to previously reported instrumentation to study photoionization processes between 1570A and 430A. Monochromatic photons were used to ionize A, He, Ne, O_2, N_2, CO, NO, CO_2, N_2O, and NO_2; and preliminary measurements of ion intensity as a function of photon energy have been obtained for the parent ions together with their fragments. The onset of ionization and the plot of ions per unit photon flux versus λ will be compared to previously reported work on photoionization cross sections. Dissociative ionization energies have also been determined for some of the above gases, and the results for N_2O favor the N_2 dissociation energy of 9.8 ev.

EARTH SCIENCES

Maryland U., College Park.
GENERAL CARGO HINTERLANDS OF NEW YORK, PHILADELPHIA, BALTIMORE AND NEW ORLEANS, by Donald J. Patton. Rept. no. 2 on Contract Nonr-595(05). Mar 58, 25p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 138 539

The present contribution to the study of port hinterlands has three objectives. First, hinterland origin and destination maps are presented for port traffic of a general cargo nature for New York, Philadelphia, Baltimore and New Orleans, the four leading general cargo ports in the eastern half of the United States. Second, several preliminary conclusions are presented regarding factors contributing to the hinterland patterns depicted. Third, an attempt is made to suggest several of the problems which would appear to merit attention in further research relating to the spatial relations of ports. (See also PB 135 898)

Quartermaster Research and Engineering Center, Natick, Mass.
GLAZE: ITS METEOROLOGY AND CLIMATOLOGY, GEOGRAPHICAL DISTRIBUTION, AND ECONOMIC EFFECTS, by Iven Bennett. Rept. on Contract DA 44-109-qm-1496. Mar 59, 224p. 216 refs. Technical rept. EP-105; AD-216 668
Order from LC mi$9.90, ph$34.80 PB 144 450

Information is given on air mass and frontal conditions associated with glaze formation in different parts of the United States. Maps illustrate surface and upper air synoptic patterns of typical glaze storms. Considerable new information is presented on the frequency, intensity, duration, and geographical distribution of glaze. Major emphasis is on the United States, but other parts of the world, particularly Europe, are included. Bituminous or macadam highway surfaces are slightly superior to concrete in inhibiting glaze formations and in contributing to its rapid melting. Material from highway departments of 34 states describes icing conditions encountered and methods used to combat the ice.

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
GENERAL DESIGN FOR WEATHER OBSERVING AND FORECASTING SYSTEM, 433L, by R. M. White, R. F. Myers and F. W. Ward. 15 Dec 57, 93p. 1 ref. AFCRC-TN-57-609; AD-133 846.
Order from LC mi$5.40, ph$15.30 PB 144 602

A study was made to review Air Force operational and technological weather support problems in order to recommend revisions and reorientations of the system design philosophy and development plan. No attempt was made to present a detailed plan: this is to serve as a general study which may function as a guide in the preparation of detailed engineering design plans. Topics of discussion include (1) the Air Force Weather problem, (2) system design characteristics, (3) system description, (4) system implementation, and (5) resources.

Air Force Cambridge Research Center, Bedford, Mass.
REFINEMENTS IN UTILIZATION OF CONTOUR CHARTS FOR CLIMATICALLY SPECIFIED WIND PROFILES, by Allen E. Cole. Oct 59, 28p. 118 refs. Air Force Surveys in Geophysics no. 116; AFCRC-TR-59-280.
Order from OTS $0.75 PB 161 346

Differences between mean monthly (or seasonal) wind profiles obtained from actual wind observations and those prepared from height contours of constant-pressure charts are examined. The study is divided into two parts: (a) a comparison of mean monthly vector winds based on complete sets of monthly rawin observations with geostrophic and gradient winds taken from mean monthly constant-pressure maps and (b) an investigation of the accuracy of mean monthly resultant winds computed from complete sets of rawin data. Procedures to be followed in preparing mean monthly and seasonal wind profiles from data obtained from the height contours on mean monthly constant-pressure maps are recommended. (Author)

Arizona State Coll., Flagstaff.
VODARO RESULTS FOR AUGUST 1954 THROUGH DECEMBER 1954 AT THE ATMOSPHERIC RESEARCH OBSERVATORY, FLAGSTAFF, ARIZONA, by Ewell Weems and Arthur Adel. Scientific rept. HB-6 on Infrared Spectroscopy of the Sun, Moon, and Earth, Contract AF 19(604)2177. 10 June 59, 23p. 4 refs. AFCRC-TN-59-464.
Order from LC mi$2.70, ph$4.80 PB 144 584

Vertical ozone distributions, obtained by the method of VODARO, are given for eighty-three days for the period August 54 through December 54. (Author)

Deutsche Forschungsanstalt für Segelflug (Germany).
MEASURE FLIGHTS FOR THE RESEARCH OF AEROPHYSICAL PROBLEMS; MEASUREMENT OF CLOUD ELEMENTS, ATMOSPHERIC VERTICAL VELOCITY, ATMOSPHERIC OZONE CONTENT, by Walter Georgii. Final rept. for 1 Mar 58-30 Sep 59 on Contract DA 91-508-EUC-297. 1959, 96p. 4 refs.
Order from LC mi$5.40, ph$15.30 PB 144 240

Size of cloud particles: Methods for direct and indirect determination of drop sizes in clouds are described. The methods developed are of sufficient accuracy to be applied for the determination of drop sizes. Vertical air velocity: (1) term of vertical velocity and vertical acceleration; (2) purpose of measurements concerning air traffic, missiles, gliding; (3) methods of measurements: flight measurements, combined measurements, balloon measurements (theodolite, radar); (4) own measurements; (5) vertical velocity and vertical acceleration in atmospheric boundary layers, in frontal zones, in waves, in local convection, and in mixing airmasses. Vertical distribution of ozone: Measurement flights of ozone have been carried out up to 6500 m altitude over forest areas, smaller settlements, over lakes and in the foot hills of the Alps. The flights indicated that the ozone amounts over the city have been always found smaller than over the country. The differences were not very great since the ozone content was always small over the country with the exception of flight No 11. During all other measurement flights a long period of high pressure dominated Europe with only small low pressure disturbances, which did not reach Bavaria. Correspondingly weak wind flow existed.

Deutscher Wetterdienst, Aachen (West Germany).
ATMOSPHERIC ELECTRIC AND METEROLOGICAL INVESTIGATIONS IN HIGHER MOUNTAIN RANGES, by Hans Israel. Final rept. on Alps-Proj. 1954-57, Contract AF 61(514)640. 1 Sep 57, 177p. 94 refs. AFCRC-TR-58-248; AD-152 607.
Order from LC mi$8.10, ph$27.30 PB 137 823

During a period of 13 months geophysical measurements were made at more than four stations, situated between 200 and more than 3.500 m above sea level in Switzerland. The measurements concerned in general the electric potential gradient of the atmosphere, the air-earth current, the general local brightness and the general meteorological data - and partially the two polar electric conductivities of the atmosphere, the content in condensation nuclei, the sun radiation in several spectral ranges and the ozone content. The results of the first total evaluation are given in 16 reports, four of which deal with the measuring technique. (See also PB 137 365)

Florida State U., Tallahassee.
FINAL REPORT, by Noel E. LaSeur. Rept. on Contract AF 19(604)753. 31 July 59, 24p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 144 531

Research devoted primarily to two general problems: (1) the structure, analysis and forecasting of synoptic scale weather systems in the tropical Atlantic region; and (2) hurricane structure and some aspects of its relation to the formation, movement and dissipation of these storms.

High Altitude Observatory, Boulder, Colo.
THE DEVELOPMENT OF THERMALLY DRIVEN CIRCULATIONS, by B. Haurwitz. Scientific rept. no. 1 on Contract AF 19(604)5488. Nov 59, 34p. 3 refs. AFCRC-TN-59-628.
Order from LC mi$3.00, ph$6.30 PB 144 592

Some simple models of atmospheric circulations are considered. It is assumed that a temperature difference in the horizontal is established and maintained by some outside agency, such as differential solar heating. The resulting motion is studied without and with the effects of friction. The advective temperature change which appears as a non-linear term in the differential equations is taken into account. Mathematical expressions are given for the development of the circulation without friction.

Illinois State Water Survey, Urbana.
AN EVALUATION OF THE AREA INTEGRATOR, by Eugene A. Mueller. Research rept. no. 7 on Contract DA 36-039-sc-75055. Dec 58, 37p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 144 670

The operational results of the area integrator as developed by the Illinois State Water Survey are reported. The use of a range integrating device with radar as a solution to the incoherent return from precipitation is described and found to improve the area comparisons of the area integrator to the radar. Results of the study indicate that better relationships between radar power return and precipitation rate must be determined before the area integrator becomes a useful tool. At present the quantitative amounts as determined by the area integrator are as accurate as the amounts obtained manually from the radar. (Author)

Massachusetts Inst. of Tech., Cambridge.
HEMISPHERIC HUMIDITY CONDITIONS DURING THE YEAR 1950, by Jose P. Peixoto. Scientific rept. no. 3 on General Circulation Project, Contract AF 19(604)2242. Oct 58, 146p. 9 refs. AFCRC-TN-58-609; AD-207 285.
Order from LC mi$7.20, ph$22.80 PB 137 989

A monograph is presented which contains the final outcome of an observational study of the water vapor field for the year 1950. The analysis was performed on polar stereographic maps showing the main geographical features. From these maps, zonally averaged values are obtained for any of the moisture characteristics. The moisture properties can be averaged over limited regions of the map for comparison with hydrologic and oceanographic measurements (e.g., evaporation and salinity measurements). The study is concerned only with the water in the vapor phase which is the most important form in which water is transported.

Massachusetts Inst. of Tech., Cambridge.
MEASUREMENT OF DROP SIZE DISTRIBUTION AND LIQUID WATER CONTENT IN NATURAL CLOUDS, by D. P. Keily and S. G. Millen. Scientific rept. no. 1 on Contract AF 19(604)3050. 30 Dec 58, 57p. 2 refs. AFCRC-TN-59-494; AD-228 667.
Order from LC mi$3.60, ph$9.30 PB 144 798

Cloud drop size distributions observed from aircraft are presented for 2 stratus and thin cumulus situations. As in a previous thin cumulus observation, 2- to 4-μ diameter drops predominate and liquid water content is much less than one tenth g/cu m. (Author)

Michigan U. Research Inst., Ann Arbor.
RESEARCH IN THE MEASUREMENT OF AMBIENT PRESSURE, TEMPERATURE, AND DENSITY OF THE UPPER ATMOSPHERE BY MEANS OF ROCKETS, by N. W. Spencer. Final rept. on Contract AF 19(604)545, continuation of Contract AF 19(122)55. June 58, 95p. 23 refs. 2096-18-F; AFCRC-TR-58-464; AD-203 480.
Order from LC mi$5.40, ph$15.30 PB 137 759

A summary discussion of research activities that took place under the subject contract is given. A listing of reports and papers prepared during the contract is included, as well as two appendices to formalize earlier informal letter reports.

Naval Ordnance Test Station, China Lake, Calif.
THE RELATION OF UPPER-AIR TURBULENCE TO TROPOPAUSE LAYERS, by Royal C. Gould. 1 Jan 59, 35p. 1 ref. NOTS-TP-2242; NAVORD-6544.
Order from LC mi$3.00, ph$6.30 PB 144 702

This report is concerned with the occurrence of turbulence aloft associated with tropopause layers, and is based on rawinsonde data taken at the Naval Ordnance Test Station, China Lake, over a two-year

period. Types of turbulence, frequency of occurence, and contributing weather factors are analyzed. It was found that turbulence was invariably associated with tropopauses, and the characteristics, type, and magnitude of the turbulence were attributed to the proximity, relative position, and degree of intensity of frontal activity. (Author)

Texas A. and M. Coll., College Station.
THE SYNOPTIC ANALYSIS AND FORECASTING APPLICATIONS OF RADAR WEATHER OBSERVATIONS, by Myron G. H. Ligda. Final rept. on Contract AF 19(604)1564. June 58, 131p. 39 refs. Reference 58-9F; AFCRC TR-58-251; AD-152 629.
Order from LC mi$6.90, ph$21.30 PB 138 225

The use of radar observations in intermediate range (12 to 48 hr) forecastings is treated. By application of an analytical technique which involves determination of the past, current, and future location of discrete volumes of atmosphere of high water content, elements of weather forecasting can be determined more precisely. The problems of storm structure are considered.

Weather Forecasting Research Center, U. of Chicago, Ill.
THE THERMAL FIELD OF THE ARCTIC STRATOSPHERE NEAR 80°W IN JANUARY, by E. Paul McClain. Scientific rept. no. 11 on Contract AF 19(604)2179. Sep 59, 23p. 18 refs. AFCRC-TN-59-619; AD-227 653.
Order from LC mi$2.70, ph$4.80 PB 144 689

Revised means, frequency distributions and other statistics based on 10 years of January temperature observations at the 200, 100, and 50-mb levels are presented for 4 arctic stations. The frequency distributions are shown to be markedly bimodal, a characteristic which becomes more pronounced with increasing height and latitude. Thermal conditions in the arctic and antarctic stratospheres are compared with the aid of recent IGY data. (Author)

Wisconsin U., Madison.
STUDIES ON THE STRUCTURE OF TURBULENCE, by J. A. Businger, V. E. Suomi, and H. A. Panofsky. Final rept. on Contract AF 19(604)1384. 31 Aug 58, 71p. 3 refs. AFCRC-TR-59-213; AD-210 492.
Order from LC mi$4.50, ph$12.30 PB 144 428

Contents:
A generalization of the mixing length concept
Similarity and dissimilarity between turbulent transfer of heat and momentum near the earth's surface
The spectrum of vertical velocity
Sonic anemometer thermometer observations at Hancock 1957

Geodesy

Air Force Cambridge Research Center, Bedford, Mass.
STUDY OF A PULSED LOGARITHMIC PHOTOMETER, by Michael R. Zatzick. Sep 59, 29p. 22 refs. Instrumentation for Geophysics and Astrophysics no. 11; AFCRC-TR-58-275.
Order from OTS $0.75 PB 161 344

A pulsed photometer circuit with a quasi-linear logarithmic response, covering a usable dynamic range of 5 orders of magnitude, is described in detail. A circuit analysis is given and an equation for the theoretical sensitivity curve (log of incident intensity vs. total dynode voltage) is derived. The experimental curve for the test circuit is in good agreement with the derived result. The thermionic dark current and leakage current are shown to be the factors which determine the range and linearity of the response. A semiquantitative argument is used to calculate the transient response in limiting cases, and the design requirements for optimizing the speed of response are discussed. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
A TREATMENT OF ANALYTICAL PHOTOGRAMMETRY WITH EMPHASIS ON BALLISTIC CAMERA APPLICATIONS, by Duane C. Brown. 20 Aug 57, 145p. 34 refs. RCA data reduction technical rept. no. 39; AFMTC-TR-57-22; AD-124 144.
Order from LC mi$7.20, ph$22.80 PB 143 235

The theory and the methods underlying the reduction of ballistic camera observations at the Air Force Missile Test Center are presented. (Author)

Northwestern U., Evanston, Ill.
AN ESSAY KEY FOR THE PHOTOIDENTIFICATION OF FARM CROPS AT SEVERAL INTERVALS DURING THE GROWING SEASON IN NORTHERN ILLINOIS, PART I. NATURE OF THE PROBLEM; PART II. GENERAL ASPECTS OF THE PHOTO APPEARANCE OF CROPS, by Clyde F. Kohn. Technical rept. no. 3 on Contract N7onr-45005. Dec 52, 47p. 24 refs. ATI-206 337.
Order from LC mi$3.30, ph$7.80 PB 144 692

One major problem in the use of aerial photographs in the study of crop distribution is the lack of keys for the identification of farm crops. This monograph is directed to the development of such keys. The interpretation of photographs used in the development of the keys was based on principles laid down in recent studies.

Northwestern U., Evanston, Ill.
AS ESSAY KEY FOR THE PHOTO IDENTIFICATION OF FARM CROPS AT SEVERAL INTERVALS DURING THE GROWING SEASON IN NORTHERN ILLINOIS. PART III. PHOTO APPEARANCE OF HAY FIELDS, by Clyde F. Kohn and Marjorie Smith Goodman. Technical rept. no. 3 on Contract N7onr-45005. July 53, 44p. AD-15 690.
Order from LC mi$3.30, ph$7.80 PB 144 693

An analysis was made of 23 hay fields scattered throughout a 13 1/2-sq mi area. The samples included hay in all possible associations with types of landforms, soils, and variations in farm practices. The fields may be identified easily and with accuracy. Hay fields have 2 characteristics in common with other crops in the research area. They are of the same size and form as fields of other crops, and the photo appearance of hay fields is not affected by variations in landforms and soils, and only slightly by variations in farm practices. The fields possess 5 characteristics which distinguish them from other crops on aerial photographs. The 2 cycles of growth through which hay passes are recorded on aerial photographs by a cyclic progression of tonal values. At each stage of growth, there are unique field markings (texture), tonal values, and objects associated with hay fields. The fields outnumber all other kinds of cultivated crops. Tones of hay fields during their early, middle, and late stages of growth register more darkly than any other group. There are no periodic limitations to the aerial photo identification of hay crops as there are to the identification of other crops in the research area. (See also PB 144 692)

Pennsylvania U., Philadelphia.
SUMMARY OF SCIENTIFIC RESULTS, by Lester E. Klimm. Rept. for 1 Dec 56-1 Dec 57 on Contract Nonr-551(01). 1 Dec 57. 7p. AD-148 211.
Order from LC mi$1.80, ph$1.80 PB 138 077

Descriptions and graphic compilations are presented of the following land-use map categories of Pennsylvania from 1:250,000-scale aerial photography: (1) the D-line method and the nearest-neighbor concept, (2) possible naval application of the D-line method, (3) multiple-category D-line analysis, (4) detailed analysis of a single dispersant having area, (5) the D-line method applied to distribution of points, and (6) the D-line method without counting or sampling the actual distribution. This approach provides a wide selection of actual distribution of categories for analysis of areal association in a state where landscapes vary from being simple to very complex.

Oceanography

Air Force Cambridge Research Center, Bedford, Mass.
SCIENTIFIC STUDIES AT FLETCHER'S ICE ISLAND, T-3 (1952-1955), VOLUME I, by Vivian Bushnell. Sep 59, 229p. 109 refs. Geophysical Research Papers no. 63; AFCRC-TR-59-232(1); AD-216 813.
Order from OTS $3.50 PB 161 289

Contents:
Geophysical studies in the Arctic Ocean by A. P. Crary and Norman Goldstein
Oceanographic observations by L. V. Worthington
The movement of ice in the Arctic Ocean by Irene M. Browne and A. P. Crary
Micropaleontology and lithology of arctic sediment cores by David B. Ericson and Gosta Wollin
Ecology of some arctic foraminifera by Keith E. Green
Marine biological work by John L. Mohr
Birds in the upper Arctic by Raymond A. Paynter, Jr.
Pelagic and benthic polychaetes of the Central Arctic Basin by George A. Knox
Epipelagic and under-ice amphipoda of the Central Arctic Basin by J. Laurens Barnard
Tritium observations by B. J. Giletti and J. L. Kulp
Oxygen isotope measurements on arctic cores by Wayne U. Ault

Marine Lab., U. of Miami, Coral Gables, Fla.
STRAITS OF FLORIDA: PHYSICAL AND CHEMICAL DATA MAY 1957 - NOVEMBER 1958, by M. P. Wennenkens, D. M. Dunlop and others. Rept. on National Science Foundation Grant G-5041 and Contract Nonr-840(01). Dec 58, 84p. Rept. 58-5.
Order from LC mi$4.80, ph$13.80 PB 144 746

This report contains hydrographic and G. E. K. data collected between May 1957 and November 1958. Sampling stations are shown on the accompanying charts. The positions of the sampling stations are determined from D. R. plots and radar fixes. Sampling was by means of Nansen reversing water bottles. Deep-sea reversing thermometers were used to determine temperature; at each station. The depths reported for sub-surface observations were calculated from measured wire angles and from unprotected reversing thermometers; accepted depths were determined by using the depth-ratio (Z/L) method as described in H. O. Publication No. 607.

Physics of the Atmosphere

Air Force Cambridge Research Center, Bedford, Mass.
A PRELIMINARY REPORT ON A BOUNDARY LAYER NUMERICAL EXPERIMENT, by Mariano A. Estoque. Oct 59, 36p. 31 refs. GRD Research notes no. 20; AFCRC-TN-59-462.
Order from OTS $1.00 PB 161 341

A mathematical model of the atmospheric boundary layer over a flat homogeneous terrain is presented. The model consists of two sublayers: a thin sublayer adjacent to the earth's surface in which the fluxes of momentum and heat are independent of height and an overlying transitional zone where frictional effects gradually decrease with height. The equations are integrated numerically to obtain the distributions of wind and temperature with height during a 24-hour period for a given set of initial and boundary conditions. The results indicate that the model is capable of predicting the diurnal wind and temperature variations which are observed over flat homogeneous terrain. (Author)

[Army] Signal [Research and Development Lab.] Fort Monmouth, N. J.
STUDY OF SINGLE STATION ATMOSPHERIC

SOUNDING SYSTEMS, VOLUME II, by Howard Davis and Seymour S. Shefter. 17 June 52, declassified 8 Sep 54. 116p. Technical memo. no. M-1453; ATI-175 097.
Order from LC mi$6.00, ph$18.30 PB 144 649

The investigation of meteorological, electronic, and other applicable instrumentation techniques to be ultimately applied to atmospheric sounding equipments included the determination of the capabilities of known equipments. In Volume I, the theoretical capabilities of a number of equipments were analyzed and it was indicated that the rawin, remitter, and radar systems were superior to the other systems. A number of flight tests were conducted to determine whether the equations derived in Volume I contained all the factors essential to a determination of the equipment accuracy, and to determine the correctness of the various system errors assumed.

Naval Research Lab., Washington, D. C.
ROCKET RESEARCH REPORT NO. 29. THE VIKING 10 FIRINGS, by Milton W. Rosen and James M. Bridger. Interim rept. 5 May 55, 39p. 6 refs. NRL Rept. 4513.
Order from LC mi$3.00, ph$6.30 PB 145 038

The tenth Viking rocket, launched at White Sands Proving Ground, New Mexico, on May 7, 1954, carried a payload of 675 pounds to an altitude of 136 miles. At the first attempt to launch this rocket on June 30, 1953 an explosion occurred in the combustion chamber. The repaired rocket was modified to include redesigned control systems which were being prepared for the new series of rockets beginning with Viking 11, and the ground equipment was redesigned and rebuilt. On the second flight attempt, the rocket performed well; there was some improvement in propellant loading, but there was a significant loss in peak altitude because of an excess of oxygen at burnout. The attitude control of the rocket was much better than in previous flights, and research equipment in the rocket operated properly; important data were obtained on the structure and composition of the ionosphere and on aerodynamic heating. Telemetering performance was excellent; a continuous record from takeoff to blowoff, at 474.3 seconds, was obtained. The rocket was tracked by radar from 27 seconds to 495 seconds, and by Askania theodolites for 102 seconds, and doppler data were obtained for 475 seconds. Trajectories, obtained from data provided by rocket-borne and range instrumentation, are compared in Appendix A. (Author)

Naval Research Lab., Washington, D. C.
THE USE OF HIGH-ALTITUDE ROCKETS FOR SCIENTIFIC INVESTIGATIONS: AN ANNOTATED BIBLIOGRAPHY, by Mildred Benton. Oct 59, 132p. 965 refs. Bibliography no. 16.
Order from OTS $0.50 PB 151 805

The growth and development of upper-atmosphere investigation by means of rockets is delineated in the periodical articles and technical reports referenced and annotated in this bibliography. Both domestic and foreign literature is included. The period covered is 1946 - June 1959. References are listed chronologically by author or issuing agency. An author index and a subject index are included. For periodical references, the normal form of entry is author, title, and journal, volume, pagination, and date, followed by a brief annotation or abstract. The form of entry for books is author, title, pagination, place of publication, publisher, and year. This sequence is also followed in citing articles in Proceedings of meetings, symposia and conferences. Research reports are reported in a similar manner except that place of publication follows the corporate author. The report number is also included following the date of publication, as well as the contract number, for sake of convenience in ordering or borrowing. The majority of references have been examined. When examination was not possible, due to non-availability of the publication, entries located in abstracting journals were used, or the statement "not examined" included.

ENGINEERING

Aeronautical Engineering

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RECALIBRATION PROCEDURE FOR OXYGEN REGULATOR TEST STAND CALIBRATOR (NATIONAL INSTRUMENT LABORATORY CALIBRATOR) by James E. P. Davis. Rept. on In Service Test Apparatus. Aug 59, 17p. 1 ref. WADC Technical note 59-275.
Order from OTS $0.50 PB 161 334

This report gives a detailed description of the apparatus used to recalibrate an oxygen regulator test stand calibrator. It also provides an accurate system for data processing and recording which gives a final calibration accuracy of ±0.5%. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE ESTIMATION OF SHORT-TIME FLIGHT PATHS FOR INTERCEPTION DASHES, by Ray Holland, Jr. (New Mexico Military Inst.) Nov 59, 35p. AFMDC-TN-59-33.
Order from LC mi$3.00, ph$6.30 PB 144 596

A method to systematize the selection of a short-time flight path is presented. It is intended to be used as the first approximation in an iterative variational computation for determining a true minimum time path for interception dashes. The method applies to an aircraft already airborne flying in a short time from specified initial values of horizontal position x_o, altitude y_o, and velocity v_o to specified destination values of horizontal position x_n and altitude y_n, remaining at all times in a single vertical plane. (Author)

Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ENVIRONMENTAL ASPECTS OF SONIC FATIGUE, by Orville R. Rogers and Robert F. Cook. Rept. on Aeroelasticity, Vibration and Noise. Feb 57, 19p. WADC Technical note 57-68; AD-118 072.
Order from LC mi$2.40, ph$3.30 PB 144 802

Equipment and aircraft structures as presently designed are not always adequate to withstand the high intensity noise produced by modern powerplants used in military aircraft. The methods presently used to test equipment and structure do not include testing in intense noise. The purpose of this report is to consolidate available noise data in a useable form to determine methods of testing equipment and structure in noise. As a result of this study requirements for noise test equipment are more closely defined. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
ARC WELDING OF HIGH-STRENGTH STEELS FOR AIRCRAFT AND MISSILE STRUCTURES, by J. T. Niemann, R. P. Sopher, and P. J. Rieppel. 31 July 59, 45p. 13 refs. DMIC memo. 27; AD-220 519.
Order from OTS $0.50 PB 161 177

High-strength steels are being used in many aircraft and missile applications because of their good mechanical properties at room temperature and up to 1000 F. The steels in this category include hot-work die steels and martensitic and precipitation-hardening stainless steels. In addition, there is considerable interest in low-alloy hardenable steels which have room-temperature yield strengths in excess of 200,00 psi. One of the important considerations in selecting these steels for a particular application is their ability to be fabricated by welding. For the past several months, the Defense Metals Information Center has been collecting information on welding the high-strength steels. This report presents the data now available on arc welding. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
TITANIUM FABRICATION AND RELIABILITY PROBLEMS IN AIRCRAFT, by W. Stuart Lyman, C. T. Olofson, and A. M. Federico (North American Aviation, Inc.) 4 Sep 59, 32p. 20 refs. DMIC memo. 33; AD-226 589.
Order from OTS $0.50 PB 161 183

Presented at the Western Metal Congress in Los Angeles, Calif., 19 Mar 59.

This memorandum is intended to be a brief, up-to-date summary of fabrication and reliability problems associated with titanium. Most of the available information is on fabrication; little has been published about reliability. A selected bibliography at the end of the memoranudm lists 20 reports and publications related to titanium fabrication and (to a very slight extent) reliability. The memorandum itself briefly reviews the subject in four quick steps: (1) Metallurgical background, (2) Reliability of incoming material, (3) Shop experiences, and (4) Service reliability. (Author)

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT LIGHT SOURCE TECHNIQUES TO A BREAKOUT LANDING ATTACHMENT FOR A TWIN-ENGINE INSTRUMENT TRAINER. Rept. on Contract Nonr-1628(00). Mar 59, 60p. 7 refs. Technical rept. NAVTRADEVCEN-1628-2; AD-227 558.
Order from LC mi$3.60, ph$9.30 PB 144 452

This report describes the results of a study to determine if a satisfactory visual presentation can be obtained with point light source techniques for a low ceiling, poor visibility landing training attachment for a twin-engine instrument trainer. The scope and important elements of the problem were determined through interviews with pilots as well as from the requirements of the contract specification. A very promising point source projection system has been devised for use as a low ceiling, poor visibility landing training attachment for a twin-engine instrument trainer. The techniques employed to simulate atmospheric conditions which limit visibility (fog, haze, rain and snow) have been proved successful in a mock-up of limited scope. It is recommended that other aspects of the proposed system be evaluated through the experiments described.

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TECHNIQUES TO HELICOPTER LOW-ALTITUDE NAVIGATION TRAINING. Rept. on Contract Nonr-1628(00). Mar 59, 49p. 8 refs. Technical rept. NAVTRADEVCEN-1628-3.
Order from LC mi$3.30, ph$7.80 PB 144 453

This report describes the results of a study to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to a helicopter low altitude navigational trainer. The scope and the important elements of the problem were determined through interviews with pilots as well as from the requirements of the contract specification. A very promising point source projection system has been devised for use in helicopter low altitude navigational training. It is recommended that this system be evaluated through the experiments described. (See also PB 144 452)

DeFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TECHNIQUES TO LOW ALTITUDE-HIGH SPEED NAVIGATION TRAINING. Rept. on Contract Nonr-1628(00). Apr 59, 49p. 8 refs. Technical rept. NAVTRADEVCEN-1628-4.
Order from LC mi$3.30, ph$7.80 PB 144 454

This report describes the results of an investigation to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to a low altitude-high speed navigation trainer. It includes an analysis of the training task to determine the skills to be developed and the cues required for its performance. A very promising point source projection system has been devised for use in low altitude-high speed navigation training. It is recommended that this system be evaluated through the experiments described. (See also PB 144 453)

Flight Control Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE INFLUENCE OF GEOMETRY PARAMETERS UPON LAG ERROR IN AIRBORNE PRESSURE MEASURING SYSTEMS, by J. P. Lamb, Jr. July 57, 53p. 15 refs. WADC Technical rept. 57-351; AD-130 790.
Order from LC mi$3.60, ph$9.30 PB 144 530

The general nature of the lag problem in airborne pressure measuring systems is discussed. It is concluded that variations in system geometry offer the most promise in improving response. The remainder of the report is given to a theoretical examination of various geometry parameters and to an evaluation (utilizing both theoretical and experimental methods) of their effect upon lag error. Techniques for computing lag error in any system are presented. Theory and experiment are shown to be in agreement for the case of laminar flow. Evidence of transitional flow is also presented. Based upon the results of the study, specific dimensions for tubing lines and pitot-static tube chambers are recommended for use in the static pressure systems of high performance aircraft. (Author)

General Electric Co. [Schenectady, N. Y.]
ELECTROLUMINESCENT LIGHTING OF AIRCRAFT INSTRUMENTS, by John J. Fraizer. Rept. on Contract AF 33(616)5277. Sep 58, 154p. 13 refs. WADC Technical rept. 58-510; AD-202 504.
Order from LC mi$7.50, ph$24.30 PB 144 902

One phase of the report is the results of environmental tests applied to 5 manufacturers' lamps. Included are temperature, humidity, radio noise, voltage, and frequency tests. The data has been evaluated and analytical relationships have been developed. The second phase of the report is the application of electroluminescence to lighting various aircraft instruments. The instruments lighted included tachometers, flowmeters, voltmeters, and two vertical tape devices. Specific problems encountered were bringing power to pointer lamps on a low torque indicators, lighting a cyclometer register, and lighting vertical tapes. (Author)

Lear, Inc. [Grand Rapids, Mich.]
WHOLE PANEL STUDY AND DEVELOPMENT. SUMMARY REPORT 1957-1958. Rept. for 1 July 57-30 June 58 on Control-Display Integration Program, Contract AF 33(616)5167. Rev. Mar 59, 290p. 30 refs. Lear Engineering rept. 1289-1; WADC Technical rept. 58-447; AD-155 815.
Order from LC mi$11.10, ph$44.10 PB 144 543

The primary objective of the program was advancement of the state of the art of instrument panel and cockpit design. The cockpits were designed for classes of vehicles rather than specific Air Force weapons systems of the future. The pilot-manager concept, which was conceived during this program, is explained. Two cockpits, called the Mark II and Mark III, were delivered to the Air Force. The instrumentation and layouts of these cockpits are described. Also presented is an enumeration of individual items studied which have been selected for further study by the Air Force and airframe manufacturers. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A REVIEW OF THE AIR FORCE MATERIALS RESEARCH AND DEVELOPMENT PROGRAM, by Helen H. Maxwell. Rept for 1 July 58-30 June 59. Nov 59, 169p. WADC Technical rept. 53-373, Supplement 6.
Order from OTS $3.00 PB 111 648 (sup. 5)

Two hundred and twelve (212) technical reports and technical notes written during the period 1 July 1958-30 June 1959 are abstracted herein. These reports cover the following general areas of research: adhesives, biochemistry, electronic materials, materials physics, metallurgy, petroleum products, plastics, protective treatments, rubber and textiles. A numerical index, contractor index and an investigator index of all the technical reports and technical notes issued during the period March 1923 - June 1959 are also provided. (Author) (See also PB 111 648 S4)

Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF A FATIGUE TESTING APPARATUS FOR TESTING HONEYCOMB SANDWICH STRUCTURAL PANELS IN SERVICE-SIMULATED SONIC FATIGUE, by Edmond F. E. Zeijdel and William H. Ashley. Rept. for 15 Apr 57-15 Apr 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5172. Sep 59, 40p. 8 refs. WADC Technical rept. 59-231.
Order from OTS $1.00 PB 161 317

Theoretical and experimental investigations for the development of a fatigue testing apparatus for testing honeycomb sandwich panels in service-simulated sonic fatigue are described in this report. These investigations indicate the need of a 200,000-v. AC generator to simulate electrostatic fields of approximately 400,000 v/cm. In addition, it is indicated that the medium surrounding the test specimen must be changed to prevent corona discharge. For this purpose sulfur hexafluoride at 9 to 10 atmospheres may be utilized. The design of a 200,000-v. AC generator is complicated and expensive. An alternative procedure to accomplish the same objectives is therefore recommended. (Author)

New York U. Coll. of Engineering, N. Y.
HANDLING AIR CONTAMINANTS RESULTING FROM A CLOSED ECOLOGICAL SYSTEM, by Gerald Palevsky. Progress rept. on the Engineering Biotechnology of Handling Wastes Resulting from a Closed Ecological System, Contract AF 18(603)71. July 57, 18p. 28 refs. AFOSR-TN-58-269; AD-154 170.
Order from LC mi$2.40, ph$3.30 PB 137 797

Consideration is given to the control of temperature, humidity, air motion, foreign matter, microorganisms, air conditioning, and water supply in creating an acceptable environment for humans working in a closed ecological system. Each factor is considered in relation to the others.

North American Aviation, Inc., Columbus, Ohio.
DOD HIGH STRENGTH TITANIUM ALLOY SHEET RESEARCH PROGRAM, by A. M. Federico and P. Maynard. Progress rept. no. 5, 1 July-30 Sep 58, on Contract NOas 57-785-d. 31 Oct 58, 32p. Rept. no. NA57H-527-5; AD-207 900.
Order from LC mi$3.00, ph$6.30 PB 137 866

Preliminary fusion and resistance welding tests are in progress on small quantities of 4Al-3Mo-1V and 16V-2 1/2 Al received.

Oklahoma U. Research Inst., Norman.
ANALYSIS DESIGN STUDY OF A HIGH CAPACITY LIGHTWEIGHT COMPRESSOR, by A. C. Buckingham, Stan H. Lowy and B. V. Ketcham. Final rept. on Contract DA 44-177-tc-502. 9 Feb 59, 156p. 16 refs. AD-208 315.
Order from OTS $3.00 PB 161 347

This design study has established the feasibility of a vane type oscillating compressor suitable for various applications where unit weight is a major consideration. In a comparative analysis with the best available lightweight centrifugal compressor, the vane type unit for a given pressure ratio and mass flow was far superior in displacement and weight savings. The comparison was made on the basis of compressor weight per atmosphere pressure rise per mass flow. Compared to the sliding vane, positive displacement compressor with discharge pressures up to 9 1/2 atmospheres and capacities to 2000 cubic feet per minute, the vane type oscillating compressor still maintains a large weight advantage. This weight advantage increases still further when comparison is made with impeller or gear type positive displacement compressors.

Princeton U., N. J.
EFFECT OF FLAPPING HINGE RESTRAINT AND OFFSET ON THE STABILITY AND CONTROL OF UNDUCTED STAND-ON HELICOPTERS, by Peter Hampton. Rept. on Contract DA 44-177-tc-392. May 59, 138p. 6 refs. Rept. no. 462; AD-227 157.
Order from LC mi$6.90, ph$21.30 PB 144 816

This report deals with the longitudinal stability and control of unducted stand-on helicopters. The effect is investigated of varying the physical characteristics of the rotor system of a typical machine of this type. The rotor, which was presumed to be rigid on the original machine, is now considered as a rotor of the flapping type, modified by: (a) varying the spring restraint of a flapping hinge mounted at the rotor hub. (b) varying the offset from the rotor hub of a free flapping hinge. In addition the induced velocity through the rotor is assumed to have a linear longitudinal variation. Theoretical stability derivatives are obtained for these cases and the resulting stability and control discussed. (Author)

Princeton U., N. J.
LONGITUDINAL STABILITY AND CONTROL OF A DUCTED-ROTOR FLYING PLATFORM, by Joseph J. Traybar. Rept. on Contract DA 44-177-tc-392. May 59, 144p. 9 refs. Rept. no. 464; AD-227 158.
Order from LC mi$7.20, ph$22.80 PB 144 815

An analysis is presented for the prediction of the longitudinal stability and control characteristics of a ducted-rotor flying platform. The stability characteristics of this vehicle are corroborated by the investigations and exhibited rather clearly by various stability diagrams. Artificial stabilization is discussed and can be used to stabilize certain configurations. The predictions of excessive trim requirements and large tilt angles for forward flight are substantiated. Also, the effects of changing duct design and vertical center of gravity location on the stability derivatives are discussed, and material is presented to reflect the degree to which these changes can be used as aids in stabilizing the platform. (Author)

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
PRESSURE DISTRIBUTION IN TRANSONIC FLOW OF RIBBON AND GUIDE SURFACE PARACHUTE MODELS, by H. G. Heinrich, J. G. Ballinger, and P. E. Ryan. Rept. on Contract AF 33(616)3755. Feb 59, 96p. WADC Technical note 59-32; AD-210 257.
Order from LC mi$5.40, ph$15.30 PB 145 031

The pressure distributions over the canopy of two rigid parachute models were made in a speed range of free stream MACH numbers from .6 to 1.2. Internal and external pressure distributions were conducted on a guide surface and a ribbon model parachute. The results of these data will be used in determining an accurate method of calculating the heat transfer throughout a parachute canopy during descent. Presented are details pertaining to the test methods and equipment used to obtain the experimental data. (Author)

Servomechanisms Lab., Mass. Inst. of Tech., Cambridge.
SIMULATION OF AIRCRAFT, by Mark E. Connelly. Rept. on Contracts N5ori-07895 and N61339-45. Feb 58, reprinted May 59, 206p. Technical rept. NAVTRADEVCEN 7591-R-1.
Order from LC mi$9.30, ph$31.80 PB 144 640

This report is an outgrowth of a one-year study of the equations of motion and the computing techniques used in the aerodynamic computer section of Operational Flight Trainers. One of the objectives of the study was to standardize and simplify, insofar as possible, the mathematical model used to represent an aircraft in flight. In this connection, an extensive analysis of axis systems, basic dynamics, and aerodynamic coefficients was carried out. Digital and analog simulation studies were employed to determine allowable simplifications in the equations of motion. The results of this work are summarized in the following report. Although the emphasis is on flight simulators used for training purposes, the material presented is generally applicable to the entire field of flight simulation. (Author)

Chemical Engineering

Army Engineer Research and Development Lab., Fort Belvoir, Va.
MOBILE LIQUID-OXYGEN PLANT, by Edward F. Kelley. Rept. for Jan 46-Jan 58 on Liquid Oxygen Plants, Storage, and Distribution Equipment (10-100 Tons per Day). 23 June 58, 131p. Technical rept. 1532-TR.
Order from LC mi$6.90, ph$21.30 PB 144 730

The report concludes that: a. The application of the Kapitza principles of liquefying air for the production of liquid oxygen, using the low-pressure cycle and turboexpander, has been accomplished to meet the military requirements for mobile, van-mounted, liquid-oxygen generators. b. The end result is a reduction in weight per ton of product, compared with industrial machinery, in the order of 75 percent. c. Development work should be continued. Development work should be pursued toward the end of transferring liquid oxygen by static pressure in lieu of the pump.

Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRICAL CLEANUP OF GASES, by J. H. Carmichael. Progress and final rept. for Mar 54-Mar 59 on Contract AF 18(600)1049. 1 May 59, 6p. 5 refs. Research rept. 71F191-R20; AFOSR TR-59-80.
Order from LC mi$1.80, ph$1.80 PB 142 947

A study of the mechanism for trapping gases as ions on metal surfaces has been made. In order to separate ionic pumping from chemical absorption, only rare gases were used. In these studies it was found that the re-emission of these gases from the surface was playing an important role. A study of the ionic pumping and spontaneous re-emission of these gases has contributed considerably in an understanding of the pumping characteristics of ion pumps and ionization gauges.

Civil Engineering

Bureau of Yards and Docks, Washington, D. C.
HOUSING ADMINISTRATION. 5 Aug 57, 433p. Technical pub. NAVDOCKS TP-Ad-3, Rev.; BUDOCKSINST 11101.29A.
Order from LC mi$11.10, ph$66.60 PB 144 513

This Technical Publication is intended for the guidance of personnel concerned with the procurement, administration, maintenance, and operation of housing facilities and programs under the jurisdiction of the Department of the Navy. It cites the authorities, powers, and responsibilities under which Navy housing facilities and programs are administered. It prescribes the procedures to be followed to obtain effective control and administration of housing, gives technical guidance and counsel, and sets out the considerations to be taken into account in making decisions. It seeks to bring about efficiency, standardization, and procedural uniformity in the administra-

policies on housing in general, the methods used to classify housing, and the organizational provisions made by the Navy to handle housing matters. Chapter 2 is devoted to public quarters. It discusses general aspects of public quarters administration, including designation, assignment, occupancy, equipping, and accountability. Chapter 3 deals with Title VIII (Wherry) housing. It sets forth policies, legislation, regulations and authorities; procedures; and the respective responsibilities of the Department of the Navy, the Federal Housing Administration, the project sponsor, and the mortgage lender. Chapter 4 discusses administration rental housing facilities that are maintained and operated directly by the Department of the Navy.

[Defense Atomic Support Agency] Washington, D. C.
BLAST LOADING ON DOMES AND ARCHES, by Ferd E. Anderson, Jr. 21 July 58, 12p. 8 refs. AFSWP-522.
Order from LC mi$2.40, ph$3.30 PB 144 501

Dome and arch structural configurations offer promise in the design of economical above-ground protective structures up to incident peak overpressures of about 100 psi. Studies of the response of such structures to blast loads are underway but are somewhat hindered by the lack of information on the blast loading likely to occur. The purpose of this report is to present an analysis of dome and arch loading derived from shock tube data, wind tunnel data, and data collected from a nulcear weapons test, in Nevada in 1957

Electrical and Electronic Engineering

Air Force Missile Test Center, Patrick AFB, Fla.
TELEMETRY AUTOMATIC REDUCTION EQUIPMENT TARE II, by E. W. Earle, J. T. Winkler and W. H. Butler. Final engineering rept. 5 Aug 58, 82p. AFMTC-TR-58-17; AD-134 267.
Order from LC mi$4.80, ph$13.80 PB 144 441

TARE II is essentially an automatic data reduction system designed to convert raw telemetry data (FM, PDM or PAM/FM) into digital form. Once in digital form, the data is then separated, reduced, linearized and tabulated at a high rate of speed by an automatic computer. The signal input to the system is on magnetic tape previously recorded from the range telemetry stations. The digitized output of the system is recorded on six tract magnetic tape in proper format for computer insertion. In addition to missile flight function information; computer formatting information and periodic time samplings are also digitized and recorded on the output tape.

Andersen Labs., Inc., West Hartford, Conn.
TAPPED CARRIER TYPE ACOUSTIC DELAY LINE. Final rept. for 15 Oct 56-30 Oct 58 on Contract AF 19(604)2146. [1958] 35p. 1 ref. AFCRC-TR-58-190; AD-228 086
Order from LC mi$3.00, ph$6.30 PB 144 417

Theoretical and experimental investigations have been conducted on several methods of accomplishing a tapped, carrier type acoustic delay line having 32 equally spaced taps, a total storage capacity of 1200 digits with a counting rate in excess of 800,000 digits per second. The various methods studied fall into the following general categories: (a) "Branch" tapping wherein the acoustic beam strikes an improperly matched boundary which is at an angle to the direction of propagation, part of the acoustic energy continuing through the boundary and part being reflected at an angle of reflection equal to the angle of incidence; one branch being terminated at an output tap transducer and the other continuing down the line to the next tap. (b)"Series" tapping, wherein the transducers for each tap are inserted directly in the acoustic beam normal to the direction of propagation. (c) Optical tapping, wherein the strains produced in the fused quartz by the acoustic beam are detected by the displacement or polarization of a light beam passing at right angles to the direction of propagation through the thickness of the quartz slab. (d) Parallel acoustic beams wherein each tap is arrived at by a separate acoustic path and has a separate input as well as separate output transducers. After some preliminary study, this method was abandoned since it does not strictly fulfill the objectives of the Contract as defined under Item 1. (e) Tapping along the path of a Raleigh type surface wave.

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING. TEST DATA ON TASK XV. RESISTOR, VARIABLE, SUBMINIATURE. VOL. I OF II. Data taken July 54-May 55, Contract DA 36-039-sc-63136. [1955] 194p. AD-114 851.
Order from LC mi$8.70, ph$30.30 PB 137 806

Battelle Memorial Inst., Columbus, Ohio.
THE FURTHER DEVELOPMENT AND EVALUATION OF AURAL READING DEVICES FOR THE BLIND, by John S. Abma, Lois L. Huffman, and Lawrence J. Mason. Summary rept. for 1 July 58-30 June 59 on Contract V1005 M-1961; Continuation of Contract V1005 M-1261. 30 June 59, 83p. 4 refs.
Order from LC mi$4.80, ph$13.80 PB 144 748

Experience in using five prototype aural reading devices indicated the desirability of a number of mechanical and electronic modifications. Changes were made and these alterations resulted in a reliable instrument that produces the letter code much more clearly than did the first models. Evaluation activities included the investigation of various training techniques.

Bendix Aviation Corp., Southfield, Mich.
DEVELOPMENT OF MILLIMETER-WAVE BACKWARD-WAVE OSCILLATOR TUBES; 35-75 KMC, by M. I. Antoniou, F. E. Clifford, and A. G. Piefer. Rept. for 15 Aug 57-14 Nov 58 on Electronic Tubes and Transistors, Contract AF 33(600)35830. Sep 59, 131p. 5 refs. WADC Technical rept. 59-401.
Order from OTS $2.75 PB 161 351

The development program included (1) analytical and experimental work on the formation and focusing of variable voltage electron beams, and on the optimum design of r-f interaction structures, (2) design, fabrication and testing of experimental tubes, and (3) delivery of three Q-band and three V-band tubes. One of the objectives in the electron gun work was to minimize the lens effects normally present in an ordinary electron gun system. The analytical and experimental work on the formation of variable voltage electron beams concentrated on the three-anode gun system. The study of the r-f circuit concentrated on the geometries of ridge-ladder and fin type structures. A metal envelope mechanical design was used for the developmental model tubes. Tests on operating tubes included measurements of frequency as a function of tuning voltage and measurements of output power. The results of the tests are given in considerable detail. One Q-band tube produced more than 25 milliwatts of output power over a portion of the band.

Bliley Electric Co., Erie, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON 5000.000 kc/s 5th OVERTONE HIGH PRECISION CRYSTAL UNITS, by J. M. Wolfskill and R. T. Schlaudecker. Completion rept. for step 1 on Contract DA 36-039-sc-54697. Nov 57, 55p. AD-158 622.
Order from LC mi$3.60, ph$9.30 PB 137 422

This report presents the process manual which was developed for the production of 5000.000 kc high precision quartz crystal units. The units produced have a short term stability of 1 part in 10^9, aging of less than 1 part in 10^8 per week and a temperature coefficient of less than 1 part in 10^7 per degree centigrade. The units use "A" cut, fifth overtone, plano-convex, polished crystal discs, wire mounted in T 5 1/2 glass envelopes. This report includes a copy of the specification governing these units, a material list, a list of the special equipment used (with pictures of the more important pieces), a discussion of the difficulties encountered, a table of yields attained and a listing of the technical personnel who performed this work. One of the most difficult phases of the program was the consistent failure of equipment to meet the exacting demands. In particular this was true during those operations which required accurate comparisons to less than 1 part in 10^9. While this was finally achieved, the only reference frequency source available for practical checking of the production quantity of these units was a preproduction sample unit which had actually been produced under this same contract. This unit has been in continuous operation since early in April of this year, 1957, and careful periodic evaluation has proved that it is still very acceptable as a reference standard. (Author)

Case Inst. of Tech., Cleveland, Ohio.
STUDY OF APERTURE FIELDS IN THE DIFFRACTION BY A SLIT, by Hwei-Piao Hsu. Scientific rept. no. 5 on Contract AF 19(604)3887. 31 July 59, 60p. 14 refs. AFCRC-TN-59-585.
Order from LC mi$3.60, ph$9.30 PB 144 582

Several approximate techniques of solution for the aperture fields in the diffraction by a slit are discussed and compared with the rigorous solution. The

latter was obtained from the Mathieu function series; an extension to the available tables being required. None of the approximate techniques are completely satisfactory. Experimental measurements by means of a parallel-plate device of the field distribution over the aperture in slits of 3.5λ, 3λ, 2.21λ, 1.27λ width were performed and discussed, and satisfactory comparison with the exact solution for the cases of 1.27λ and 2.21λ width obtained. The exact solution of diffraction by a slit due to a line source is also presented. (Author)

Colorado U. Engineering Experiment Station, Boulder.
ATTAINABLE CHARACTERISTICS FOR A SPANATRON TUBE, by J. C. Twombly. Technical rept. no. 7 (Final) on Contract Nonr-1147(01). 30 Apr 58, 22p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 138 571

Using performance of a cyclotron resonance microwave detector in a uniform magnetic field as a reference, performance of such a tube in the non-uniform field required for wide-band spectrum analysis is presented. The relationship between threshold sensitivity and spectrum width per channel is demonstrated, and experimental verification is cited. Likewise, the effect of channel width on the shape of the frequency response curve for that channel is developed, along with factors governing the choice of this channel width. Representative oscillograms are included for illustration.

Compagnie Generale de Telegraphie Sans Fil (France).
A NEW TYPE OF ENDFIRE ANTENNA "SAUCISSON ANTENNA", by Erich Spitz. Final technical rept. no. 1 for 1 May-30 Sep 59 on Contract DA 91-591-EUC-1128. 1959, 28p.
Order from LC mi$2.70, ph$4.80 PB 144 459

The report describes the first phase of development a new type of an endfire antenna, called "Saucisson Antenna". It consists essentially of a twin-line surrounded by a helix. The antenna should work in the range 350-600 Mc/s. Scale models working in the S band (2.600-4.500 Mc/s) have been realized and investigated. The best one is described and experimental results are given. (Author)

Compagnie Generale de Telegraphie Sans Fil (France).
RESEARCH ON AIR TO GROUND SCATTER (I) [AND] SUPERGAIN AND VOLUMETRIC ANTENNAS (II), by J. Robieux and E. Spitz. Technical (Final) rept. on Contract AF 61(514)1150, part of complete final rept. on Contract AF 61(052)102. 15 June 59, 27p. AFCRC-TR-59-193.
Order from LC mi$2.70, ph$4.80 PB 144 597

An antenna, radiating in the rear direction at 220 Mc, designed to be mounted on a C-54 plane, was investigated. The antenna consisting of four corrugated surfaces was built in reduced scale and pattern and gain is given. Some experiments with closely coupled sources are given. A built supergain broadside antenna is described. (Author)

Computation Lab., Harvard U., Cambridge, Mass.
COMPUTATION OF FM COCHANNEL INTERFERENCE, by Howard Aiken. Rept. on Design and Operation of Digital Calculating Machinery, Contract AF 19(604)4947. 1 July 59, 27p. 8 refs. Scientific rept. no. AF-54; AFCRC-TN-59-778.
Order from LC mi$2.70, ph$4.80 PB 144 973

Corning Glass Works, N. Y.
CAPACITORS, HIGH KVA TRANSMITTING TYPES, GLASS DIELECTRIC. Final rept. on Contract NObsr-57558. 1 Apr 55, 63p.
Order from LC mi$3.90, ph$10.80 PB 145 025

This final report on the development of high power transmitting capacitors with glass dielectric contains a short summary of the background of the development. Salient elements of design of these capacitors are noted. Data on final samples submitted for evaluation, and methods of their construction, are presented.

Cruft Lab., Harvard U., Cambridge, Mass.
QUARTERLY SCIENTIFIC REPORT NO. 20. Rept. for 1 Apr-1 July 58 on Contract AF 19(604)786. 1 July 58, 4p. AFCRC-TN-58-364; AD-160 808.
Order from LC mi$1.80, ph$1.80 PB 137 891

Brief summaries of work on theory of antennas coupled to two-wire line; the problem of electrical scanning of dipole arrays; scattering from a reactively loaded linear antenna; scattering from slotted cylinders; and the scattering of plane waves by obstacles.

Diamond Ordnance Fuze Labs., Washington, D. C.
BIREFRINGENCE OF FERRITE TUBES IN CIRCULAR WAVEGUIDE, by N. Karayianis and J. C. Cacheris. 19 Aug 59, 24p. 3 refs. TR-651.
Order from LC mi$2.70, ph$4.80 PB 144 566

Birefringence of various ferrite configurations in circular waveguide over the frequency range 9.0 to 10.0 kMc. The use of ferrite tubes in circular waveguide as quarter-wave plates is feasible, dependent on a compromise between bandwidth and differential phase shift per unit length.

Diamond Ordnance Fuze Labs., Washington, D. C.
A TECHNIQUE FOR DESIGNING TRANSFORMERS TO MATCH BETWEEN TWO CIRCULAR WAVEGUIDES, by N. Karayianis. 28 Aug 59, 15p. 5 refs. TR-765; AD-229 091.
Order from LC mi$2.40, ph$3.30 PB 144 705

A simple method of designing transformers to match between two arbitrary impedance, circular waveguides is described, and an example given. The method combines a generalization of measurements made of tubes of Teflon in circular waveguide with the general knowledge concerning the nature of multistep transformers. The experimental results of the application of the technique to design a match between standard-size X-band circular guide and a complex dielectric-ferrite-loaded

reduced-size circular guide are included. The essential results are that the reflections after matching are more than 15 db down from the incident signal in the range 9.1 to 9.9 kmc, whereas before matching there was almost total reflection of the incident signal. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
TEST CIRCUITS FOR THE MEASUREMENT OF TRANSISTOR CURRENT-GAIN IN THE 0.1- TO 200-Mc FREQUENCY RANGE, by George N. Kambouris and Erwin Hirschmann. 15 June 59, 11p. 7 refs. TR-723; AD-219 810.
Order from LC mi$2.40, ph$3.30 PB 144 665

Tests sets were designed and constructed that permit accurate measurement of the magnitude of transistor current gain in both the common-emitter and common-base configurations over an extended frequency range (up to 200 Mc) and at various bias conditions. Components and techniques used and problems encountered are described. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
WIDE-BAND TRANSISTORIZED VIDEO AMPLIFIER, by Einar Naess. 30 June 59, 8p. TM-59-5.
Order from LC mi$1.80, ph$1.80 PB 144 710

The design and construction data are included of a miniaturized, wideband video amplifier utilizing 2N502 transistors. The final design occupies a volume of 0.7 cu in., weighs 0.5 oz, and operates with 0.2 watt, at 12 volts. It has a 65-db voltage gain, 60-Mc bandwidth, and one-volt output across a 1000-ohm impedance. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
PATTERN SYNTHESIS FOR ANTENNA ARRAYS ON CIRCULAR, ELLIPTICAL, AND SPHERICAL SURFACES, by R. H. DuHamel. Technical rept. no. 16 on Contract N6-ORI-71 Task XV. May 52, 103p. 60 refs. ATI-166 395.
Order from LC mi$5.70, ph$16.80 PB 144 814

A general method of pattern synthesis is presented for an array of antenna elements placed on a circle, an ellipse, a sphere, a spheroid and an ellipsoid. Since only the element pattern is required, the antenna elements may be dipoles or loops, either with or without a concentric reflecting surface, or slots. This method of pattern synthesis could be quite useful in the design of antenna systems for direction finding, radar, and other applications.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
PROOFS OF SOME NETWORK THEOREMS BY TOPOLOGICAL FORMULAS, by S. L. Hakimi and W. Mayeda. Interim technical rept. no. 11 on Contract DA 11-022-ORD-1983. 25 Sep 58, 25p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 138 574

In this report, some properties of network functions are deduced by means of topological formulas. The studies include the relationship between missing powers in polynomials in network functions and network geometry, Fialkow and Gerst coefficients conditions, and frequency and magnitude scaling. Although some of these results were previously known, we will show that they can also be obtained with simplicity using topological formulas.

Electronic Communications, Inc., Timonium, Md.
BROADBAND, STEERABLE LINEAR ARRAYS, by D. D. King, R. F. Packard, and R. K. Thomas. Scientific rept. no. 1 on Contract AF 19(604)5234. 7 Oct 59, 30p. AFCRC-TN-59-789.
Order from LC mi$2.70, ph$4.80 PB 144 598

Requirements for a broadband steerable linear antenna array are given. The limitations due to grating lobes of an equally spaced array are discussed. Several different unequally spaced arrays have been studied which have two advantages: (1) fewer elements for comparable beamwidth (2) grating lobes and minor lobes replaced by sidelobes of unequal amplitude and all less than the main beam. A scheme for controlling the cosine arguments in the radiation pattern formula is given which has resulted in the best pattern of this study.

Electronics Research Lab., U. of California, Berkeley
MODES IN LINEAR CIRCUITS AND LINEAR SAMPLED DATA SYSTEMS, by Charles A. Desoer. Rept. on Contract AF 18(600)1521. 27 July 59, 45p. 19 refs. Series no. 60, issue no. 224; AFOSR-TN-59-849.
Order from LC mi$3.30, ph$7.80 PB 144 493

The purpose of this paper is to develop the concept of modes in linear circuits. It is well known that the chapter on modes in lossless circuits or in conservative mechanical systems belongs naturally to any good text on the subject. The contribution of this paper is to show that provided a suitable point of view is taken, the concept of modes does apply indeed to any linear circuit: more precisely, it will be shown that it applies to any lossy or lossless, active or passive, reciprocal or nonreciprocal circuit. The importance of the mode concept lies in the fact that it allows one to consider a linear circuit as a whole, to break up its behavior as a sum of very simple patterns, and to visualize easily the effect of externally applied forces. Furthermore it provides a very informative description of the resonance phenomenon.

Federal Telecommunication Labs., Nutley, N. J.
LOW-LOSS COAXIAL CABLES. Final rept. for 1 Oct 55-30 Sep 56 on Contract DA 36-039-sc-70140. Feb 57, 77p. 3 refs. AD 134 895.
Order from LC mi$4.50, ph$12.30 PB 145 059

To improve the quality of polyethylene coaxial cables, theoretical changes in conductor designs and dielectric structure leading to lower loss are considered, particularly to reduce attenuation in the super-high-frequency (SHF) band. The principles of foaming polyethylene by decomposition of chemical additives

are described, and the effects on the dielectric properties are discussed.

Ferranti Electric, Inc., New York.
DEVELOPMENT OF AN ACOUSTIC DELAY LINE FOR DIGITAL STORAGE. Final rept. on Contract AF 19(604)3900. 8 July 59, 32p. 1 ref. AFCRC-TR-59-169.
Order from LC mi$3.00, ph$6.30 PB 144 442

The primary purpose of this work is to extend the region of the low temperature coefficient of delay. An additional object has been an evaluation of the reproducibility of the temperature coefficient, when similar materials, given identical treatment, are used to make several delay lines. Other important topics investigated are: adjustable tapped torsional lines, lines operating at a higher frequency, use of compensating materials to reduce overall temperature effects and establishment of a procedure whereby proper heat treatment of a material may be determined.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS by Douglas W. Robertson and S. N. Witt, Jr. Progress rept. no. 1, 16 Apr-15 July 56, on Contract DA 36-039-sc-71191. [1956] 46p. 4 refs.
Order from LC mi$3.30, ph$7.80 PB 138 498

Four units of extended frequency range have been constructed under the present contract for use with experimental bridge and substitution type CI Meters. These units complete a set of ten rheostats which exhibit phase angles of less that $\pm 11^{o}$ over a range of 30 to 200 ohms from 75 to 300 mc/sec.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, S. N. Witt, Jr. and William R. Free. Progress rept. no. 3, 15 Oct 56-15 Jan 57, on Contract DA 36-039-sc-71191. [1957] 54p.
Order from LC mi$3.60, ph$9.30 PB 138 496

An experimental thermistor bridge power measuring system was assembled and tested. The results obtained from the experimental system indicate that a system of this type should be capable of measuring crystal power dissipations over the range of 0.5 to 4.0 mw with an accuracy of ±5 percent. The experimental model of the coaxial Crystal Parameter Bridge was completed. Impedance matching within 15 percent for magnitude and 5 degrees for phase angle at drive levels as low as 0.5 mw have been obtained with the present unit. (See also PB 138 497)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, S. N. Witt, Jr. and William R. Free. Progress rept. no. 4, 16 Jan-1 June 57, on Contract DA 36-039-sc-71191. [1957] 71p. 3 refs.
Order from LC mi$4.50, ph$12.30 PB 138 495

A prototype thermistor-bridge power meter for measuring the r-f power dissipated in VHF quartz crystals was constructed and tested. An experimental UHF capacitance bridge oscillator was constructed that displayed characteristics suitable for use with the coaxial bridge. Crystal controlled oscillations as high as 420 mc/sec were obtained with a modified version of this oscillator. (See also PB 138 496)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY OF THE EFFECTS OF PROCESSING TECHNIQUES AND MATERIALS ON AGING OF QUARTZ CRYSTAL UNITS, by Richard B. Belser. Quarterly rept. no. 5, 15 May-15 Aug 56, on Contract DA 36-039-sc-64613. [1956] 128p.
Order from LC mi$6.30, ph$19.80 PB 138 707

A glass-sealing lathe and a chamber for the simultaneous plating by evaporation of both faces of resonator blanks have been constructed.

Ionospharen-Institut Breisach (West Germany).
RESEARCH ON PULSE TRANSMISSION AT OBLIQUE IONOSPHERIC INCIDENCE, by Karl M. A. Bower. Annual summary rept. 1958/9 on Contract AF 61(052)129. 23 July 59, 13p. 1 refs. AFCRC-TN-59-770.
Order from LCmi$2.40, ph$3.30 PB 144 589

Description of apparatus for oblique incidence pulse experiments including amplitude recording. First results obtained between Germany and the US. (Author)

[ITT] Labs., Nutley, N. J.
LOW- AND VERY-LOW-FREQUENCY ANTENNA DATA. Final engineering rept. for May 56-Aug 57 on Contract Nonr-2148(00). Oct 57, 76p. 7 refs. AD-145 986.
Order from LC mi$4.50, ph$12.30 PB 137 694

The problems involved in applying helical top-loading techniques to large, high-power antennas for the VLF range were studied. Electrical design and performance parameters are calculated for a 15-kc antenna and a 1/10 scale model. Results indicate that it is feasible to erect a high tower on land with a large helix and capacitive load mounted on top. A typical 15-kc antenna would consist of a guyed fabricated steel tower 1700 ft high surmounted by a 150-ft helix and 150-ft capacitive load on top of the helix. The tower can be grounded and insulators can be omitted in the guy wires. The antenna feed line would be run up to the tower to the base of the helix. The helix would be made entirely of strong insulating material except for a few discretely placed metal members to strengthen the frame. Radiation efficiency of about 60% appears attainable. Voltage at the top of the antenna approaches 5 megavolts rms for 2 megawatts input. The resulting voltage gradients have a safety factor of about 3.5 on the breakdown strength of air. The Q is relatively high which limits the keying speed. Experiments on 1/10,000 scale models of the 15-kc structure indicated that directive arrays are feasible. Such arrays would simplify the problems of mechanical design, erection, and high voltage (since the power would be divided between several towers).

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSISTORIZED RELAY AMPLIFIER, by R. A. Bruns and J. H. Wilcher. Rept. on Contract DA 04-495-ORD-18. 2 Sep 58, 17p. 6 refs. Memo. no. 20-170; AD-207 045.
Order from LC mi$2.40, ph$3.30 PB 144 715

The development of a transistorized relay amplifier of superior performance to vacuum-tube type of amplifiers commonly used is described. The circuit was designed from an analytic approach utilizing matrices amenable to digital computer solution for the performance of a large amount of computations. The digital computer permitted a thorough survey of parameter studies and illustrates a powerful design method extendible to cirucits of greater complexity. Performance tests of the transistorized relay amplifier with the analog computer showed it to be superior to the vacuum-tube type in lower noise level, a smaller inactive zone, and much faster time response. (Author)

Johns Hopkins U., Baltimore, Md.
A THEORY OF NEARLY LINEAR SYSTEMS, by Francis H. Clauser. Rept. on Contract AF 49(638)496. [1959] 75p. AFOSR-TN-59-1133.
Order from LC mi$4.50, ph$12.30 PB 144 779

A theory is developed which permits the usual concepts of impedance and admittance to be applied to nonlinear systems, but the impedances and admittances now become matrices whose components give not only the response to the multiple frequencies that are present in nonlinear systems, but also the intercoupling of these frequencies as well. Numerous examples are used to show that the method can treat a wide variety of problems such as subharmonic and superharmonic resonance, oscillator lock-in, parametric amplification, superregeneration, rectification, modulation and the like. (Author)

Marathon Battery Co., Wausau, Wis.
INDUSTRIAL PREPAREDNESS STUDY ON PAPER LINED BATTERIES TYPE BA-270/U-XPL. by George H. Schroeder. Final technical rept. on Contract DA 36-039-sc-30270. Sep 57, 65p.
Order from LC mi$3.90, ph$10.80 PB 144 503

The equipment provided for the production of paper lined cells for battery BA-270/U-XPL is described. The more significant experimental work is recounted as well as the performance of batteries furnished the Signal Corps on several occasions. The batteries furnished as the third preproduction lot met the performance requirements. The contractual batteries were made and shipped. (Author)

Mauch Labs., Inc., Dayton, Ohio.
THE DEVELOPMENT OF A READING MACHINE FOR THE BLIND, by A. F. Emanuel and H. A. Mauch. Summary rept. for 12 Sep 58-30 June 59 on Contract V 1005 M-1943. 30 June 59, 8p.
Order from LC mi$1.80, ph$1.80 PB 144 749

A mechanical model of the human speech mechanism was built and evaluated in an effort to produce a speech-like, and more easily learned, output. This model was then abandoned because of its inherent limitations. Further efforts to produce a speech-like output results in the development of a collection of speech sounds (word fragments) which are capable of being used to construct artificial words closely resembling speech. A device which will mechanically compose artificial words from word fragments was designed and partially constructed. Studies are described which propose solutions to scanning problems.

Mellon Inst. [of Industrial Research, U. of Pittsburgh, Pa.]
HIGH TEMPERATURE PRINTED CIRCUITRY, by G. H. Young, C. H. T. Wilkins and others. Quarterly rept. no. 10, third series, 1 Jan-31 Mar 59, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 1959, 55p. 11 refs. AFCRC-TN-59-777.
Order from LC mi$3.60, ph$9.30 PB 144 545

Continued investigations regarding the development of high temperature, passive, two-dimensional, printed circuitry have included: surface resistivity studies; further development of film capacitors; metal film resistor studies; and development of non-glaze-containing, screen-painted enamel circuits. (See also PB 138 813)

Michigan U. Research Inst., Ann Arbor.
INVESTIGATION OF MICROWAVE PROPERTIES OF FERROELECTRIC MATERIALS, by C. B. Sharpe. Quarterly progress rept. no. 2, 1 May-1 Aug 58 on Contract DA 36-039-sc-75003. Aug 58, 15p. 3 refs. 2732-2-P.
Order from LC mi$2.40, ph$3.30 PB 138 790

A theory based on the scattering matrix approach is presented for high dielectric constant materials. Correction formulas for the non-uniform field effect in disc and rectangular shaped samples at high frequencies have been verified.

Michigan U. [Research Inst.] Ann Arbor.
PRODUCTION OF LARGE TRANSIENT CURRENTS BY INDUCTIVE ENERGY STORAGE, by R. C. Walker and H. C. Early. Rept. on Contract AF 40(600)720. Dec 57, 21p. 2 refs. 2665-2-T.
Order from LC mi$2.70, ph$4.80 PB 144 549

Research involving transient currents of the order of 10^6 to 10^7 amperes involves peak power levels which are larger than can ordinarily be obtained from a utility power line. Some form of intermediate energy storage is usually desirable which will permit taking energy from the power line over a period of seconds or minutes and then discharging the energy over a

much shorter interval. The relative merits of several methods of energy storage were discussed in an AIEE paper. In this paper it is shown that storage of electrical energy in a magnetic field is often economically advantageous in situations where the energy is in the megajoule range and the discharge current pulse has a duration of several milliseconds.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
DISCONTINUITIES IN THE CENTER CONDUCTOR OF SYMMETRIC STRIP TRANSMISSION LINE, by H. M. Atschuler and A. A. Oliner. Rept. on Contract AF 19(604)2031. 13 July 59, 38p. 11 refs. Research rept. R-749-59; PIB-677; AFCRC-TN-59-599.
Order from LC mi$3.00, ph$6.30 PB 144 437

A systematic measurements program has been carried out to check the validity of theoretical formulas for the equivalent circuit parameters of a variety of discontinuities in the center conductor of symmetric strip transmission line. These theoretical formulas have been in part previously available and are in part new or modified. Results indicate that, in general, these formulas are adequate for most engineering purposes and that certain of the network parameters can be neglected.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
OPTIMUM VOLTAGE TRANSFER EQUALIZATION FOR A REACTIVE LOAD AND A FINITE GENERATOR, by Walter H. Ku. Rept. on Contract Nonr-839(05). 13 Feb 59, 17p. 5 refs. Research rept. R-678-58; PIB-606; AD-218 471.
Order from LC mi$2.40, ph$3.30 PB 144 822

The problem of designing the optimum coupling networks is considered. A definitive result was obtained for the ratio of voltage gain of a dissipative matched equalizer to that of a reactive equalizer for a given lossless load when a generator with a finite internal resistance is used. If the voltage ratio is prescribed with a normalized shape f(w), and the maximum possible scale factor consistent with physical realizability is K_M for a matched equalizer and K_X for a lossless equalizer, then in general for any realizable f(w), $K_X/K_M=\sqrt{2}$. Examples comparing the performance of optimum matched and optimum lossless equalizers are presented. (Author)

Motorola, Inc., Chicago, Ill.
RESEARCH AND DEVELOPMENT OF CATHODE RAY TUBES, by Kurt Schlesinger. Final rept. on Contract DA 36-039-sc-64614. [1958] 281p. 26 refs. AD-157 744.
Order from LC mi$11.10, ph$44.10 PB 144 914

Electrostatic wide angle deflection (65 degrees) from a common center has been accomplished with "soft" beams (2 to 4 KV), using specially developed electrostatic yokes, or "Deflectrons". The new wide angle Deflectrons consist of a glass cone, 1-1/2" long, whose inside surface carries a plated metal pattern with 4 terminals. Pincushion distortion and noncircularity has been corrected by special geometry of the printed pattern, notably the "sine^2 graded pitch" type. Post acceleration from 2.5 KV to 25 KV has been accomplished, without any loss of deflection, by a new "barrier mask" intensifier using a high-transmission (50%), etched, metallic, dome of high resolution (3.10^5 holes at 18" diameter). Secondary emission from the first surface has been cancelled by a coat of magnesium oxide on a base of enamel, using a barrier bias of 100 volt relative to an adjacent wire collector. Three types of displays have been built using this combination: (1) A single gun, 19" - 65° electrostatic radar indicator. (2) A dual deflection tube, using a single gun but two aligned Deflectrons in sequence. (3) An all electrostatic character writing tube, called "Printoscope". This latter tube uses a total of five Deflectrons; four are grouped in two Tandem units for character selection; one is used for address. Performance records and special circuit information are included in the report. (Author)

Naval Ordnance Test Station, China Lake, Calif.
AN ALL TRANSISTOR PDM TELEMETRY CODER, by James S. Sherwin. 1 June 57, 12p. NOTS-1807; NAVORD rept. 5600; AD-146 367.
Order from LC mi$2.70, ph$4.80 PB 144 721

This report describes an all transistor PDM telemetry coder that is very linear, is unaffected by variations in signal voltage during the information pulse, and is free from the microphonic effects encountered in vacuum tube circuits. The complete circuit includes an astable blocking oscillator pulse-rate generator, a voltage-controlled delay multivibrator (DMV) encoder, and a gated memory circuit which prevents variations in signal voltage from appearing at the input to the DMV during the information pulse. The coder operates at a pulse rate of 900 ±5 pps, exhibits a transfer function linear to within ±0.5%, and can be calibrated to 0.1%. Seven silicon transistors are utilized. (Author)

Naval Research Lab., Washington, D. C.
CALCULATION OF TRANSIENT DISCHARGES BETWEEN SEPARATING CONTACTS, by H. E. Strauss and C. W. Klee. Interim rept. 13 Jan 60, 16p. 9 refs. NRL Rept. 5416.
Order from OTS $0.50 PB 161 024

A criterion has been formulated for the prediction of the type of transient-repetitive short arcs or glow to be expected between separating contacts interrupting a current too small to cause drawing-out of an arc. In simple form, the criterion is that when the current calculated for an assumed glow transient, using a formula based on an idealized relationship of voltage and current involving constant parameters, is less than a critical current, a glow discharge forms, and when the calculated current is greater, an arc discharge forms. If a glow discharge occurs, the energy in the circuit is sufficiently dissipated at the end of this discharge that only circuit oscillations follow. If an arc occurs, generally energy conditions in the circuit will be such that the gap voltage rebuilds to the breakdown potential; and usually this occurs a number of times resulting in a series of arcs. In order to evaluate the merit of the criterion and the assumed parameters, transients were observed experimentally in the simple circuit on which the

analysis was based and compared with the calculated transients. The agreement found between the two encourages confidence in the basic assumptions that permitted selections of a criterion and of discharge parameters. (Author)

Naval Research Lab., Washington, D. C.
INVERSE NETWORKS, by Charles F. White. Final rept. 23 Nov 59, 11p. 2 refs. NRL rept. 5420.
Order from LC mi$2.40, ph$3.30 PB 143 407

"Inverse networks" are introduced as a class of two terminal-pair, linear, passive, structurally dual networks. From a given network composed of combinations of lumped resistance, inductance, and capacitance another "inverse" network with an identical voltage transfer function may be formed by use of the concept of inverse impedances together with a topological transformation procedure that is presented.

Naval Research Lab., Washington, D. C.
SUBMERGED VLF RECEPTION; A STUDY OF VARIOUS LOOP COUPLING METHODS, by S. V. Fratianni. 31 Dec 46, declassified 15 Dec 53. 19p. 6 refs. Rept. R-2872.
Order from LC mi$2.40, ph$3.30 PB 144 601

This problem provides for research to yield more effective submerged reception, the present phase relating to the attainment of the best energy transfer from the collecting loop to the receiver. Various coupling units available to the service have been studied. While the study of couplings is the prime consideration, it was found desirable to include the limitations of the various couplers and their usefulness to the Navy.

Naval Research Lab., Washington, D. C.
TWO-DIMENSIONAL TRACKING WITH IDENTICAL AND DIFFERENT CONTROL DYNAMICS IN EACH COORDINATE, by R. Chernikoff, J. W. Duey, and F. V. Taylor. Interim rept. 27 Nov 59. 7p. 2 refs. NRL rept. 5424.
Order from LC mi$1.80, ph$1.80 PB 143 803

In many complex tracking devices, the control dynamics may differ in the various coordinates. This requires the operator to supply a different transfer function in each tracking dimension. The purpose of this investigation was to determine the effect upon tracking produced by using various pairings of position, rate, and acceleration control dynamics in the X and Y coordinates of a two-dimensional tracking system. The results indicate that in all cases, minimum error occurred when the dynamics in the two coordinates were the same and that error increased as the dissimilarity between the dynamics became greater. These findings are interpreted as suggesting that a human has a limited information-handling capacity, that some of this capacity is used to change from one task to another, and that the greater the difference between control tasks the less the capacity which remains for the performance of either. (Author)

Naval Research Lab., Washington, D. C.
THE USE OF QUICKENING IN ONE COORDINATE OF A TWO-DIMENSIONAL TRACKING SYSTEM, by J. W. Duey and R. Chernikoff. Interim rept. 30 Nov 59, 6p. 3 refs. NRL rept. 5428.
Order from LC mi$1.80, ph$1.80 PB 143 801

In a previous study, it was found that tracking error in one coordinate of a two-dimensional tracking system was affected by the dynamics used in the other coordinate. In particular, tracking performance progressively deteriorated as the dynamics in the two coordinates became more dissimilar. The present study sought to extend these findings by determining how the introduction of quickening into one coordinate of a second-order, two-coordinate tracking system would affect performance in the unquickened coordinate. In the light of the previous study, it might be expected that quickening one coordinate would degrade the performance of the other. On the other hand, the simplification of the tracker's task induced by quickening might effect an improvement in performance. The findings suggest that a counterbalance of the above factors was achieved, since quickening one coordinate did not affect performance in the other. (Abstract)

Navy Electronics Lab., San Diego, Calif.
HUMAN FACTORS IN THE DESIGN AND UTILIZATION OF ELECTRONICS MAINTENANCE INFORMATION, by J. H. Stroessler, J. M. Clarke and others. 31 May 57, 36p. 11 refs. Research rept. 782; AD-149 158.
Order from LC mi$3.00, ph$6.30 PB 144 662

The results of the survey are summarized in the report proper and are given in full in Appendix C.

Navy Electronics Lab., San Diego, Calif.
A SIMPLIFIED DISTORTION ANALYZER, by H. E. Chubb and S. H. Sessions. 13 July 57, 17p. 8 refs. Research and Development rept. 789; AD-205 995.
Order from LC mi$2.40, ph$3.30 PB 144 661

The problem was to develop a simple technique and equipment for measuring audio distortion in sonar trainers, particularly those using phonographic or magnetic-tape input, as an aid to maintenance technicians in making rapid checks on and locating malfunctions in trainers and similar equipments.

Navy Electronics Lab., San Diego, Calif.
STUDIES IN HUMAN CONTROL DYNAMICS, by M. Lichtenstein. Rept. for Sep 54-May 56. 7 Oct 57, 37p. Research and Development rept. 805; AD-206 439.
Order from LC mi$3.00, ph$6.30 PB 144 724

The continuous control performances of operators were studied in relation to system input characteristics, control system transfer functions, tracking mode, and display factors. Analyses of results were made in terms of integrated track errors, input and

output auto- and cross-correlation functions, spectrum analyses, and phase-plane diagrams. Some hypotheses about control action were developed. Some applications of test results to engineering design of man-operated control systems are suggested.(Author)

Navy Experimental Diving Unit, Naval [Weapons Plant] Washington, D. C.
THE PERFORMANCE OF UNDERWATER TELEVISION USING BOTH NATURAL AND ARTIFICIAL ILLUMINATION, by J. R. R. Hartner, G. M. Janney, and T. L. Rakoskie. Interim rept. 2 June 59, 41p.
Research rept. 2-59; AD-226 794.
Order from LC mi$3.30, ph$7.80 PB 144 673

A study of the performance of underwater television using natural and artificial illumination was started. The hydrological range capabilities of various television systems were measured. Various combinations of commercial sources of illumination were tested both in the day-time and at night. The initial results show that, in relatively turbid water, the night-time performance is somewhat superior to the performance possible in the day-time. (Author)

New York U. Coll. of Engineering, N. Y.
ON THE WIENER PREDICTION PROBLEM AND THE PROBLEM OF THE OPTIMIZED, NOISEFREE AUTOMATIC CONTROLLER, by Nils Ashlund. Rept. on Contract AF 49(638)586. Oct 59, 19p. 6 refs.
Technical note 400-2; AFOSR-TN-59-1100.
Order from LC mi$2.40, ph$3.30 PB 144 783

A solution of the Wiener prediction problem in the sampled, non-stationary case has been presented by Kalman. The method used is founded on statistical orthogonal projections. Kalman and Koepcke have also presented a solution of the problem of minimizing a generalized loss-function defined for a sampled, noisefree automatic controller. Here dynamic programming is used. The solutions of the two problems have structural resemblances and the problems are called the duals of each other by Kalman, who finds the close resemblance very surprising.

Office of Scientific Research and Development. Div. 14.
X-BAND VIDEO CRYSTALS, by W. E. Meyerhoff and W. E. Stephane (Pennsylvania U.). Rept. on Contract OEMsr-[383] 20 May 44, declassified, 11p. 4 refs. Rept. no. 274; ATI-21 017.
Order from LC mi$2.40, ph$3.30 PB 144 648

Procedures are described for the manufacture of X-band video crystals with an average figure of merit of over 100. Their resistance averages 20,000 ohms. Pulses of about 0.6 erg cause the figure of merit to decrease by 20%. These crystals are fairly stable, the figure of merit changing ±10% on the average over a week's time. (Author)

Office of Scientific Research and Development. Div. 17.
RESPONSE CHARACTERISTICS OF INTERPHONE EQUIPMENT NUMBER 3 INCLUDING INFORMATION ON PROPOSED STANDARD TEST METHODS FOR HEADSET RECEIVERS AND MICROPHONES, by H. W. Rudmose, F. M. Wiener and others (Cruft Lab.) Rept. on Contract OEMsr-658. 1 Mar 43. declassified 10 May 46. 132p. OSRD rept. no. 1095; ATI-158 961.
Order from LC mi$6.90, ph$21.30 PB 144 518

This report records the results of an experimental program planned to investigate and to develop where necessary suitable methods for testing the physical properties of military interphone equipment. The research reported here was started at the request of the late Commander Malcolm P. Hanson of the Navy Department Bureau of Aeronautics. Part of this program has been covered in two previous transmittals of the same title, dated January 30 and June 23, 1942. Information is now being obtained on the effects of reduced pressure and low temperature on the behavior of the human voice, and will be presented at a later date. The earlier reports contain tentative methods of testing microphones and headphones, but following further experience, certain revisions have seemed necessary. It is believed that those test methods advocated at this writing are suitable for use in preparing specifications. Part of the procedures have already been adopted by the United States Army and Navy.

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 1, 1 Feb-1 May 58, on Contract NObsr-72751. 12 May 58, 13p.
Order from LC mi$2.40, ph$3.30 PB 144 954

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 2, 1 May-1 Aug 58, on Contract NObsr-72751. 15 Aug 58, 20p. AD-219 009.
Order from LC mi$2.40, ph$3.30 PB 144 872

A method of evaluating variable capacitors for small variations of capacity when under vibration was satisfactorily achieved. These variations can be measured in terms of frequency where the capacitor is the tuning element of a 16 - 32 mc oscillator. (Author) (See also PB 144 954)

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 3, 1 Aug-1 Nov 58, on Contract NObsr-72751. 17 Nov 58, 30p.
Order from LC mi$2.70, ph$4.80 PB 144 873

The variable capacitor to be built under this contract has a specification of frequency deviation when subjected to vibration and used to tune an oscillator over the 16 - 32 Mc. range. The specification calls for a maximum deviation of 100 cycles. A number of variable capacitors were evaluated for frequency deviation when subjected to vibration and used as the tuning element of a 16 Mc. oscillator. These capacitors were selected to cover a reasonable range of construction variables such as air gap, plate size, frame, etc. In addition, modifications were made and evaluated. The lowest deviations on standard capacitors exceeded

1200 cycles. The data taken in this report period will be valuable in determining the structure of a special capacitor unit which will be built to permit the various capacitor parameters to be evaluated independently. (Author) (See also PB 144 872)

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 4, 1 Nov 58-1 Feb 59, on Contract NObsr-72751. 13 Feb 59, 26p.
Order from LC mi$2.70, ph$4.80 PB 144 874

A rugged capacitor frame structure was built to permit evaluation of various parameters independently. The first group of findings (evaluation of deviation in terms of plate hardness) is nearly complete. Under vibration at 55 cycles per second, the average high quality stable capacitor has a frequency deviation of 4,000 cycles. Some structures show deviations as low as 1,200 cycles. Modifications can be made to obtain reductions in the order of 50 percent. Effects of variations of each parameter involved are being analyzed to obtain information which will permit making a design incorporating the optimum value in each case. Thus a design of very low frequency deviation will be achieved. (Author) (See also PB 144 873)

Radio Condenser Co., Camden, N. J.
VARIABLE CAPACITOR DEVELOPMENT, by E. J. Caron. Quarterly rept. no. 5, 1 Feb-1 May 59, on Contract NObsr-72751. 15 May 59, 18p.
Order from LC mi$2.40, ph$3.30 PB 144 875

This report covers a series of experiments to determine the manner in which the design parameters of a variable air capacitor affect the frequency stability of an oscillator using this capacitor as the main frequency determining element. The parameters investigated include air gap, rotor and stator plate thickness, rotor plate radius, and rotor and stator plate hardness. A rugged frame structure was built in such a manner that these parameters could be investigated independently of other factors. The data obtained has been used to design a capacitor with high stability against vibration and of a size which is reasonable and practical. (Author) (See also PB 144 874)

Radio Corp. of America, Princeton, N. J.
DEVELOPMENT OF AN ELECTROSTATICALLY FOCUSED MEDIUM-POWER TRAVELING-WAVE AMPLIFIER FOR S-BAND, by D. J. Blattner and F. E. Vaccaro. Final rept. for 1 Dec 56-31 Mar 58 on Contract AF 19(604)1947. [1958] 43p. 3 refs.
AFCRC-TR-58-127; AD-152 363.
Order from LC mi$3.30, ph$7.80 PB 137 828

Work performed has demonstrated the feasibility of operating traveling wave tubes with electrostatic focusing over a wide range of power levels. With no compromise of the advantageous features of traveling wave amplifiers - wide bandwidth, high gain, linear small-signal amplification - many of their disadvantages have been removed. Thus the electrostatically focused traveling wave amplifier requires no magnetic focusing field, (hence no alignment), is light in weight, and can be made as independent of environmental conditions as any thermionic tube vacuum tube.

Raytheon Mfg. Co. Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and G. Freedman. Quarterly rept. no. 8, 28 Dec 56-28 Mar 57, on Contract DA 36-039-sc-66038. [1957] 28p. AD-159 992.
Order from LC mi$2.70, ph$4.80 PB 138 094

Tentative specifications for the QC-117 transistor, based on the Type 30 welded package, are being discussed. The introduction of small quantities of boron in the emitter results in considerable beta improvement and also in improved voltage saturation. (See also PB 129 406)

Raytheon Mfg. Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freedman. Quarterly rept. no. 10, 28 June-28 Sep 57, on Contract DA 36-039-sc-66038. [1957] 21p. AD-159 994.
Order from LC mi$2.70, ph$4.80 PB 138 054

Results of QC-131 lifetime tests to 2000 hours indicate good shelf life characteristics, relatively stable beta and acceptable Ico performance for room temperature and high temperature and operating storage conditions. (See also PB 138 050)

Raytheon Mfg. Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freedman. Quarterly rept. no. 11, 28 Sep-28 Dec 57, on Contract DA 36-039-sc-66038. [1957] 14p. AD-159 995.
Order from LC mi$2.40, ph$3.30 PB 138 055

The reproducibility of boron-aluminum alloys for fused-junction LF silicon transistor (type QC-131) emitters was studied. The use of boron-aluminum and tin instead of boron-tin and aluminum emitter alloys improved the falloff of hfe (small-signal short-circuit forward-transfer current ratio) vs I_e (emitter current), and the saturation resistance. The boron-aluminum ribbon alloys, which were successfully used on experimental units, were tried on pilot production of the QC-131. Results were satisfactory. A diluted etching solution improved pilotline yields at the in-line test stage and lowered the base resistance. (See also PB 138 054)

Raytheon Mfg. Co., Newton, Mass.
SILICON POWER TRANSISTORS (DEVICES 15 AND 16), by Frank M. Dukat and George Freedman. Final rept. for 1 Jan-30 Oct 57 on Feasibility Study of Diffused Semiconductor Devices, Contract DA 36-039-sc-72710. [1957] 105p. AD-207 652.
Order from LC mi$5.70, ph$16.80 PB 138 052

Feasibility, both mechanical and electrical, has been demonstrated for Device 15 and for Device 16 to a modified specification. This has been done by the approach of double diffusion for which two feasible variations are described.

Raytheon Mfg. Co., Newton, Mass.
SILICON VIDEO AMPLIFIER (DEVICE 25), by John Sardella, Anthony Caggiano and others. Quarterly rept. no. 1, 12 Sep-12 Dec 57, on Industrial Preparedness Study on Transistors, Contract DA 36-039-sc-72710. [1957] 38p. AD-207 653.
Order from LC mi$3.00, ph$6.30 PB 138 051

Rome Air Development Center, Griffiss AFB, N. Y.
PHASED ARRAYS, by George J. Vogel. Nov 59, 63p. 7 refs. RADC-TR-59-135.
Order from LC mi$3.90, ph$10.80 PB 144 775

In conventional radars, the antenna physically moves to cause the radar beam angle to change. The physical limitations of this antenna movement impose serious restrictions on the uses to which this radar can be put. In Phased Arrays, the antenna does not move. The beam angle is changed by electronic means. This report presents the author's effort on phased arrays over the past year (1958). The author describes how the beam position is determined, some limitations peculiar to phased arrays and an improvement. A number of techniques using the advantages of phased arrays (that normal radars do not have) are also presented. To make the most of the proposed radars, considerable computer and hardware design must be accomplished. (Author)

Seattle U., Wash.
RESEARCH ON TRAVELING WAVE ANTENNAS, by Donald K. Reynolds and Rubens A. Sigelmann. Final rept. on Contract AF 19(604)4052. June 59, 37p. 2 refs. AFCRC-TR-59-160; AD-217 821.
Order from LC mi$3.00, ph$6.30 PB 144 657

Continuously excited traveling wave antennas: By means of the continuous excitation of a long (40 λ) Yagi antenna by a two wire transmission line, periodic interchanges of energy between the line and the antenna can be obtained. The amplitude modulation of the surface wave on the antenna produced in this matter gives rise to useful end-fire radiation characteristics over a wide frequency band. Twisted Yagi antennas: Results are presented on a 40 λ twisted Yagi, with 4 identical twist sections. This antenna is shown to have useful end-fire characteristics and high directivity, although with very high side lobe levels. Distributed excitation of uniform traveling wave antennas: By means of a distributed exciter, which spreads the excitation of a 10 λ uniform Yagi antenna over the first quarter of the length of the antenna, a radiation pattern is obtained which is very nearly that of an ideal uniformly excited end-fire line source operating such as to produce maximum forward gain. Traveling wave antennas with broad pattern bandwidth: This investigation attacks the problem of non-uniform linear arrays, operated such that at a given frequency only a portion of the array can support a surface wave. By this means it is hoped to provide a substantially constant radiation pattern over a large frequency band. Preliminary results are presented. (Author)

Semiconductor Lab., Hughes Products, Los Angeles, Calif.
HIGH-FREQUENCY SILICON TRANSISTOR, by T. W. Griswold. Supplementary Feasibility rept. for 1 Sep-31 Oct 57 on Contract DA 36-039-sc-72702. [1957] 16p.
Order from LC mi$2.40, ph$3.30 PB 138 484

The techniques used to make Device 21 have been refined to the practical limit in an effort to meet the requirements of Device 22. Process changes to vary the depth of penetration, base width, base and emitter doping have been made. (See also PB 133 238)

Stanford Electronic Labs., Stanford U., Calif.
AN APPLICATION OF THE THEORY OF GAMES TO RADAR RECEPTION PROBLEMS, by N. J. Nilsson. Rept. on Contracts AF 19(604)1847 and Nonr-225(24). 21 Apr 58, 114p. 16 refs. Technical rept. no. 704-1.
Order from LC mi$6.00, ph$18.30 PB 138 585

Stanford Electronic Labs., Stanford U., Calif.
A 2-8 kMc BIFILAR HELIX BACKWARD-WAVE OSCILLATOR, by R. W. Grow and D. A. Dunn. Rept. on Contract DA 36-039-sc-73178. 29 Sep 58, 16p. 6 refs. Technical rept. no. 382-1; AD-207 852.
Order from LC mi$2.40, ph$3.30 PB 137 914

This paper describes a very wide band voltage tunable bifilar helix backward-wave oscillator for use in a signal generator or for other low power applications. The oscillator tuned continuously from 2 to 8 kmc with a voltage variation of 76 to 2140 volts. With 5 ma of beam current it produced between 6 and 240 mw of RF power over this frequency range. The operating curves were reasonably smooth throughout the tuning band, making it both practical and useful as an electronically tunable oscillator. (Author)

Stanford Electronics Labs., Stanford U., Calif.
THE USE OF DOPPLER SHIFT FOR THE DIRECTIONAL RESOLUTION OF RECEIVED SIGNALS, by E. Gehrels. Technical rept. no. 32 on Contract Nonr-225(24). 21 Apr 58, 130p. 15 refs.
Order from LC mi$6.30, ph$19.80 PB 138 549

This dissertation describes a way in which two or more signals of the same radio frequency, but of a different direction of arrival, may be resolved by taking advantage of the above Doppler shift. In this case the received signal consists of the sum of the various individual signals, each having a superimposed frequency modulation whose characteristics depend on the direction of arrival of that particular signal component. By properly processing the composite signal the individual components can be separated, thus achieving directional discrimination analogous to that of a directional antenna. Because of this analogy, the rotating antenna system is called a "Doppler array."

Stanford Research Inst. [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 1, 1 July-30 Sep 54, on Contract DA 36-039-sc-64454. 13 Oct 54, 30p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 145 045

This report presents the results of a literature survey dealing with various aspects of insulator contamination. On the basis of this survey and of discussions with members of this and other laboratories, certain recommendations for the conduct of the research program have been made. (Author)

Stanford Research Inst [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 2 1 Oct-31 Dec 54, on Contract DA 36-039-sc-64454. 25 Jan 55, 57p. 7 refs.
Order from LC mi$3.60, ph$9.30 PB 145 046

Accelerated conditions for contamination of samples by migration of silver from electrodes were developed, and studies of the effect of relative humidity, voltage, certain cleaning procedures, and other treatments were made on the paper-base phenolic laminate, Grade XXXP. Silver migration was promoted by high humidities and voltages, and by certain cleaning methods. Using about ten different samples of plastics, filled and unfilled, the effect of fingerprints on the d-c surface resistance was studied. The presence of iron was demonstrated in an etched sample of copper-clad XXXP by using sensitized filter paper. A sensitive filter paper test for the presence of rosin, a universal ingredient of fluxes for electronic use, was developed. To become familiar with the operation of the contamination chamber, aerosols of sodium chloride were generated in the presence of XXXP samples. (See also PB 145 045)

Stanford Research Inst. [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 3, 1 Jan-31 Mar 55, on Contract DA 36-039-sc-64454. 4 May 55, 66p.
Order from LC mi$3.90, ph$10.80 PB 145 047

The susceptibility of various materials to migration of silver from electrodes was investigated. Solder coating of silver, as a preventive measure, was also studied; it was found that the net volume of silver migration, on XXXP, was greatly reduced but that its damaging effects were only somewhat lessened. The relative behavior of a number of new materials in a standard humidity cycle was ascertained before and after contamination with fingerprints. The materials included Teflon-glass, epoxy-glass, diallyl phthalate-glass, Kel-F, neoprene, polyvinylchloride, cellulose acetate butyrate, steatite, and pyrex glass. A study of etching time (with ferric chloride) vs resistivity showed that exposure of XXXP panel in the etching solution for about five times as long as was necessary to remove copper from it had no serious degrading influence on its surface resistivity. Three rosin-alcohol fluxes of various degrees of activation were studied in regard to their effect on surface resistance of XXXP. The effect of contamination of XXXP, N-1, G-6, G-5, Teflon-glass, and epoxy-glass with sodium chloride and sulfuric acid aerosols was studied. Occurrences of insulation failure in a commercial printed circuit panel are being investigated. (See also PB 145 046)

Stanford Research Inst. [Menlo Park] Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 4, 1 Apr-30 June 55, on Contract DA 36-039-sc-64454. 25 July 55, 38p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 145 048

The susceptibility to silver migration of diallyl-phthalate-glass, Kel-F, Mycalex 400, and a new sample of N-1 was studied. Gold flash was tested as a silver migration preventive and found to be almost completely successful. An improvement in the method of detection of surface iron and copper was made by sensitizing the test paper with o-phenanthroline. Using this improved paper, the effect of etching time and washing time on the retention of iron by XXXP was determined and, where possible, was correlated with changes in surface resistivity. Fingerprints on Mycalex 400 were found not to lower the high humidity resistance below that to which a clean sample is reduced in that environment. Tests of unfluxed XXXP samples and fluxed and dip-soldered XXXP samples that had been exposed to airborne dust for a month showed that the high humidity surface resistance of the former was much more seriously lowered than that of the latter. A standing potential of 480 v dc on a fingerprint-contaminated XXXP sample at high humidity improved the surface resistance by a factor of 17 in 20 hours. Printed circuit processes used by a number of West Coast companies were studied in relation to the contaminants problem. (See also PB 145 047)

Stanford Research Inst. Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 5, 1 July-30 Sep 55, on Contract DA 36-039-sc-64454. 11 Nov 55, 38p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 145 049

It was found that silver will not undergo migration when it is present in chemical combination with another metal. For the occurrence of silver migration, silver must touch the base material. However, it was found that a link between the silver and the base material could be formed by a fiber or a dust particle, permitting silver migration to occur. Cadmium plating was also shown to prevent migration. In the first of a series of experiments dealing with the prevention of silver migration by surface treatment, migration on XXXP and melamine-glass laminates was reduced about 75% by pre-treatment of the laminates with a silicone emulsion. The nature of contamination of glass-fiber-filled melamine and Teflon laminates by silver migration was shown with photomicrographs of silver migrated samples of these materials. In comprehensive experiments using XXXP base material the effect of etching time and washing time on surface resistance was studied, as was also surface retention of iron and copper. An improved test for surface iron and copper based on zinc ferrocyanide was developed. Abrasion of etched XXXP panels, an operation normally employed to remove the photoresist which protects copper during etching, was shown to improve surface resistance and to reduce greatly the quantity of surface iron and copper. No serious surface leakage was found from

several commercial activated rosin-base solder fluxes when tested either before or after dip-soldering, even after one week of storage at 97% relative humidity. Ferric oxide, and only ferric oxide, was identified as the precipitate which formed in a used ferric chloride etching solution. (See also PB 145 048)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 6, 1 Oct-31 Dec 55, on Contract DA 36-039-sc-64454. 31 Jan 56, 48p.
Order from LC mi$3.30, ph$7.80 PB 145 050

A commercial silver conducting ink, designed for the fabrication of printed circuits by direct screening on an insulating base material, was tested for silver migration. The silver underwent very extensive migration on Mycalex, slight migration of XXXP, and no migration on epoxy-glass. Fourteen electronic components containing silver-plated or silver alloy parts were tested for silver migration. Migration occurred on dielectrics of seven of the components, four extensively enough so that ultimate failure of the component was indicated. The susceptible dielectrics were steatite, nylon, and the paper-base phenolic laminate, XXXP. A practical, general test for contamination is suggested, based on leakage resistance measurements at low and high humidity. A study of the effect of the degree of exhaustion of the etching bath on the surface resistance of etched circuits showed no correlation. Continued study was given to a comparison of activated rosin-base solder fluxes in their effect on the surface resistance of XXXP. None of the activated fluxes tested introduced leakage caused by the activator, even through a strenuous and degrading temperature-humidity cycling procedure lasting one month. The effect of MFP (Moisture and Fungus Proof) varnish on the surface resistance of contaminated and uncontaminated printed circuits was studied using XXXP. The effect of surface contamination on the a-c property, Q, at 50 megacycles, was studied in preliminary experiments. Q is a measure of the quality of a dielectric with respect to energy losses. These experiments showed that, with fingerprint contamination, a 30% drop in Q occurred in measurements at 97% relative humidity. (See also PB 145 049)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 7, 1 Jan-31 Mar 56, on Contract DA 36-039-sc-64454. 30 Apr 56, 42p.
Order from LC mi$3.30, ph$7.80 PB 145 051

Three types of silver-containing printed circuits were studied with respect to silver migration. A commercial sample of the type made from pressed silver powder underwent extensive migration. Commercial samples of circuits made by chemical deposition of silver followed by plating of copper were tested, and a slight to moderate amount of migration was found to occur, although the layer of silver present was extremely thin. Silver-plated etched copper circuits supported migration on both XXXP and on epoxy-glass laminates. Various printed circuit washing solutions in commercial use were evaluated with respect to their contaminating etched boards (not with respect to thoroughness of etchant removal) and none of those tested was found to degrade circuits seriously, if the circuits were made from XXXP or epoxy-glass laminates. The solvents acetone, toluene, and trichloroethylene were found not to degrade the surface resistance of the XXXP and epoxy-glass samples upon which they were tested; in fact, with some samples (particularly epoxy-glass) the effect on the resistance was a beneficial one. Baths for electroplating solder, silver, nickel, and rhodium were studied. It was found that solder-plating, using a fluoborate bath, did not affect the insulation resistance of the XXXP or epoxy-glass samples. Silver plating, however, caused an appreciable drop in resistance of both the XXXP and epoxy-glass samples. The nickel-and rhodium-plating treatments resulted in slight to moderate lowering in the surface resistance of some samples of both types of laminates. Fingerprint and ferric chloride contamination reduced Q about 30-50% with XXXP and epoxy-glass laminates. The behavior of uncontaminated samples upon introduction into high humidity was quite variable. Printed circuits having samples of three types of protective coatings specially developed for the Signal Corps were submitted by them for testing. Two of the three were much superior to the other in insulation resistance tests at high humidity. (See also PB 145 050)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 8, 1 Apr-30 June 56, on Contract DA 36-039-sc-64454. 20 Aug 56, 52p. 5 refs.
Order from LC mi$3.60, ph$9.30 PB 145 052

Because the end result of silver migration in electronic equipment can be dielectric failure, the use of silver is commonly avoided. Although data from this and other research efforts have outlined the parameters affecting silver migration, these data cannot always be used as a guide to predicting the occurrence of silver migration in real situations. A scheme has been developed which would relate the various parameters by means of a nomograph. Exploratory experiments were made in which the effect of temperature, at 95-100% relative humidity, on silver migration was investigated. In an additional experiment pertaining to the temperature-humidity relationship, the danger of silver migration in a piece of equipment at high humidity before and after warm-up was evaluated. Silver migration from coin silver, an alloy containing 10% copper, was found to be enormously less than that from pure silver. Various printed circuit washing solutions in commercial use were evaluated with respect to thoroughness of etchant removal. The most effective washing solutions on both XXXP (a paper-base phenolic laminate) and epoxy-glass were hydrochloric acid, Pluronic L-62 (a non-ionic detergent), and, possibly, Versene. Activated-rosin soldering fluxes were studied further by means of a new test which was developed to explore contamination by solder flux decomposition products. Significant differences among activated fluxes were demonstrated in preliminary experiments. The resistance of selected samples as a function of relative humidity, continuously changed at a uniform rate, was measured, and the results interpreted in terms of conductivity in a surface film of water and, to some extent, in the volume of the material. A circuit was developed for studying the change in resistance of a dielectric at high humidity as a function of applied voltage and of time. The results of experiments with XXXP show that increased voltage and a standing potential improve resistance. (See also PB 145 051)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Quarterly progress rept. no. 9, 1 July-30 Sep 56, on Contract DA 36-039-sc-64454. 1 Nov 56, 24p.
Order from LC mi$2.70, ph$4.80 PB 145 053

Progress is reported for work accomplished on the following phases: (1) the problem of relay contact contamination, for which a background was acquired for use in setting up for a laboratory study; (2) surface contamination of glass hermetic seals in capacitors; (3) development of a method for predicting the occurrence of silver migration; (4) inhibition of silver migration by alloying the silver; and (5) contamination of etched circuits by solder fluxes. (Author) (See also PB 145 052)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON ELECTRICAL MATERIALS, by S. Chaikin. Quarterly progress rept. no. 10, 1 Oct-31 Dec 56, on Contract DA 36-039-sc-64454. 31 Jan 57, 39p.
Order from LC mi$3.00, ph$6.30 PB 145 054

Progress is reported for work accomplished on the following phases: (1) the problem of relay contact contamination, for which an analytical procedure was developed and the thermal stability of insulating materials studied; (2) surface contamination of glass hermetic seals in capacitors; and (3) a method for predicting the occurrence of silver migration on phenolic-paper laminate. (Author) (See also PB 145 053)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON ELECTRICAL MATERIALS, by S. Chaikin. Quarterly progress rept. no. 11, 1 Jan-31 Mar 57, on Contract DA 36-039-sc-64454. 30 Apr 57, 30p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 145 055

Contact contamination in sealed relays was studied chemically and particles and films were found. Outgassing of insulating materials used in sealed relays was investigated. Electrical leakage across glass hermetic seals in sealed capacitors may be caused by cracks in the glass. (Author) (See also PB 145 054)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON ELECTRICAL MATERIALS, by S. Chaikin. Quarterly.progress rept. no. 12, 1 Apr-30 June 57, on Contract DA 36-039-sc-64454. 31 July 57, 8p. AD-200 596.
Order from LC mi$1.80, ph$1.80 PB 145 056

Because contact contamination in sealed relays can be caused by outgassing of organic insulation, this property of nine commercial magnet wire coatings was studied by measuring weight loss at 160°C in a nitrogen atmosphere. Over the 600-hr test period, Alkanex, Thermaleze, Celenamel, and Isonel showed the lowest weight losses, Siliclad and Sodereze the greatest, with Formvar, Nylclad, and Heavy Epoxy intermediate. (Author) (See also PB 145 055)

Stanford Research Inst., Menlo Park, Calif.
STUDY OF EFFECTS AND CONTROL OF SURFACE CONTAMINANTS ON DIELECTRIC MATERIALS, by S. Chaikin. Final rept. for 1 July 54-15 Dec 57 on Contract DA 36-039-sc-64454. 15 Jan 58, 214p. 35 refs.
Order from LC mi$9.60, ph$33.30 PB 145 057

A chemical and electrical study has been carried out dealing with surface contamination of printed circuits and with silver migration. Printed circuit contaminants included fingerprints, etching and plating bath chemicals, solder fluxes and others. Factors accelerating silver migration were found to be temperature, relative humidity, and voltage. Susceptibility of various base materials were studied and many types of silver-bearing printed circuits were investigated. Methods of minimizing silver migration were found and a means of predicting its occurrence in a real situation was developed. (Author) (See also PB 145 056)

Sylvania Research Labs., Bayside, N. Y.
MEDIUM POWER VELOCITY SORTING DETECTOR. Final rept. on Contract AF 30(602)1588. 15 Oct 58, 71p. 1 ref. Rept. no. YD-58-3; AD-208 911.
Order from LC mi$4.50, ph$12.30 PB 138 590

Syracuse U. Research Inst., N. Y.
STUDY OF SYSTEM RELIABILITY, by F. M. Reza, A. Speth and S. Jutila. Technical rept. no. 1 on Contract AF 19(604)2452. June 58, 19p. 2 refs. SURI rept. no. EE 507-586T-1; AFCRC-TN-58-356; AD-160 799.
Order from LC mi$2.40, ph$3.30 PB 137 852

The present technical report covers the major work done on the project during our first year. The three main lines of study undertaken were: Part I - Study of the tolerance in systems; Part II - Redundant component networks; Part III - Equilibrium between disturbances and recoveries.

Transistor Applications, Inc., Boston, Mass.
INVESTIGATION OF THE APPLICATIONS OF NEGATIVE RESISTANCE DIODES FOR SWITCHING CIRCUITS, by A. W. Carlson and Robert E. McMahon. Final scientific rept. for 16 Mar 58-16 Sep 59 on Contract AF 19(604)3066. Sep 59, 29p. 5 refs. AFCRC-TR-59-352; AD-144 426.
Order from LC mi$2.70, ph$4.80 PB 144 426

This is the final report of work concerned with switching applications of semiconductor negative resistance devices. Work accomplished since the last scientific report included some multivibrator circuits using a tunnel diode and application of p-n-p-n diodes as core drivers. The work accomplished during the contract is reviewed and conclusions stated.

Mechanical Engineering

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 6. CENTRAL HEATING PLANTS. CHAPTER 7. COMPRESSED AIR PLANTS. 15 July 54, 77p. Technical pub. NAVDOCKS TP-Pu-3.
Order from OTS $2.00 PB 161 358

Chapter 6 covers central heating plants and is primarily concerned with the design and maintenance of plants supplying steam for heating and industrial uses. Feed-water heating and pumps are described. The second half of the chapter covers maintenance, operation, and inspection of boilers, stokers, oil and gas burners, and heating plant auxiliaries; testing equipment and troubleshooting also are discussed, and methods of steam-pressure reduction are analyzed. Chapter 7 offers detailed information on the design, construction, operation, and maintenance of compressed air plants. This information covers the selection of compressors and auxiliary equipment, their application in the plants, and the design of the interconnecting piping for compressors and auxiliary equipment, as well as for vacuum services. Maintenance and operation of air compressors and auxiliary equipment, together with pertinent safety precautions and instructions, are outlined in the latter part of the chaper.

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 8. ELECTRIC POWER DISTRIBUTION. 15 Oct 55, 156p. Technical pub. NAVDOCKS TP-Pu-3.
Order from OTS $3.50 PB 161 359

Chapter 7 offers detailed information on the design, construction, operation, and maintenance of compressed air plants. This information covers the selection of compressors and auxiliary equipment, their application in the plants, and the design of the interconnecting piping for compressors and auxiliary equipment, as well as for vacuum services. Maintenance and operation of air compressors and auxiliary equipment, together with pertinent safety precautions and instructions, are outlined in the latter part of this chapter.

Ordnance, Missiles, and Satellite Vehicles

Aeronutronic Systems, Inc. [Glendale, Calif.]
STUDY OF METHODS OF PRODUCING HIGH-SPEED PARTICLES, by T. Bergstralh, D. Kruciff and others. Final rept. on Contract AF 49(638)366. Nov 58, 68p. 20 refs. Pub. no. U-698; AFOSR-TR-59-181.
Order from LC mi$3.90, ph$10.80 PB 144 731

The aims of this research program were to: (1) Investigate methods for accelerating small particles with diameters in the range of 1 to 1000 microns to velocities of 5 to 10 km/sec. (2) Investigate methods for measuring the size and velocity of such particles. (3) Make measurements of the effects of particle impacts on various materials.

Air Force Cambridge Research Center, Bedford, Mass.
THE APPROXIMATE ANALYSIS OF ZERO-LIFT TRAJECTORIES, by C. P. Hoult. Aug 59, 27p. 27 refs. GRD Research Notes no. 17; AFCRC-TN-59-404.
Order from OTS $0.75 PB 161 340

The gross motion of a ballistic rocket following a zero-lift trajectory during both powered flight and re-entry is discussed with special reference to the importance of the appropriate dimensionless parameters. Approximate solutions are found for the tip-over maneuver, low- and high-altitude powered flight, and re-entry. Of the greatest significance to the rocket dynamicist is that all the above solutions are related to confluent hypergeometric functions which have been used to describe short-period motion in the literature. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
THE DETERMINATION OF SPACE ORIENTATION AND LENGTH OF AN ELONGATED OBJECT FROM SERIES OF LONG FOCUS PHOTOGRAPHS, by Heinrich J. Eichhorn. Rept. on Contract AF 08(606)1156. 4 Sep 59, 38p. RCA Data Processing Technical rept. no. 51; AFMTC-TR-59-19.
Order from LC mi$3.00, ph$6.30 PB 144 421

A method is developed to derive the kinematical parameters of a tumbling elongated object from either an isolated series of observationa of this object's "body angles" and simultaneous observations of its azimuth and altitude as seen from one station, as well as from series of these data that were observed simultaneously at two separated stations. The theory is tested on and applied to the pass of the rocket of Sputnik III in the morning of 1958 September 11, which was observed from San Salvador and from Mayaguana. The methods developed for the One- and for the Two Station Solutions (both of which were

tried) yield practically identical results. The length of the aforementioned rocket was computed with a relative accuracy of 2.8% from data collected at the same pass.

Antenna Lab., Calif. Inst. of Tech., Pasadena.
ON SATELLITE TYPE ANTENNAS, by G. G. Weill and Cavour Yeh. Technical rept. no. 17 on Contract AF 18(600)1113. 30 Aug 58, 21p. 2 refs. AFOSR-TN-58-655; AD-162 186.
Order from LC mi$2.70, ph$4.80 PB 137 903

Using some previous study of the radiation of an antenna over a perfectly conducting sphere, various structures of antennas for space vehicles are discussed theoretically. The currents induced on the sphere are taken into account for the computation of radiation patterns. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
PERFORMANCE CHARACTERISTICS OF THE ACCELERATION SWITCHING HYDRAULIC SERVO, by W. Seamone. Rept. on Contract NOrd-7386. Sep 58, 25p. 6 refs. CM-945; AD-208 258.
Order from LC mi$2.70, ph$4.80 PB 144 719

The acceleration switching technique has been found to enhance hydraulic servo system performance for applications requiring precision and reliability over a wide range of load and environmental conditions. This paper discusses static and dynamic performance of a switching-type system and shows where performance is improved over the equivalent linear flow-control servos. Operation of acceleration switching servos under adverse environmental conditions shows little degradation of system performance. (Author)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
EVALUATION OF SIGHTING DEVICES FOR A SMALL HAND-HELD ROCKET LAUNCHER, by Harold T. Curran, Jr., Robert T. Gschwind and others. Sep 59, 21p. 6 refs. Technical memo. 6-59.
Order from LC mi$2.70, ph$4.80 PB 144 542

This study investigated the degree of difference in accuracy due to aiming error between three types of experimental sighting devices: An iron sight with a twenty inch sight radius utilizing a plexiglass plate upon which a reticle was etched for the front post (Sight "A"), a unity-power optic using singlet lenses (Sight "B"), and a unity-power optic using doublet lenses (Sight "C"). Twenty-eight Infantry men from Fort Dix, New Jersey were used as subjects. Greater accuracy will be attained with Sight "C" than Sight "B", and Sight "B" will yield better performance than Sight "A". Determinants of qualitative disparity between the sights, and possible effects of low illumination sighting are discussed.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE CALCULATION OF MAXIMUM ORDINATE OF AN A-4 ROCKET FROM THE CONDITIONS AT BURNOUT, by Virginia M. Reklis and C. Ronald Cassity. Feb 48, declassified, 43p. Rept. no. 655.
Order from LC mi$3.30, ph$7.80 PB 144 809

In Part I standard formulae are given for the determination of the maximum ordinate of an A-4 rocket (or any long time-of-flight missile). A practical example, A-4 round 12, is given as illustration. The variation of the force of gravity with altitude and the rotation of the earth have been taken into account. In Part II the formulae have been adjusted to a series from more adaptable to quick computation. For expediting the determination of maximum ordinates of future missiles tables are presented giving the maximum altitudes with corresponding times-of-flight after burnout as functions of the areal velocity, the vertical component of velocity and altitude at burnout. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DOPPLER DETERMINATION OF POSITION, by Boris Garfinkel. 11 Apr 47, 14p. 1 ref. Rept. no. 638.
Order from LC mi$2.40, ph$3.30 PB 145 061

The problem of determining the position of a missile from three simultaneous radio-doppler observations has been treated by S. Kusaka. A new method of solution described here shortens the computations and improves the accuracy of the results. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DOPPLER DETERMINATION OF PROJECTILE TRAJECTORY, by Shuichi Kusaka. May 46, 9p. Rept. no. 609.
Order from LC mi$1.80, ph$1.80 PB 145 063

For the determination of the trajectory of a projectile by means of a radio transmitter and three receivers, formulae are given for the coordinates of the projectile in terms of the observed quantities. Formulae are derived for the general case and two special cases are considered. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
FULL-SCALE FREE-FLIGHT BALLISTIC MEASUREMENTS OF AIRCRAFT ROCKETS BY OPTICAL METHODS, by Dirk Reuyl. 15 June 48, declassified. 63p. 5 refs. Rept. no. 676.
Order from LC mi$3.90, ph$10.80 PB 144 805

Optical methods of full-scale free-flight ballistic measurements of aircraft rockets are described briefly. A series of photographs is included to illustrate the methods. The methods are applicable to other projectiles as well. Also they may be readily modified to serve in the ballistic studies of ground rockets and other missiles in free flight. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRACKING TELESCOPE FUNDAMENTALS, by James B. Edson. 23 Aug 48. 25p. 1 ref. Rept. no.

672.
Order from LC mi$2.70, ph$4.80 PB 144 803

This report assembles a foundation of simple basic information useful in the design and operation of tracking telescopes. Some topics discussed are: Appearance of the missile compared to planets; conditions for optimum missile visibility; telescope size requirements; effects of the atmosphere; station site selection; tracking and photographic techniques. Construction and installation at White Sands Proving Ground of the first tracking telescope is described. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRAJECTORY OF THE ROCKET A-4 DURING BURNING OBSERVED BY MITCHELL PHOTOTHEODOLITES, by H. P. Hitchcock and V. M. Reklis. 16 Oct 47, declassified. 54p. 1 ref. Rept. no. 639.
Order from LC mi$3.60, ph$9.30 PB 144 808

The method of observing the Rocket A4 at White Sands Proving Ground with two Mitchell phototheodolites, measuring the film, and reducing the data is explained. The trajectory data obtained for rounds 3 to 17 are presented and the results analyzed briefly from a ballistic point of view, as well as from the point of view of their accuracy. (Author)

Carnegie Inst. of Tech., Pittsburgh, Pa.
RE-EXAMINATION OF THE THEORIES OF JET FORMATION AND TARGET PENETRATION BY LINED CAVITY CHARGES, by R. J. Eichelberger. Rept. on Contract DA 36-061-ORD-394. June 54, 128p. 25 refs. CEL rept. no. 1.
Order from LC mi$6.30, ph$21.30 PB 144 831

Diamond Ordnance Fuze Labs., Washington, D. C.
ARMING ASSEMBLY, BOMB FUZE: TAIL T46E1 AND SHAFT, DRIVE, FUZE ARMING, T7E1, T8E1, AND T9E1, by Charles N. Whelan. Terminal rept. 10 Nov 59, 16p. 3 refs. TR-770.
Order from LC mi$2.40, ph$3.30 PB 144 704

The research and development and the production engineering of the Arming Assembly, Bomb Fuze: tail T46E1, and the Shaft, Drive, Fuze Arming T7E1, T8E1, and T9E1 have been completed. The arming assembly was developed to arm the M905 (T771), M906 (T788), and T787 mechanical bomb tail fuzes when installed in conical-fin general purpose bombs. The drive shafts have been given separate Federal Item Identifications because a different length shaft is required for each of the three bomb fin assemblies (M128A1, M129, and M130) on which the arming assembly is to be used. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A SELF-CONTAINED MECHANICAL RECORDING ACCELEROMETER, by George Blagman. 1 July 59, 22p. 3 refs. TR-703; AD-228 747.
Order from LC mi$2.70, ph$4.80 PB 144 708

A mechanical recording accelerometer has been developed to measure firing or impact accelerations in non-rotated projectiles or rockets. The instrument is small, rugged, and self-contained, requiring no outside power, no external triggering, and no telemetry. The sensing and recording mechanism can be adapted to measurement of impulses up to 5000 g over periods up to 30 msec. A record of acceleration magnitude versus time is provided with an accuracy of ±10 percent of peak values. The record is permanent and readily interpreted. Field tests of the instrument in an 81-mm mortar shell were successful. The instrument can be reused after recovery. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A TRANSDUCER INFORMATION PROGRAM FOR ORDNANCE, by J. Pearlstein. 1 Oct 59, 43p. 16 refs. TR-752; AD-227 969
Order from LC mi$3.30, ph$7.80 PB 144 409

An Ordnance Transducer Research Project has been established at DOFL in accordance with OTCM 36576. The requirements set forth in the OTCM were studied against a background of information from a limited number of sources in order to plan an effective program for conducting the project. The results of this study are summarized below: (1) The principles involved in the design, performance, and evaluation of transducers cut across all the fields of physical science and engineering. (2) Ordnance activities are coextensive with all these fields. (3) A central problem of the project - the documentation of the results of scientific research and technology, involving the elements of selecting, classifying, storing, searching, retrieving, and communicating information - must be given continued study. (4) It is proposed to adopt a "multiaspect" documentation system similar to the "Peek-a-Boo" system employed by the Office of Basic Instrumentation of the National Bureau of Standards for coverage of the scientific literature. (5) A simple 5 in. x 8 in. card index will be used for commercially available transducers.

Director of Defense Research and Engineering, Washington, D. C.
TECHNICAL RESOURCES DIRECTORY: MISSILE GROUND SUPPORT EQUIPMENT. 1 Nov 59, 22p.
Order from OTS $0.50 PB 161 103

Through its extensive research and engineering programs, the Department of Defense is developing material and equipment designed to meet present and future military requirements. The diverse tasks embraced in these programs range throughout the broad scope of military activities. This directory of military technical resources is intended to encourage communication in the Military Departments and in industry in the area of ground support equipment for missile systems.

Feltman Research and Engineering Labs., Picatinny Arsenal, N. J.
LEAD AZIDES FOR USE IN DETONATORS, by Robert L. Wagner. Jan 60, 38p. 23 refs. Technical rept. 2662.
Order from LC mi$3.00, ph$6.30 PB 143 938

During the development of a short detonator (M47) for use in 20 mm ammunition it became evident that as smaller fuzes were made, more efficient explosives for use in initiators would be needed. To meet such a need several different types of lead azide were investigated as possible replacements for the standard dextrinated lead azide covered by Military Specification MIL-L-3055. The types of lead azides investigated include dextrinated, RD-1333, polyvinyl alcohol (PVA), British Service, colloidal, and dextrinated colloidal. A minimum of 25 mg RD-1333 lead azide or 30 mg PVA lead azide was required to initiate RDX in the M47 detonator as compared with 90 mg for dextrinated lead azide. Neither RD-1333 nor PVA was hygroscopic, but dextrinated lead azide picked up over .5% moisture in 35 minutes at 82%-92% relative humidity. RD-1333, PVA, British Service, colloidal, and dextrinated colloidal lead azide had impact sensitivities of 5, 4-5, 2, 2, and 3 inches, respectively, using the 2-kg weight, as compared with 4-6 inches for dextrinated lead azide.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PRODUCT ENGINEERING TO IMPROVE MATERIALS AND DESIGN MODIFICATION OF FIBER CONTAINERS AND HERMETICALLY SEALED CONTAINERS (6046-90, 91, 92, 93), by Theodore Fruchtman. Oct 59, 7p. Final engineering rept. FR: 3-60.
Order from LC mi$1.80, ph$1.80 PB 144 744

Under this Project work was done on a variety of items and subdivisions. This report summarizes the work, item by item.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
THE T36E1 STEEL-WOOL WHITE-PHOSPHORUS (SWP) SMOKE GRENADE, by Leo F. Young and William M. Conway. Nov 59, 33p. 9 refs. Technical rept. 2618.
Order from LC mi$3.00, ph$6.30 PB 144 743

A smoke grenade which can be projected from combat vehicles for concealment has been developed. Designated the T36E1, it contains a white phosphorus smoke charge in which steel wool is used to prevent excessive spread of the smoke cloud.

General Electric Co., Schenectady, N. Y.
ACCELERATION CHARACTERISTICS OF THE HERMES B-1 RAMJET TEST VEHICLE, by W. F. Dankhoff and L. H. Edelfelt. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 21 Sep 49, declassified 17 Nov 58, 16p. 1 ref. Technical information series no. DF-49-GL-153.
Order from LC mi$2.40, ph$3.30 PB 144 627

This report presents the results of an investigation to determine the effect of air-fuel ratio and altitude upon the acceleration characteristics of the Hermes B-1 test vehicle between the Mach numbers of 2.9 and 4.0.

General Electric Co., Schenectady, N. Y.
AERODYNAMIC EVALUATION OF HERMES A-3A ROUNDS #1 AND #2, by O. Klima, Jr. and R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 7 Oct 53, declassified 17 Mar 58, 8p. 4 refs. Technical information series no. DF 53A0654.
Order from LC mi$1.80, ph$1.80 PB 144 609

The results of a preliminary aerodynamic analysis of Rounds #1 and #2 made to correlate the aerodynamic behavior of the missile with the predicted behavior as obtained from wind-tunnel test results are presented herein.

General Electric Co., Schenectady, N. Y.
ALTERNATIVE NAVIGATION SYSTEM SIMILAR TO 84 MINUTE PENDULUM SYSTEM, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Jan 53, declassified 17 Mar 58, 7p. Technical information series no. DF 53A0500.
Order from LC mi$1.80, ph$1.80 PB 144 620

A slight method of mechanization of 84 minute pendulum navigation system is presented. Alternate methods of mechanization of 84 minute pendulums are possible and should be investigated. (See also PB 144 623)

General Electric Co., Schenectady, N. Y.
ANALYSIS OF WING TEMPERATURE AT VARIOUS POINTS-SKIN ONLY, by W. W. Fischer. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Nov 50, declassified 17 Mar 58, 77p. 4 refs. Technical information series no. DF 50A0517.
Order from LC mi$4.50, ph$12.30 PB 144 631

A proposed wing for the Hermes B-1 utilizing biconvex configuration, monocoque type construction has been analysed for temperature distribution during the first three minutes after takeoff from the ground. Steel and titanium sheet materials with various surface treatments were considered.

General Electric Co., Schenectady, N. Y.
DAMPED 84 MINUTE PENDULUM NAVIGATION SYSTEM, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Jan 53, declassified 17 Mar 58, 11p. Technical information series no. DF 52A0667.
Order from LC mi$2.40, ph$3.30 PB 144 617

A method for damping an 84 minute pendulum navigation system is discussed. The method involves the use of doppler velocity data in addition to the usual inertial data. The method discussed is operable but, in many cases, not advantageous.

General Electric Co., Schenectady, N. Y.
DESIGN OF INTERIM TACTICAL ANTENNA MOUNT PER SPEC. OST 3039, by B. Wilbur. Rept. on Project [Hermes] Contract [DA 30-115-ORD-23]. 23 Sep 53, declassified 13 May 58, 86p. Technical information series no. DF-53A0401.
Order from LC mi$4.80, ph$13.80 PB 144 618

Design incomplete at time of U. S. Government cancellation of contract. Status of design, reasons for basic features, are shown, with photos of model and main layouts.

General Electric Co., Schenectady, N. Y.
DEVELOPMENT PROPOSALS OF THE PROPULSION SUB-SECTION OF PROJECT HERMES. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 22 Jan 54, declassified 25 Dec 58, 69p. 3 refs. Technical information series no. DF54A0510.
Order from LC mi$3.90, ph$10.80 PB 144 614

This study was created to furnish a collecting point for ideas which have been suggested as deserving further study. Some of these ideas are practical and immediately applicable, others are unproved. The ideas outlined in this study are aimed toward bi-propellant rockets with some comparison to hybrid-types included.

General Electric Co., Schenectady, N. Y.
EIGHTY-FOUR MINUTE PENDULUM, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 14 Feb 52, declassified 17 Mar 58, 19p. Technical information series no. DF 52A0517.
Order from LC mi$2.40, ph$3.30 PB 144 623

This report discusses the methods and the physical picture involved in calculating the characteristics of an "84 minute pendulum", a term describing a certain class of navigational devices. Includes the description, an analysis, and a discussion of error in the system. The system as described can have many sources of errors. A preliminary investigation indicates that the stabilizers tried for damping the device and eliminating the oscillatory would seem to make the steady state reponse errors larger. Further study of the investigations done by other organizations should be done. (See also PB 144 617)

[General Electric Co., Schenectady, N. Y.]
EXPERIMENTAL NORMAL FORCE COEFFICIENT AND CENTER OF PRESSURE FOR SIMULATED STICK-FREE CONDITIONS OF PROPOSAL VII; AND PROPOSAL VII_{10}, by John O. Powers. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 1 Aug 52, declassified. 8p. Hermes A-2 Aerodynamic data memo. no. 20C.
Order from LC mi$1.80, ph$1.80 PB 144 612

Hermes A-2 Aerodynamic Specification Memorandum #20B presented a theoretical estimate of the approximated variation of stick-free normal force coefficient and center of pressure as a function of Mach number for the Proposal VII configuration. The present memorandum (20C) presents the experimental values of these parameters as obtained by recent supersonic wind-tunnel tests at the Aberdeen Proving Ground and the Jet Propulsion Laboratory. Experimental values are also presented for a Proposal VII type configuration modified by a 10% increase in each of the fin dimensions. This configuration is here denoted as Proposal VII_{10}.

General Electric Co., Schenectady, N. Y.
GIMBAL GEOMETRY AND SERVO ANALYSIS FOR HA3B ODOMETER, by J. D. M. Cameron. Rept. on Project [Hermes] Contract [DA 30-115-ORD-23]. 27 May 53, declassified 17 Mar 58, 19p. Technical information series no. DF53A0593.
Order from LC mi$2.40, ph$3.30 PB 144 621

Report contains gimbal geometry analysis, which, when combined with gimbal servo equations, leads to differential equations that can be solved for table position errors as functions of time if missile angular velocities are known. Appendices contain pertinent trigonometric identities, discussion of Euler angular velocities, and a sample calculation.

[General Electric Co., Schenectady, N. Y.]
HA-2 TRIM CHARACTERISTICS WITH TRAILING-EDGE BARS AS CONTROLS (XSSM-A-13), by John O. Powers. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 4 Oct 52, declassified 28 May 58, 8p. Hermes A-2 Aerodynamic data memo. no. 10G.
Order from LC mi$1.80, ph$1.80 PB 144 613

The configuration considered in this memorandum differs from other configurations in the Hermes Aero. Data Memo. #10 Series in that the flap type controls have been replaced by a new type of aerodynamic control. The previous memos in the #10 series remain valid for the configurations there considered.

General Electric Co., Schenectady, N. Y.
HERMES A-3B INERTIAL AZIMUTH GUIDANCE, by A. P. Adamson. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 7 Apr 52, declassified 17 Nov 58, 13p. Technical information series no. DF 52A0535.
Order from LC mi$2.40, ph$3.30 PB 144 626

A discussion of the possibility of using an inertial guidance system for the HA3B azimuth control and an analysis of the performance which might be expected from such a system. Inertial control for the HA3B azimuth control is sufficiently attractive so that it should be studied carefully and immediately since it may provide a means whereby the guidance system maybe greatly simplified. The two major problems to be investigated are: (a) What gyro drift rate must be expected in the missile. (b) How can the azimuth odometer be aligned before takeoff.

General Electric Co. [Schenectady, N. Y.]
HINGE MOMENT, NORMAL FORCE, AND CENTER OF PRESSURE OF THE FINS EXCLUDING FIN EFFECT ON THE BODY, by Helen C. Engvold and Otto Klima, Jr. 30 Mar 53, 6p. 2 refs. Hermes A-3A Aerodynamic Data Memo. 44B.
Order from LC mi$1.80, ph$1.80 PB 144 353

This memorandum replaces memoranda 44 and 44A and may be used to estimate the hinge moments for the Hermes A-3A missiles through #8. Preliminary subsonic wind-tunnel tests results at NACA Langley Laboratory on a model of the Hermes A-3B

and free-flight tests of a somewhat similar fin taken from reference 2 have made it possible to further refine the previous estimates. A more rigorous subsonic analysis of the effect of angle of attack α and angle of fin deflection, δ, (on C_h C_z, and center of pressure of the fin force than has been made here will be made on the Hermes A-3B when the final NACA Langley tests are available. The normal-force coefficients given in this memorandum include only the actual force on the fins and do not include the effect of the fin on the body; hence they should not be used in trim calculations. Fin forces given in memorandum #3D remain valid for trim calculations. The effects of fin elastic deflections on hinge moments are not included in this memo. Although it is probably not necessary to evaluate these aeroelastic effects for the success of A-3A flights through #8, they will be needed to apply the hinge moment results from the A-3A firings to the Hermes A-3B. Without a knowledge of aeroelastic affects, the hinge-moment measurements that are to be made on the A-3A full-scale missiles (to aid in determining the maximum hinge moments expected on the Hermes A-3B) will be of little use. The Douglas people are presently evaluating these A-3A aeroelastic effects for Mach numbers above 2.0. It does not appear practicable to evaluate these below M = 2 except by full-scale flight test, where results with high and low dynamic pressure, q, may yield a significant comparison.

General Electric Co., Schenectady, N. Y.
INERTIAL GUIDANCE SYSTEM FOR HERMES A2, by A. P. Adamson. Rept. for 1 Mar 51-1 Mar 52 on Project Hermes, Contract [DA 30-115-ORD-23]. 1 Mar 52, declassified 25 Dec 58, 7p. Technical information series no. DF-51A0516.
Order from LC mi$1.80, ph$1.80 PB 144 622

Some of the development problems which must be solved in this data folder are listed. An inertial guidance system should be technically possible for Hermes A-2. Such a system would have military advantages and its development should be carried out as soon as possible.

General Electric Co., Schenectady, N. Y.
INERTIAL GUIDANCE SYSTEMS, by A. P. Adamson. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. Oct 51, declassified 17 Mar 58, 17p. Technical information series no. DF 51A0524.
Order from LC mi$2.40, ph$3.30 PB 144 615

An inertial guidance system which might be suitable for Hermes A-2 and Hermes A-3 guidance is considered. The primary aim is to determine whether such a system is feasible and to explain its operation and characteristic so they are easy to understand. The system discussed seems feasible and reasonably simple though quite accurate inertial elements are needed.

[General Electric Co., Schenectady, N. Y.]
NORMAL FORCE COEFFICIENT AND CENTER OF PRESSURE WITH ZERO ELEVATOR DEFLECTION PROPOSAL VII, by Richard E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 10 Sep 52, declassified. 3p. Hermes A-2 (XSSM-A-13) Aerodynamic data memo. no. 21B.
Order from LC mi$1.80, ph$1.80 PB 144 610

This memorandum supersedes A-2 Aero. Spec. #21A. It presents a revision of the Proposal VII stick-fixed (i.e. undeflected elevator) normal force and center of pressure previously presented in that memo. The revision is based on supersonic wind-tunnel tests of the complete configuration. Memo. #21A was based on linearized theory with modified bare body test data.

General Electric Co., Schenectady, N. Y.
PRELIMINARY A4, B-1 TRAJECTORY, by F. Fay. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 18 May 50, declassified 17 Nov 58, 16p. Technical information series no. DF 50A0509.
Order from LC mi$2.40, ph$3.30 PB 144 628

A trajectory is presented here for the A-4, B-1 (wingless) combination. The A-4 (German) is used as a booster to deliver the Hermes B-1 ramjet to the specified launching conditions of : Mach No. — 4.0, Missile Attitude— 20° (from horiz.), Altitude— 60,000 ft.

General Electric Co. [Schenectady, N. Y.]
ROLL MOMENT DUE TO FIN DEFLECTION AND AEROELASTIC EFFECTS, by Otto Klima, Jr. and Patricia A. Gill. 10 Mar 53, declassified. 2p. Hermes A-3A Aerodynamic Data Memo. 39A.
Order from LC mi$1.80, ph$1.80 PB 144 354

This memorandum is based on recent wind-tunnel test results of the Hermes A-3B adjusted to apply to the Hermes A-3A. An approximation of the aeroelastic effects is also included. The effect of the jet vane on roll moment is not included. This moment may be calculated using Memoranda 16C and 16E.

[General Electric Co., Schenectady, N. Y.]
ROLL MOMENT DUE TO NONSYMMETRY, by O. Klima, Jr. 10 Mar 53, 1p. Hermes A-3A Aerodynamic Data Memo. 39B.
Order from LC mi$1.80, ph$1.80 PB 144 355

Hermes A-3A Aerodynamic memo #39A should be used for rudder effectiveness in roll. In addition to the roll moment caused by fin deflection a nonsymmetrical attitude of the missile to the air flow, resulting from a roll angle and an angle of attack, also introduces a roll moment. This roll moment varies as the fourth power of the angle of attack but is not appreciable at angles below 10°. Since the A-3A missiles through number 8 will probably not experience angles of attack much larger than 10°, this nonsymmetrical roll study will not be continued on the A-3A. If the free flight shoots of the A-3A reveal roll difficulties this nonsymmetrical effect can be investigated at that time using Hermes A-3B wind tunnel test results. The report is here quoted in its entirety.

General Electric Co., Schenectady, N. Y.
S1 DIGITAL COMPUTER, by T. R. Green. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 29 Apr 52, declassified 17 Mar 58, 29p. Technical information series no. DF 52A0545.
Order from LC mi$2.70, ph$4.80 PB 144 616

Part I of this report develops a theory for determining by digital computer the four corrections, range and azimuth displacement, azimuth velocity, and time correction for initiating terminal straight line flight. This part also contains a computer flow diagram. Part II introduces dimensional analysis for displacement, range, desirable parameters, as well as pulse values. Average error is in the order of 64 feet. This error lowered to 42 or 31 feet with additional adjustment as described in the general introduction.

General Electric Co., Schenectady, N. Y.
SKIN TEMPERATURE AND COOLING ANALYSIS OF THE COMBUSTION CHAMBER WALL AND NOZZLE OF THE HERMES B-1 VEHICLE, by I. H. Edelfelt and N. C. Witbeck. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Oct 48, declassified 17 Mar 58, 12p. 6 refs. Technical information series no. DF-49-GL-65.
Order from LC mi$2.40, ph$3.30 PB 144 607

The transient and equilibrium temperatures of the Hermes B-1 combustion chamber and exhaust nozzle are calculated for design flight conditions. The resultant temperatures indicate that some means of nozzle cooling is required to prevent tailpipe burnout. Two means of nozzle cooling are investigated theoretically; namely, air cooling by annularly ducted ram air, and protection by means of fuel additives. It is found that the two methods in combination will prevent equilibrium temperatures from exceeding 1800° F.

[General Electric Co., Schenectady, N. Y.]
STATIC STABILITY MARGIN FOR ROUNDS 1-4 (NEAR VERTICAL TRAJECTORY), by O. Klima, Jr. and S. K. Hellman. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 26 Aug 52, declassified. 5p. 4 refs. Hermes A-3A Aerodynamic data memo. no. 14A.
Order from LC mi$1.80, ph$1.80 PB 144 619

This memorandum supplements Aero. Spec. Memo. 14. It gives the possible range of static stability margin for the A-3A missile during the powered flight portion of Rounds 1-4 (near vertical trajectory). The static stability margin given in this memorandum is based on the most recent center-of-pressure results for the complete missile as presented in memorandum 24E and includes calculated effects of elasticity, air temperature effects, and tolerances on center of gravity and center of pressure locations. All this data is for the near-vertical power-on trajectory of the first four rounds of the A-3A.

General Electric Co., Schenectady, N. Y.
SUMMARY OF A4, B-1 TRAJECTORIES, by F. Fay. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. [1950] declassified 17 Mar 58, 47p. Technical information series no. DF 50A0514.
Order from LC mi$3.30, ph$7.80 PB 144 630

The results of a number of Hermes A-4, B-1 trajectories are included with a brief resume of the general purpose of each. For reference the trajectories have been given Roman numerals corresponding to their chronological order. On the following page a plot of each has been made in x-y coordinates. In trajectories I and II a modified A4 was used as a booster. This is the same A4 that was incorporated in the Hermes II Ram and is designated here as A4 (modified). A standard A4 was assumed for trajectories III, IV, and V.

General Electric Co., Schenectady, N. Y.
SUMMARY OF HERMES B-1 TEST VEHICLE DRAWINGS, by K. I. Igler. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Sep 50, declassified 17 Mar 58, 20p. Technical information series no. DF 50A0510.
Order from LC mi$2.40, ph$3.30 PB 144 629

[General Electric Co., Schenectady, N. Y.]
SUPERSONIC ELEVATOR NORMAL FORCE - PROP. VII, by R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 9 Oct 52, declassified. 7p. Hermes A-2 Aerodynamic data memo. no. 17F.
Order from LC mi$1.80, ph$1.80 PB 144 611

This memorandum presents supersonic elevator normal force characteristics for the Proposal VII configuration. It supplements the previous memos of this series which remain valid for their respective configurations. During April, 1952 an experimental investigation of the supersonic elevator normal force characteristics of the Hermes A-2, Proposal VII configuration was conducted at the Aberdeen Proving Ground. The test data have been reduced and the elevator normal-force characteristics calculated. This memorandum presents the results of these computations.

General Electric Co., Schenectady, N. Y.
TRANSIENT TEMPERATURE OF INTRA-WING ANTENNA LEAD, by W. W. Fischer. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. Dec 50, declassified 25 Dec 58, 19p. 3 refs. Technical information series no. DF 50A0520.
Order from LC mi$2.40, ph$3.30 PB 144 632

The transient temperature of a proposed antenna lead between the wing skins has been calculated for two possible conditions. For flight times of more than two minutes duration, after separation from the A4 booster, a rigid co-axial antenna lead must be used to prevent failure of the lead. Aluminum tube with ceramic spacers for the inner conductor would provide a satisfactory arrangement for flight times up to 8 minutes. Supports for the lead should be minimized both in quantity and cross-sectional area and be made of thermally non-conducting, heat-resistant material.

[General Electric Co., Schenectady, N. Y.]
TRIM NORMAL-FORCE COEFFICIENT AND ELEVATED DEFLECTION FOR TRIM FOR COMPLETE MISSILE — PROPOSAL VII, by R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23].

16 Sep 52, declassified. 7p. 3 refs. Hermes A-2 (XSSM-A-13) Aerodynamic data memo. no. 10E.
Order from LC mi$1.80, ph$1.80 PB 144 608

This memorandum which supersedes Memorandum 10D, presents revised supersonic trim normal force and elevator deflections for the Proposal VII configuration as described in Hermes A-2 Aerodynamic Data Memoranda 20B and 10D. The revision is based on supersonic wind-tunnel tests of the complete configuration. The data previously presented in Memo 10D were based on theory and modified bare-body test data.

High Altitude Observatory, Boulder, Colo.
SCIENTIFIC REPORT NO. 1, by James W. Warwick. Rept. for 14 Apr-13 July 58 on Contract AF 19(604)3872. 1 Oct 58, 21p. 5 refs. AFCRC-TN-58-392; AD-160 848.
Order from LC mi$2.70, ph$4.80 PB 137 796

A secular change took place in the spin-fading rate during the three weeks of observation of the radio transmissions from Sputnik I, between 4 Oct and 24 Oct 57. This effect allows a determination of atmospheric density near the perigee point. For an assumed atmospheric scale height of 30 kilometers, we derive a value 3.8×10^{-13} gm. cm^{-3} for the density at 220 kilometers. Some fluctuations in the spin decay appear to be real, and may result from small changes in the orientation of the spin axis within the satellite. An alternative interpretation, in terms of charged drag resulting from motion of the satellite through the ionospheric plasma, requires a charge of at least 10^4 volts on the satellite. This charge might be acquired in the auroral zone.

Massachusetts Inst. of Tech., Cambridge.
ORDNANCE LOGISTICS STUDIES. II. SECONDARY ITEM SUPPLY CONTROL, by Herbert P. Galliher. Interim technical rept. no. 9 on Fundamental Investigations in Methods of Operations Research, Contract DA 19-020-ORD-2684. Aug 58, 99p. 2 refs.
Order from LC mi$5.40, ph$15.30 PB 138 575

This is a further report of an operations research study being conducted for the Field Service Division of the Office of the Chief of Ordnance. The general objective of the study has been to develop improved decision-rules for controlling stocks of secondary items (primarily repair parts), especially in respect to the incidence of stock-shortages, the size of inventories and the costs of stocking and replenishment.

Naval Ordnance Lab., White Oak, Md.
TEMPERATURE MEASUREMENT WITH LEAD SULFIDE CELLS, by W. W. Scanlon, L. G. Mundie, and P. W. Shadle. 20 Mar 50, 12p. NOLM 10830.
Order from LC mi$2.40, ph$3.30 PB 145 030

With lead sulfide cells it is possible to measure quickly and accurately the skin temperature of an object from room temperature to 400° or 500°C provided care is taken to standardize the surface emissivity. Temperatures which exist for one or two seconds can be measured with an accuracy of ±0.22°C at 30°C, and ±0.02°C at 80°C. Temperatures which exist for only a few tens of microseconds can be measured with accuracies of ±8°C at 160°C and ±2°C at 210°C. (Author)

Naval Research Lab., Washington, D. C.
THE INFLUENCE OF TEMPERATURE ELEVATION ON THE PENETRATION OF MISSILES INTO COPPER TARGETS, by W. J. Ferguson and K. R. McKinney. Interim rept. 19 Nov 59, 14p. 2 refs. NRL rept. 5407.
Order from LC mi$2.40, ph$3.30 PB 143 406

One-eight-inch-diameter tungsten carbide spheres were fired into thick copper targets at room temperature and at 800°F at velocities from less than 1000 to 5000 ft/sec. It is shown that the depth of penetration, crater diameter, and volume of target material displaced increase as a consequence of the elevation of the temperature. The depth of penetration of the missile and the volume of target material displaced are essentially independent of cracking and breakup of the missile until extensive fracturing makes it impossible to ascertain from visual observation that the missile was probably spherical. (Author)

Picatinny Arsenal, Dover, N. J.
ENGINEERING OF EQUIPMENT FOR MASS PRODUCTION OF M9 MORTAR PROPELLANT, by F. A. Handville. Dec 59, 30p. 3 refs. Technical rept. DB-TR: 2-60.
Order from LC mi$2.70, ph$4.80 PB 144 738

Studies were conducted which indicated the feasibility of using ball powder as a replacement or alternate to M9 flake propellant both for the ignition charge and for the propellant increments for the Cartridge, HE, M362 for the 81 mm mortar.

Picatinny Arsenal, Dover, N. J.
AN ULTRASONIC METHOD FOR THE ACCEPTANCE TESTING OF TUNGSTEN CARBIDE CORES (PHASE I), by David Stein. Nov 58, 18p. 2 refs. Technical rept. DE-TR: 8-58; AD-207 673.
Order from LC mi$2.40, ph$3.30 PB 138 508

Size and location of defect indications observed ultrasonically correlated consistently with the general size and location of flaws revealed by sectioning or fracture of cores. The test results indicated that ogive flaws may be more critical in determining ballistic behavior than body flaws.

Stanford Research Inst., Menlo Park, Calif.
THE STUDY OF ROCKET SLED SLIPPER WEAR PROBLEMS, by J. S. Arnold, T. D. Witherly, and C. T. Vincent. Rept. on Contract AF 29(600)1516. Oct 59, 59p. 2 refs. AFMDC-TR-59-38.
Order from LC mi$3.60, ph$9.30 PB 144 595

In the use of rocket-propelled track vehicles, the wear of the sliding bearing (slipper) which is the contact between the vehicle and the track has sometimes led to component failures. Methods of reducing

this wear include the use of track coatings and wear-resistant slipper materials. Four metal coatings (aluminum, lead, zinc, and tin babbitt) were tested with stainless steel and molybdenum sliders on the AFMDC track (Holloman Air Force Base) at 2500 ft/sec for 2000 ft. Of these coatings, zinc was the most effective and reduced the wear rate of the slipper material to approximately one-fifth that observed on the bare rail, a reduction well within the problem specification. Two nonmetallic coatings,

Utah U., Salt Lake City,
PROPAGATION CHARACTERISTICS OF DETONATION GENERATED PLASMAS, by L. L. Udy. Rept. on Contract AF 18(603)100. 20 June 58, 35p. 6 refs. AFOSR-TN-58-754; AD-201 613.
Order from LC mi$3.00, ph$6.30 PB 138 177

Electrical conduction measurements were made in the highly ionized plasma region produced by detonating high explosives. The plasma was determined to originate directly from reaction of the high explosive rather than from thermal ionization associated with the accompanying shock wave. The mechanism of conduction was considered, and it was shown that electron flow through the plasma accounted for practically all of the current.

Watertown Arsenal Labs., Mass.
MAGNETIC INSPECTION OF PROJECTILES BY INDUCTION TECHNIQUES, by Patrick C. McEleney and Vincent H. Early. Rept. on Improved Magnetic Inspection Control Procedures. Nov 59, 18p. 1 ref. WAL TR-145/18.
Order from OTS $0.50 PB 161 328

An Automatic Flaw Detector for projectiles utilizing the magnetic induction method for inspection of high explosive shell bodies and armor-piercing shot of sizes 75mm through 120mm. This report discusses over-all principles of operation, explains electromechanical and electronic circuits, defines present status of equipment and makes recommendations for future work.

Sanitation and Safety Engineering

Bureau of Yards and Docks, Washington, D. C.
INSTALLATIONS--GENERAL. INSECT AND RODENT CONTROL. 1 Feb 56, 176p. Technical pub. NAVDOCKS TP-Pu-2, supersedes issue of 15 May 53; Air Force Manual no. 85-7; Army Technical manual no. 5-632, superseded issue of 7 Oct 47.
Order from OTS $3.00 PB 161 357

This manual discusses the control of insects, rodents, and other pests at Department of Defense installations. Special emphasis is placed on the supervision and execution of measures recommended for the control of pests that affect the health, efficiency, and morale of those residing at installations, or that damage and destroy property, including stockpiles of supplies. Measures include water management for mosquito control, termiteproofing, ratproofing, chemical treatment of wood and soil, fumigation of commodities, application of residual and other types of sprays, application of insecticidal dusts, and trapping and baiting for rodent control. Included among pests that must be controlled are: mosquitoes, flies, fleas, lice, ticks, chiggers, bed bugs, cockroaches, foliage-feeding insects, scale insects, aphids, stored-product pests, termites, wood borers, fungi, rats, mice, field rodents, and predatory animals.

Naval Radiological Defense Lab., San Francisco, Calif.
FEASIBILITY AND APPLICABILITY OF ROOF WASHDOWN SYSTEM, by W. S. Kehrer and M. B. Hawkins. 7 May 58, 42p. 12 refs. Research and development technical rept. USNRDL-TR-232.
Order from LC mi$3.30, ph$7.80 PB 144 801

The feasibility and applicability of a washdown or water curtain system against radioactive fallout for building roofs were evaluated, based on the results of a water requirements experiment plus presently available information. The system was found to be both feasible and applicable. The evaluation is based on commercially available components, including the test surfaces. However, some thoughts are also given on a new general design of buildings and on roofing surfaces to be developed to obtain optimum roof washdown effectiveness.

Ship Building

Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF WELD-JOINT FLAWS AS INITIATING POINTS OF BRITTLE FRACTURE, by R. P. Sopher, A. L. Lowe, Jr., and P. J. Rieppel. Rept. on Contract NObs-61748. 29 Aug 58, 56p. 5 refs. SSC-107.
Order from OTS $1.50 PB 161 323

A study of conditions needed for initiation of a brittle fracture from flaws 4 in. or less in length. If local stresses are high in the vicinity of a flaw, then the applied stress may be low when brittle fracture initiates from that flaw provided that the steel is at or near the nil ductility temperature. Stress conditions that are expected to exist in ship structures were incorporated in the test specimen.

David Taylor Model Basin, Washington, D. C.
POWERING CHARACTERISTICS FOR A LIBERTY SHIP PROPELLED BY OUTBOARD TYPE PROPULSION UNITS, MODEL 3748-1, by B. Nakonechny and A. H. Weaver, Jr. Jan 58, 22p. 3 refs. Rept. 1263.
Order from LC mi$2.70, ph$4.80 PB 144 644

The David Taylor Model Basin conducted experiments on a model of a Liberty ship to determine (1) the number of outboard-type marine propulsion units needed to propel the ship at speeds of 8 and 10 knots, (2) the best locations along the second deck for installing the units, and (3) the optimum axis of rotation of

the propeller. It was concluded from the tests that at least three units are required for a speed of 8 knots and five units for a speed of 10 knots; that there are seven satisfactory locations for installing the units; and that the optimum axis of rotation for the propeller is zero degree (parallel to centerline of ship) in all locations except one. It was also recommended that a suitable plate be fitted on the full-scale propulsion units. (Author)

Illinois U., Urbana.
PRELIMINARY STUDIES OF BRITTLE FRACTURE PROPAGATION IN STRUCTURAL STEEL, by W. J. Hall, W. G. Godden and O. A. Fettahlioglu. Rept. on Contracts NObs-(65790, 72046). 15 May 58, 91p. 17 refs. SSC-111.
Order from OTS $2.25 PB 161 325

Tests were conducted to obtain information concerning the crack speed and the strain distribution in a mild steel plate during brittle crack propagation. The adopted specimen consists of an insert plate welded to pull plates mounted in the testing machine. The plate is cooled with dry ice, and impact drives a wedge into a notch in the edge of the specimen. Crack speeds ranging from 1150 to 5900 fps were recorded; absolute peak elastic strains as high as 0.002500 in. per in. were recorded in the vicinity of the fracture with negligible permanent set remaining after the fracture.

Naval Ordnance Lab., White Oak, Md.
THE INVESTIGATION OF RADIOISOTOPES FOR THE INSPECTION OF SHIP WELDS, by E. L. Criscuolo, D. P. Case, and D. Polansky. 28 Feb 58, 64p. 12 refs. SSC-110.
Order from OTS $1.75 PB 161 324

A study was conducted that explored the potentialities of radioactive isotopes for the inspection of welds in ship structures. Various parameters were investigated to determine an optimum radiographic technique for the inspection of hull welds of 1/2- to 2-in. plate. Technique and sensitivity curves for thulium, iridium, cesium, and colbalt are included. For the inspection of welds in 1/2-in. to 1-in. thick plate, iridium is the most promising isotope. A portable exposure container for iridium has been developed.

Swarthmore Coll., Pa.
WELD FLAW EVALUATION, by Samuel T. Carpenter and Roy F. Linsenmeyer. Final rept. on Contract NObs-72060. 29 July 58, 122p. 14 refs. SSC-105.
Order from OTS $2.75 PB 161 322

This report is an evaluation of the ability of weld flaws to initiate brittle fracture. It deals with brittle fracture mechanics, static tests on flawed butt welds, static and dynamic tests on small butt weld flaws with and without residual stress, and static tests on weld flaws in a controlled field of high residual stress.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Rodman Lab., Watertown Arsenal, Mass.
EVALUATION OF SEVERAL TOOL-LIFE TESTING TECHNIQUES, by Roy Mennell and Edwin A. Jeffery. Dec 58, 39p. 9 refs. Rept. no. RPL 23/5.
Order from LC mi$3.00, ph$6.30 PB 138 506

During testing, tool rake angles, cutting speed, and depth of cut were varied and other machining variables controlled or randomized. Accelerated tool-life criteria evaluated include: wear-land on the flank face of the cutting tool, percentage increase in feed force on the cutting tool, and surface finish of the workpiece.

Rutgers [State] U. [New Brunswick, N. J.]
PRELIMINARY STUDY ON JUMPING AND RUNNING TYPES OF LOCOMOTION, by R. K. Bernhard. July 58, 54p. 12 refs. Land Locomotion Research Branch rept. no. 43; AD-220 980.
Order from LC mi$3.60, ph$9.30 PB 144 540

Running, leaping, galloping, bouncing and jumping motions are analyzed from theoretical considerations for their applications to vehicle propulsion. The theory is then substantiated by test data taken from a laboratory analogue of various oscillatory motions. Cross-country speeds on the order of 20-30 mph are proved feasible compared to the 5-10 mph speeds obtainable by present wheeled and tracked vehicles. Since the oscillations may be uncomfortable to the vehicle operator, various isolation systems are proposed. (Author)

Engines and Propulsion Systems

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TABLE OF LEGENDRE FUNCTIONS FOR COMPLEX ARGUMENTS, by M. E. Lyman. Rept. on Contract NOrd-7386. 10 Dec 58, 25p. 2 refs. TG-323; AD-209 360.
Order from LC mi$2.70, ph$4.80 PB 144 718

These calculations were made on the Univac Scientific 1103A Computer, using the subroutine written for the calculations of rocket instability. Since precision was not required, no attempt has been made to minimize loss of accuracy.

Arnold Engineering Development Center, Tullahoma, Tenn.
EVALUATION OF HOT-WATER-DRIVEN DIFFUSER EJECTORS, by R. P. Rhodes. Rept. on ARO, Inc., Contract AF 40(600)800. Nov 59, 32p. 3 refs. AEDC-TN-59-127; AD-227 981.
Order from LC mi$3.00, ph$6.30 PB 144 415

Exploratory investigations were conducted to evaluate the performance of various diffuser-ejector configurations driven by water heated to the saturation temperature. The apparatus consisted of a nozzle mounted axially in a cylindrical diffuser, which was connected to an exhaust system. A pressure vessel was provided in which the water was collected and heated. Tests were conducted using nozzle configurations having water flows ranging from 0.39 to 3.99 lb/sec at a driving pressure of 200 psia in combination with 6, 8, and 10-in. diffusers. At this fixed driving pressure, the mass flow of water per unit diffuser area was found to be the controlling parameter. As this parameter was increased, the maximum rise ratio of the ejector decreased, and the cell pressure increased. Lowering the driving pressure reduced the minimum cell pressure but also reduced the pressure rise ratio across the diffuser. A maximum ejector rise ratio of 4.2 and a minimum cell pressure of 0.22 psia were achieved during the course of this investigation.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE PREPARATION OF 3,3,3,-TRIS (NITRATOMETHYL)-PROPENE-1 AND 3,3-BIS (NITRATOMETHYL)-BUTENE-1, by Lester P. Kuhn and Alan C. Duckworth. Aug 59, 14p. 4 refs. Memo. rept. no. 1230.
Order from LC mi$2.40, ph$3.30 PB 144 729

The synthesis of two new vinyl compounds containing nitrate ester groups and having the structures

$CH_2 = CHC(CH_2ONO_2)_3$ and $CH_2 = CHC(CH_2ONO_2)_2CH_3$

is described. Many of the intermediates involved in the preparation of these compounds are also described for the first time in this report.

Detroit Arsenal, Center Line, Mich.
LOW TEMPERATURE TEST OF THE RELOCATED CRANKCASE OIL DIAPHRAGM BREATHER ASSEMBLY, by Milton C. DuBay. 25 Nov 57, 24p. Rept. no. 4025 (Final); AD-156 378.
Order from LC mi$2.70, ph$4.80 PB 144 760

The object of this test was to determine whether freezing of a relocated crankcase oil diaphragm breather assembly, as installed on the AVI 1790-8 engine, can be obtained at the low temperature of minus 40 F.

Diamond Ordnance Fuze Labs., Washington, D. C.
A TRANSISTORIZED TELEMETER FOR THE MEASUREMENT OF ROCKET-MOTOR PRESSURE ON THE APG STATIC SPIN STAND, by Walter L. Gieseler. 10 Apr 59, 12p. 1 ref. TR-728; AD-219 322.
Order from LC mi$2.40, ph$3.30 PB 144 664

A telemeter has been developed for determining rocket-motor pressures during tests on the static spin stand of the Ballistic Research Laboratories at Aberdeen Proving Ground. This device is designed to telemeter pressures up to about 2000 psi, and to withstand spin rates of about 200 rps. The circuit design and test results are given. (Author)

Propulsion Research Lab., Polytechnic Inst. of Brooklyn, N. Y.
A NON-LINEAR NON-STEADY AEROTHERMOCHEMICAL ANALYSIS OF COMBUSTION INSTABILITY IN A ROCKET CHAMBER, by Henry Berger. Rept. on Contract AF 49(638)165. 1 May 59, 83p. 16 refs. Technical note PRL-TN-59-5; AFOSR-TN-59-703.
Order from LC mi$4.80, ph$13.80 PB 144 500

In this report the fundamental equations are carefully derived. The assumptions necessary to obtain an approximate quasi-one-dimensional system of equations are explained. The characteristic equations are then derived; their final form is changed slightly in order to suit the numerical procedures. The steady state gas flow conditions constitute the initial conditions of the problem. Various steady state equations are derived and the stability of some of these in difference form is considered briefly. The special problems arising from the use of a zero initial velocity at the injector are analysed in detail. Use of an integrated form of the energy equation is made in avoiding some of these difficulties. Numerical results are obtained by using representative estimates for some of the parameters and are presented graphically. A rigorous method of numerical integration of the non-steady equations, differing from the standard characteristic method common in gas dynamics analyses, is examined. Its advantages are considered and sample numerical calculations are presented.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
SPRAY COMBUSTION THEORY, by F. A. Williams. Technical rept. no. 26 on Contract DA 04-495-ORD-446. Aug 58, 20p. 4 refs. AD-203 610.
Order from LC mi$2.40, ph$3.30 PB 137 529

The coupled steady-state equations of motion of a statistical ensemble of spherical droplets and a coexisting multicomponent reacting gaseous continuum are derived under the assumption that the induced random fluctuations in the properties of the fluid are negligible. These equations are reduced to a form appropriate for describing the one-dimensional flow of a fluid containing a spray which is stationary with respect to the gas. The burning-rate eigenvalue problem for one-dimensional heterogeneous combustion process of the type $A \rightarrow nB$ is formulated, and an analysis for sprays composed of uniform droplets illustrates the properties of the eigenvalue. An approximate analytical solution for the burning velocity is shown to be in numerical agreement with experiments on tetralin. (See also PB 136 043)

Sundstrand Turbo Div., Sundstrand Machine Tool Co. [Pacoima, Calif.]
SELECTED SCALING PROCUDURES FOR LIQUID-FUEL ROCKET ENGINES, by S. S. Penner. Technical note no. 6 on Contract AF 18(603)107. 31 Mar 58 17p. 5 refs. S/TD no. 1241; AFOSR-TN-58-416; AD-158 219.
Order from LC mi$2.40, ph$3.30 PB 144 656

In previous technical notes, we have considered the development of scaling procedures for liquid-fuel rocket engines with maintenance of complete similarity for all important operating variables, and also the special case in which only similarity with respect to high-frequency oscillations is enforced. It is the purpose of the present discussion to consider scaling rules of intermediate scope. The judicious utilization of the results derived from the present study should prove of value in deciding on the particular set of similarity conditions which must be satisfied in order to minimize development costs for large-scale engines.

Machine Parts and Mechanisms

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A BIBLIOGRAPHY ON GAS LUBRICATED BEARINGS - REVISED, by Eugene B. Sciulli. Rept. on Contract Nonr-2342(00). 15 Sep 59, 109p. 290 refs. Interim rept. I-A2049-5.
Order from OTS $2.50 PB 161 017

Wherever possible a resumé in English of each reference is included. In most cases the abstracts were taken verbatim from the author, translation being made when required. When necessary or desirable, resumés were prepared or revised by FIL staff members. Five indexes are provided: A Yearly index; Corporate Name index; Subject index containing thirteen descriptively worded categories or headings specifically chosen to cover the many varieties and types of gas lubricated bearings; an index listing all the patents in numerical order; and an index listing the country of origin of the reference when that country is other than the United States. Every effort has been made to make this a comprehensive listing of all references published prior to July 1, 1959.

Manufacturing Equipment and Processes

Battelle Memorial Inst., Columbus, Ohio.
RESEARCH AND DEVELOPMENT OF PROCEDURES FOR JOINING OF SIMILAR AND DISSIMILAR HEAT-RESISTING ALLOYS BY ULTRASONIC WELDING, by Norman E. Weare, John N. Antonevich and others. Rept. for July 57-June 58 on Metallic Materials, Contract AF 33(616)5342. Feb 59, 83p. 16 refs. WADC Technical rept. 58-479; AD-208 323.
Order from LC mi$4.80, ph$13.80 PB 145 015

Metallographic examinations of the heat-resistant weldments showed the presence of cracks at the edges of many of the spot welds. Methods of preventing such cracking can probably be determined. Efforts in the fundamental studies were aimed at studying the mechanism of bonding by ultrasonic welding.

Climax Molybdenum Co. of Michigan, Detroit.
ARC-CAST MOLYBDENUM-BASE ALLOYS, by M. Semchyshen and R. Q. Barr. Supplement to summary rept. on Contract N8onr-78701. 1957. 171p. 22 refs.
Order from LC mi$8.10, ph$27.30 PB 144 447

Contents:
Mechanical properties of wrought alloys
Mechanism of strengthening within the molybdenum-titanium system
Alloy systems:
Molybdenum-titanium
Molybdenum-niobium
Molybdenum-zirconium
Molybdenum-hafnium
Metallographic techniques
X-ray fluorescence analysis for alloying elements in molybdenum-base alloys

Columbia U. School of Engineering, New York.
A SIMPLE ALLOCATION PROBLEM, by C. Derman, Technical rept. no. 1(N) on Contract Nonr-266(55). 26 Jan 59, 14p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 144 554

We are concerned with the following allocation problem. Suppose at the beginning of a given time period there exists T units of some product (or service) which are to be allocated among k locations. The demand at each location is a random variable with a distribution which depends on the location. At the end of the time period the unused produce (or service) loses its value. The problem of interest here is that of allocating the T units among the k locations so that the expected number of units used to satisfy demand is maximized.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE WELDING OF WROUGHT AGE-HARDENABLE NICKEL-BASE ALLOYS FOR SERVICE AT ELEVATED TEMPERATURES, by W. J. Lepowski and R. E. Monroe. 25 Nov 59, 21p. 39 refs. DMIC memo. 38.
Order from OTS $0.50 PB 161 188

The purpose of this memorandum is to summarize information on welding wrought age-hardenable nickel-base alloys. The report will cover the fusion and resistance welding of some of the more familiar alloys that comprise the age-hardenable nickel-base materials.

Princeton U., N. J.
ESTIMATES OF NATIONAL AND REGIONAL STEEL PRODUCTION IN THE UNITED STATES FOR 1970,. by Robert E. Kuenne. Technical rept. no. 4 on Contract Nonr-1858(02). 2 Feb 59, 46p. 20 refs. Econometric Research Program Research Memo. no. 6.
Order from LC mi$3.30, ph$7.80 PB 144 577

MATERIALS

Department of the Army, Washington, D. C.
JOINT MILITARY-INDUSTRY PACKAGING AND

MATERIALS HANDLING SYMPOSIUM [NO. 3]
1-3 OCTOBER 1957, FORT LEE, VA. Oct 57, 177p.
Order from LC mi$8.10, ph$27.30 PB 144 930

A series of papers which includes, among others the following subjects: Packaging and handling for your FUTURARMY; Aerial delivery techniques and progress; Food packaging developments; Transportation developments; Current Army packaging practices and concepts; Project MASS; Packaging and materials handling equipment for guided missiles; Paper and paperboard containers; The steel shipping container; Flexible packaging barriers; Humidity indicators; Reinforced plastics for military packaging; New pallet designs and racks; Handling of specialized loads; Radio-controlled tractor trains; Personal communications in materials handling; The logair operation; Inter-theater airlift; Intra-theater airlift; Marine Corps developments; Tools for underway resupply; Review of recent changes to some of the major packaging and materials handling documents; Analysis of major changes--specification MIL-P-116C; "Preservation, methods of"

Detroit Arsenal, Center Line, Mich.
HANDBOOK OF THE FUNGI PRESCRIBED FOR USE IN MILITARY SPECIFICATIONS, by Charles B. Lee. 25 Mar 57, 136p. Rept. no. 3656 (Final).
Order from LC mi$6.90, ph$23.10 PB 144 678

This handbook is arranged with an introduction to and a definition of the classes, genera and species of fungi observed in the deterioration of military materials. Three classes of the lower fungi are discussed and species from these classes are illustrated either by photograph or drawing and each is given a brief description in non-technical language. A total of thirty-one species of fungi is mentioned and, in addition, taxonomic keys are presented as aids in identification. A short specification analysis by species is also included.

Naval Civil Engineering Lab., Port Hueneme, Calif.
A FEASIBILITY STUDY OF THE APPLICATION OF MASS SPECTROMETRY TO PAINT VEHICLE ANALYSIS, by R. D. Hitchcock. Interim rept. 11 Sep 59, 96p. 28 refs. Technical rept. 030; AD-209 528.
Order from OTS $2.25 PB 161 326

A Pyrex glass heated-inlet system was designed and built for the introduction of paint vehicles into the mass spectrometer in a vapor state. It was found that a conventional ball-and-socket glass joint, operable by external magnets, could be used as a vacuum cut-off valve. It was also found that stable temperatures could be maintained in the inlet system without hermostatic control. Repeated analyses of linseed oil at 250 C, 300 C, 350 C, and 400 C were made. Repeated analyses of a vinyl alkyd vehicle and a paint solvent were made and for each material the prominent peaks were treated mathematically to yield a single frequency distribution. Both distributions appeared to be almost perfectly Gaussian -- an indication that, because of the small number of peaks, the measured values of each peak are normally distributed. Percentage standard deviations derived from the plots showed that variations for the vinyl alkyd peaks are of the order of magnitude of 4 percent, and for the solvent, of the order of magnitude of 2 percent. The cracking patterns of other drying oils and synthetic resins and mixtures of these two types of vehicles were measured and studied. It is concluded that a Pyrex glass heated-inlet system can be used to introduce the vapors of paint vehicles into a mass spectrometer and that, in spite of random variations in molecular structure induced by elevated temperatures, a distinct cracking pattern can be associated with each vehicle. (Author)

Wayne [State] U., Detroit, Mich.
OPERATING CHARACTERISTIC CURVES AND OTHER FEATURES OF TRUNCATED LIFE TESTS WITH REPLACEMENT, by Benjamin Epstein. Technical rept. no. 5 on Contract Nonr-451(00). 15 May 53, 49p. 2 refs. AD 11 455.
Order from LC mi$3.30, ph$7.80 PB 145 034

The purpose of this report is to furnish some tables and graphs for the replacement case when items which fail are replaced at once by new items.

Ceramics and Refractories

Clevite Research Center, Cleveland, Ohio.
MODIFIED PIEZOELECTRIC LEAD TITANATE ZIRCONATE CERAMICS, by Frank Kulcsar. Technical rept. no. 14 on Contract Nonr-1055(00). 2 Dec 57, 29p. 1 ref. AD-150 443.
Order from LC mi$2.70, ph$4.80 PB 138 222

In an effort to increase the dielectric constant, small additions of Nb_2O_5 or Ta_2O_5 were made to lead titanate zirconate compositions near the morphotropic phase boundary. The compounds, PbO, TiO_2, ZrO_2, and one of the addition compounds (Nb_2O_5, Ta_2O_5, La_2O_3, and $SrCO_3$) were mixed and pressed into disks. Electrical measurements were made at room temperature including measurements of the capacity, dissipation factor, and resonant and antiresonant frequencies. The modified ceramics had piezoelectric planar coupling coefficients of at least 0.50 and dielectric constants of up to 1300. The mechanical Q factor was decreased to about 70. A marked improvement was noted in shelf-aging characteristics and in stability with respect to the temperature dependence of the resonant frequency. The Curie temperature was also lowered. The grain structure was refined, especially the ceramics containing 2 w-% additions of Nb_2O_5 or Ta_2O_5. Dielectric constants up to 1695 with planar couplings of about 0.55 were obtained by adding 1 w-% Nb or 2 w-% Ta to $Pb_{0.95}Sr_{0.05}(Zr_{0.54}Ti_{0.46})O_3$.

Fansteel Metallurgical Corp., North Chicago, Ill.
INFORMAL MONTHLY PROGRESS REPORT [TO NEPA PROJECT] by Ralph Wehrmann. Rept. for 21 July-20 Aug 48. 26 Aug 48, 8p. NEPA 738-FAN-14; AD-203 997.
Order from LC mi$1.80, ph$1.80 PB 138 315

Fansteel Metallurgical Corp., North Chicago, Ill.
INFORMAL MONTHLY PROGRESS REPORT TO NEPA PROJECT, by Ralph Wehrmann. Rept. for 21 Nov - 20 Dec 48. 24 Dec 48, 7p. NEPA 858-FAN-19; AD-203 995.
Order from LC mi$1.80, ph$1.80 PB 138 322

See also PB 138 315.

Massachusetts Inst. of Tech., Cambridge.
TITANIUM CARBIDE-NICKEL CERMETS: PROCESSING AND JOINING, by John Wulff, James E. Cline and others. Rept. on Contract AF 33(038)8879. Mar 52, declassified 15 Dec 53. 21p. 17 refs. WADC Technical rept. 52-103; ATI-171 301.
Order from LC mi$2.70, ph$4.80 PB 144 559

Titanium carbide-nickel cermets can be sintered to have transverse rupture strengths over 250,000 pounds per square inch. Joining titanium-carbide cermets to high-temperature alloys has been accomplished by vacuum diffusion, and gives a weld stronger than the cermet. Fabrication of cermet articles of graded composition has been successfully accomplished by fragmentation-forming, i.e. cold forging the powder in a ductile envelope and subsequently sintering.

Pennsylvania State [U. Mineral Industries Experiment Station, University Park]
AN EXPERIMENTAL STUDY OF SILICATE LIQUID IMMISCIBILITY, by M. D. Karkhanavala and W. A. Weyl. ONR Technical rept. no. 45 on Contract N6onr-269, Task Order 8. Apr 52, 6p. 6 refs. ATI-159 366.
Order from LC mi$1.80, ph$1.80 PB 144 560

The inverted S-shaped liquidus curve of certain silicate systems (Li_2O-SiO_2 and BaO-SiO_2) is attributed to an existing "tendency" towards immiscibility. The authors advance a theory of the atomic structure of a homogeneous phase having a tendency towards unmixing. It is assumed that two basically different types of groups are present, but that the interfacial energy is too high to allow these groups to form separate phases. This difficulty can be overcome by bringing into the system a noble metal (Pd) in a finely subdivided state. By this means a homogeneous melt of 10.4 mol % Li_2O and 89.6 mol % SiO_2 was separated into two phases.

Fuels, Lubricants, and Hydraulic Fluids

Aerojet-General Corp., Azusa, Calif.
PRESSURE-MEASURING INSTRUMENTATION FOR COMBUSTION STABILITY STUDIES, by Leon Green, Jr. Rept. on Contract AF 18(600)1048. Dec 55, 43p. AGC TN-14; OSR-TN-55-474; AD-81 081.
Order from LC mi$3.30, ph$7.80 PB 137 840

The operation of the pressure-measuring system employed in the solid-propellant combustion stability study being pursued under the present contract is described, and the limitations of the system are pointed out.

Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE INFLUENCE OF LUBRICANT PROPERTIES ON THE PERFORMANCE OF AIRCRAFT GAS TURBINE ENGINE ROLLING-CONTACT BEARINGS, by L. B. Sibley, J. C. Bell and others. Final technical rept. for 22 Apr 57-21 Sep 58 on Contract AF 33(616)5109. Oct 58, 75p. 73 refs. WADC Technical rept. 58-565; AD-204 218.
Order from LC mi$4.50, ph$12.30 PB 145 032

The development of improved lubricants for aircraft gas turbine engine bearings depends, to a large extent, on how well the influence of lubricant properties on bearing performance can be predicted. A literature and field survey and some special experiments and analyses on this problem have been conducted. A possible approach for further research in this field is suggested.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF QUANTITATIVE TESTS FOR ESTABLISHMENT OF STABILITY OF PROPELLANT, by Charles Lenchitz, Norman E. Beach, and Marvin Goldstein. Dec 58, 9p. 2 refs. Technical memo. no. GL-5-58.
Order from LC mi$1.80, ph$1.80 PB 138 354

As basic information, the stability tests standard at this Arsenal were evaluated for quantitative efficiency. This work substantiates a belief that the current thermal stability tests are qualitative rather than quantitative. The present tests are based on the detection or measurement of the gaseous products of propellant decomposition.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
INVESTIGATION OF THE STABILITY OF DETERIORATING PROPELLANTS, by Norman E. Beach. Dec 58, 21p. 1 ref. Technical memo. no. GL-4-58.
Order from LC mi$2.70, ph$4.80 PB 138 355

This report covers the accomplishments under the initial project. The scope of this "starter" project was to plan for and initiate work leading to the determination of the safe-life characteristics of propellants, and the test(s) or determination (s) which best give basis for a prediction of remaining safe life of propellants.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
NATIONAL EVALUATION OF THE QUICK TEST FOR DETECTION OF PROPELLANT DETERIORATION, by Norman E. Beach and John F. Dippman. Dec 58, 48p. Technical memo. no. GL-1-58.
Order from LC mi$3.30, ph$7.80 PB 138 356

Object was to effect a wide, unbiased trial of the Quick Test for detection of deterioration in stored propellant through the independent efforts of the potential user. The parameters for evaluation are: functional adaptability, universality, relation to existing stability tests and efficiency with respect to the establishment of cut-off criteria.

Naval Research Lab., Washington, D. C.
FLUOROALKOXYSILANES, by C. M. Murphy, J. G. O'Rear and others. Interim rept. 15 Dec 59, 16p. 9 refs. NRL rept. 5411.
Order from OTS $0.50 PB 161 026

Eight fluoroalkyl esters of silicic acid and one of phosphoric acid were prepared from the fluoroalcohols $F(CF_2)_n CH_2OH$, $H(CF_2CF_2)_nCH_2OH$, $H(CF_2CF_2)_n(CHOH(CH_3)$, and $H(CF_2CF_2)_nCOH(CH_3)_2$. These orthoesters were studied as potential high-temperature lubricants and hydraulic fluids. Most of the compounds have pour points below -65°F. Increasing the fluorine content improves flammability resistance but raises the viscosity-temperature coefficient. Orthoesters derived from primary fluoroalcohols are resistant to pyrolysis and oxidation but sensitive to hydrolysis. Stabilization against hydrolysis is achieved by introducing one or two tert-butoxy groups but at the expense of thermal and oxidation stability. Both secondary and tertiary fluoroalkoxy groups are inferior to tert-butoxy groups for stabilizing orthoesters against hydrolysis. The best compromise structures fail one or more of the requirements for a satisfactory high-temperature lubricant or hydraulic fluid.

Leather and Textiles

Fabric Research Labs., Inc., Dedham, Mass.
AN INDEX OF BLEND IRREGULARITY AND ITS PRACTICAL USE, by Myron J. Coplan, Charles A. Lermond, and Ruth A. Kenney. Technical rept. no. 4 on Contract Nonr-1422(00). 31 Dec 57, 26p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 138 405

It appears that staple processing machining tends to allow fibers to remain in clusters. Three cylinder carding reduces this somewhat. Drafting apparently reduced the clustering as evidenced by blend distribution along the strand length. The actions of doubling and condensing alone cannot accomplish this, but seem to randomize single fibers within cross-sections. (See also PB 124 313)

Fuels Research Lab., Mass. Inst. of Tech., Cambridge.
HEAT TRANSFER TO SKIN THROUGH THERMALLY-IRRADIATED DRY CLOTH, by N. Y. Chen and W. P. Jensen. Technical rept. no. 6 on Contract Nonr-1841(37). 8 July 58, 71p. 7 refs. AD-200 210.
Order from LC mi$4.50, ph$12.30 PB 144 818

An analysis is presented of the problem of heat transmission through dry opaque or diathermanous cloth and an air space into underlying skin, following exposure to thermal radiation. The problem is solved numerically by finite difference approximations, the method being given in detail. It is shown that a technique requiring only the appropriate weighting of temperature-rise data obtained from three curves yields results within 1 to 2% of those obtained by extensive machine calculations in which allowance is made for energy absorption at each of several increments into which the diathermanous cloth is conceptually divided. The analytical work is verified by good agreement with experimental results.

Owens-Corning Fiberglas Corp., Newark, Ohio.
PROPERTIES OF GLASS FIBERS AT ELEVATED TEMPERATURES, by W. H. Otto. Final rept. for 15 June 58-15 Aug 59 on Contract NOas-58-841-c. 15 Sep 59, 80p. 4 refs.
Order from LC mi$4.50, ph$12.30 PB 144 574

Glass fibers of four different glass compositions were evaluated on the basis of measured tensile strength, stress-rupture and modulus of elasticity at elevated temperatures. Strength-temperature relations were established for each glass from 75°F to that temperature at which a reduction of approximately seventy-five per cent of the original value was encountered. Stress-rupture measurements over the possible temperature range were made for load durations up to twenty hours. Measurements of modulus of elasticity were made at temperatures up to the softening temperature of the fibers. The effects of environment and commercial organic finishes on tensile strength and stress-rupture were investigated. (Author) (See also PB 143 669)

Quartermaster Research and Engineering Center, Natick, Mass.
STUDIES ON THERMAL PROPERTIES OF FABRICS OF VARYING SPECTRAL RESPONSE FOR THE OUTER LAYER OF THE COLD-WET UNIFORM IN A TWO-LAYER SYSTEM. PART I. PHYSICAL MEASUREMENTS OF FABRIC ASSEMBLIES. PART II. THERMAL PROTECTIVE PROPERTIES OF CAMOUFLAGE FABRICS, by Alvin O. Ramsley. Sep 59, 39p. 22 refs. Textile Series rept. 109; AD-227 159.
Order from LC mi$3.00, ph$6.30 PB 144 532

An investigation considering the problem of whether the somewhat higher absorptance required for adequate infrared camouflage would increase hazards from thermal radiation is described. Three cotton fabrics were used which differed from each other only in regard to the specific vat dyes required to achieve OD-7 and OG-107. One sample was vat dyed to a visual shade matching OG-107 but having a reflectance at 1μ satisfactory for good camouflage against active infrared detectors. Part I describes preparation of samples, optical and thermal measurements. Thermal data were obtained with the Quartermaster carbon arc source and inanimate receivers. Part II reviews available literature which used similar fabric systems. Previously reported data, obtained both in laboratory and field studies, neither refute nor corroborate the view that a good infrared camouflage colorant system in clothing assemblies is necessarily inimical to good thermal protection. The experimental portion describes a test in which pigs were protected during exposure to the carbon arc source by each of the 3 fabrics. It was concluded that the fabric which possesses all the reflectance characteristics necessary for good camouflage affords at least as good protection as the present standard OG-107. (Author)

Plastics

Aerojet-General Corp., Azusa, Calif.
A STUDY OF THE KINETICS OF SOLID-PHASE REACTIONS. Quarterly no. 9, 16 Sep-15 Dec 58, on Contract AF 18(603)74. 12 Dec 58, 9p. 3 refs. Rept. no. 1282-9.
Order from LC mi$1.80, ph$1.80 PB 144 571

The surface decomposition (linear pyrolysis) of both linear and cross-linked polymethylmethacrylate polymers has been studied over the surface-temperature range from 550 to 910°K.

Army Prosthetics Research Lab., Washington, D. C
REVISED TECHNIQUE FOR STAINING VINYL FILMS, by James T. Hill. 13 Oct 58, 5p. 1 ref. Technical rept. no. 5838; AD-205 260.
Order from LC mi$1.80, ph$1.80 PB 144 726

A revised technique of staining vinyl films, to determine their resistance to oil soluble inks, is presented A new ink formula is also presented to insure a reproducible supply of stainant. (Author)

Cornell U., Ithaca, N. Y.
AN EXPERIMENTAL STUDY OF MECHANICAL AND DIELECTRIC LOSSES IN CERTAIN HIGH POLYMERS, by H. S. Sack. Final rept. on Contract Nonr-401(09). Jan 59, 90p. 23 refs.
Order from LC mi$4.80, ph$13.80 PB 144 405

Second-order transitions in pure polyvinyl acetate, cellulose acetate pure and plasticized, cellulose nitrate pure, plasticized, plasticized and stabilized, and plasticized and cross-linked were studied using both mechanical and dielectric loss measurements. In the study of mechanical losses, the main effort was directed towards low frequencies, and equipment was designed which permitted measurements down to about 10^{-4} cps. Temperatures as low as -200°C were used in some cases. Dielectric measurements were made at higher frequencies, i.e., 60 cps to 2 mc. The addition of a plasticizer does not change radically the value of the activation energy for any particular transition, but only shifts the peaks to lower temperatures. The addition of a stabilizer makes the measurements more consistent and reproducible. Contrary to expectation, cross-linking reduces the value of the activation energy as observed from dielectric measurements. Plasticized samples are found to be rather unstable. It is suspected that the plasticizer evaporates during the experiments, thus often leading to incorrect results.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PREPARATION AND CHARACTERIZATION OF GRAFT COPOLYMERS, by Suresh N. Chinai, Jacob D. Matlack and others. Nov 59, 28p. 20 refs. Technical rept. 2660.
Order from OTS $0.75 PB 161 047

A number of synthetic problems involved in the preparation of poly(methyl methacrylate) grafted to polystyrene and its precursors have been resolved. The preparation of a completely isopropylated polystyrene by the polymerization of p-isopropylstyrene monomer has obviated earlier difficulties of color, fluorescence, and variable composition. The subsequent antoxidation of this material in a non-aromatic solvent, cyclohexane, with lauroyl peroxide as the oxidation catalyst has yielded a material of good reproducibility and high purity. Resorting to a sugar-containing polymerization recipe gave grafting at favorable rates with fair reproducibility. The grafts and their precursors were characterized by light-scattering and viscosity techniques. The apparently insufficiently dissimilar nature of the component polymers prevented the resolution of the polymeric mixture by extraction and fractional precipitation methods into similar structural species. The course of the fractional precipitation was followed with radioactive polymer. The infrared spectra of the p-isopropylstyrene monomer and its intermediates, and of related polymeric materials, are presented and analyzed in this report.

Material Lab., New York Naval Shipyard, Brooklyn.
THE EFFECTS OF WATER IMMERSION ON THE PROPERTIES OF GLASS REINFORCED POLYESTER LAMINATES, by S. Dastin. Final rept. 5 Apr 57, 7p. Lab. Project 4860-J-5.
Order from LC mi$1.80, ph$1.80 PB 145 028

The effects of water immersion on the properties of woven roving reinforced polyester laminates have been studied. Laminates were fabricated at the Laboratory by the "void free" vacuum bag technique, employing present day improved finish woven roving reinforcements. The laminates investigated showed superior wet strength retention as compared to laminates fabricated with earlier woven roving reinforcements. Further, the study indicated that, with a general purpose polyester a one hour gel system is sufficient to wet the reinforcement satisfactorily and to yield a sound laminate. The investigation also showed that, if resistance to water attack is a prime consideration, the laminate should contain resin in excess of about 45% by weight. (Author)

Office of Technical Services, Washington, D. C.
NEW PLASTIC MATERIALS THROUGH GOVERNMENT RESEARCH, by James Kanegis. Aug 58, 95p. 143 refs.
Order from OTS $2.25 PB 161 332

Hundreds of unclassified R&D reports released over the past three years by government agencies have been analyzed for significant content. Those of greater interest have been selected for review in the following order: irradiated plastics; molding; transparent materials; adhesives; coatings; fibers; sealants,

foams, interlayers, honeycomb; laminates; specific plastics such as inorganic and metallorganic polymers, silicones, fluoroplastics, acrylics; polyesters, epoxides, polyurethanes; polyethylene; vinyls and vinylidenes; phenolics; others such as styrenes, polyamides, and S-base. Fields of interest of various agencies are outlined. Most comments are documented, usually by reference to specific PB reports. (Author)

Rubber and Elastomers

Rock Island Aresenal Lab., Ill.
IDENTIFICATION OF ELASTOMERS BY INFRARED SPECTRA OF THEIR PYROLYZATES, by J. W. McGarvey. 19 Aug 58, 24p. 7 refs. Rept. no. 58-2159.
Order from LC mi$2.70, ph$4.80 PB 138 408

Representative infrared spectra of the pyrolyzates of various types of elastomers were recorded for the purpose of identifying unknown elastomers by comparison. This procedure offers an unusually rapid, qualitative method of analysis and possesses certain advantages which are lacking in more conventional techniques. The identification of an unknown sample by comparison of its infrared pyrolyzate spectrum to reference spectra in this report will usually permit a complete analysis to be made in approximately twenty minutes.

Rock Island Arsenal Lab., Ill.
TENSILE TEST REPRODUCIBILITY OF ELASTOMERIC VULCANIZATES, by Stanley L. Eisler. 3 Sep 58, 29p. 9 refs. Rept. no. 58-2315.
Order from LC mi$2.70, ph$4.80 PB 138 409

A number of variables were studied to determine their effect on the reproducibility of tensile tests of elastomeric vulcanizates. It was found that the size of the filler particles and the presence of undispersed curative particles, which probably produced areas of overcure, were the two most important factors affecting the tensile test reproducibility. These findings are in contrast to most published work which has dealt principally with the sample preparation and test procedure errors.

Wood and Paper

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, KHAYA OR AFRICAN MAHOGANY (KHAYA SPP.) by R. F. England. Sep 59, 5p. 7 refs. Progress rept. no. E-412-4.
Order from LC mi$1.80, ph$1.80 PB 144 701

The laminating properties of Khaya were investigated using three commercial adhesives. Curing conditions of 150-153°F for 6 hours (glueline temperature) produced satisfactory results with each of the adhesives tested. (Author)

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, KOKRODUA (AFRORMOSIA ELATA) by R. F. England. Sep 59, 5p. 7 refs. Progress rept. no. E-412-5.
Order from LC mi$1.80, ph$1.80 PB 144 700

The laminating properties of Kokrodua (a tropical African hardwood) were investigated using three commerical adhesives. Curing conditions of 150-153°F for 6-1/2 hours (glueline temperature) produced satisfactory results with each of the adhesives tested. (Author)

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, GREENHEART (OCOTEA RODIAEI) by R. F. England. Sep 59, 6p. 7 refs. Progress rept. no. E-412-6.
Order from LC mi$1.80, ph$1.80 PB 144 699

The laminating properties of greenheart (a tropical South American hardwood) were investigated using three commercial adhesives. Curing conditions of 150-154°F for 6 hours (glueline temperature) produced unsatisfactory results with each of the adhesives tested. (Author)

MATHEMATICS

Air Force Cambridge Research Center, Bedford, Mass.
AN ALGORISM FOR FACTORING X^n-1 OVER A FINITE FIELD, by Eugene Prange. Oct 59, 23p. AFCRC-TN-59-775.
Order from LC mi$2.70, ph$4.80 PB 144 588

An algorism is given for factoring X^n-1 over the finite field F_q of q elements. This can be of use in constructing another finite field over F_q, in constructing a linear recursion of period n over F_q, or in constructing cyclic error-correcting group codes. The algorism has two parts: Step 1, the construction of the multiplicative identities of the minimal ideals of $F_q[X]/[X^n-1]$; Step 2, the use of these idempotents in the construction of the irreducible factors of X^n-1. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A CONTINUOUS TRANSLATION OF HOLDER AND LIPSCHITZ FUNCTIONS, by H. Mirkil. Technical note no. 7 on Contract AF 49(638)294. 30 Oct 59, 19p. 6 refs. AFOSR-TN-59-983.
Order from LC mi$2.40, ph$3.30 PB 144 763

Applied Mathematics and Statistics Lab., Stanford U., Calif.
HOLDER CONTINUITY OF N-DIMENSIONAL QUASI-CONFORMAL MAPPINGS, by E. David Callender. Technical rept. no. 81 on Contract Nonr-225(11). 19 Feb 59, 32p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 144 813

This paper is an extension of previous work on the Hölder continuity of two-dimensional quasi-conformal mappings. The approach of Finn and Serrin is used to prove analogous results in n dimensions.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ESTIMATION OF DISPERSION FROM DIFFERENCES, by Anthony P. Morse. 13 July 45, 21p. 6 refs. Rept. no. 557.
Order from LC mi$2.70, ph$4.80 PB 145 060

In order to estimate dispersions in data, it is frequently desirable to eliminate the effects of unknown trends. It is shown that this may often be done by employing differences of an appropriate order. Tables estimating the precision of such a method are given. (Author)

California U., Berkeley.
THE ASYMPTOTIC BEHAVIOUR OF THE REAL SOLUTIONS OF CERTAIN SECOND ORDER DIFFERENTIAL EQUATIONS, by J. G. van der Corput. Technical rept. no. 3 on Asymptotic Expansions, Contract AF 18(600)958. June 55, 175p. 7 refs. AD-74 696.
Order from LC mi$8.10, ph$27.30 PB 144 546

Primary consideration is given to complete asymptotic expansions of the form $y'' + [P(x) + f(x)]y' + [Q(x) + g(x)]y = 0$, where f(x) and g(x) are perturbations of the related equation $y'' + P(x)y' + Q(x)y = 0$. Attention is also given to the case where the full asymptotic expansion is not required, and weaker conditions on f(x) and g(x) are considered which permit a discussion of the behavior of the solutions at infinity. (See also PB 144 547)

California U., Berkeley.
FUNDAMENTAL THEOREMS OF ASYMPTOTICS, by J. G. van der Corput. Technical rept. no. 1 on Asymptotic Expansions, Contract AF 18(600)958. June 54, 71p. 2 refs. AD-39 511.
Order from LC mi$4.50, ph$12.30 PB 144 547

Topics covered are equality, limits, convergent series, convergent multiple series, uniform convergence, analytic functions with prescribed asymptotic expansion, and equations.

California U., Berkeley.
INFINITELY MULTIPLE VALUED HARMONIC FUNCTIONS IN SPACE WITH TWO BASE BRANCH CURVES OF ORDER ONE. PART II, by Griffith C. Evans. Technical rept. no. 4 on Contract Nonr-222(62). Jan 59, 21p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 144 552

See also PB 143 409

Chicago U., Ill.
STRONG INVERTIBILITY OF C^∞ FUNCTIONS, by John J. McKibben. Technical rept. no. 5 on Investigations in the Theory of Partial Differential Equations, Contract DA 11-022-ORD-1833. Aug 58, 14p.
Order from LC mi$2.40, ph$3.30 PB 138 576

This is a discussion of the strong invertibility of infinitely differentiable functions. It is proved that an infinitely differentiable function is strongly invertible at each of its non-singular zeros.

Chicago U., Ill.
THE TEN TYPES OF H-SPACES, by I. M. James. Rept. on Contract AF 18(600)1383. Aug 59, 11p. 17 refs. AFOSR-TN-59-857; AD-228 377.
Order from LC mi$2.40, ph$3.30 PB 144 495

Columbia U., New York.
A STATISTICAL SCREENING PROBLEM, by Herbert Robbins. Rept. on Contract Nonr-266(59). Feb 59, 11p. CU-1-59-Nonr-266(59)MS; AD-211 292.
Order from LC mi$2.40, ph$3.30 PB 144 825

The following decision problem is considered. Θ is an unknown quantity which when measured yields a random variable
$$X = \Theta + Y,$$
where Y, the error in measurement, is a random variable with known distribution function $G(y) = Pr[Y \leq y]$.

Harvard U., Cambridge, Mass.
APPROXIMATION BY BOUNDED ANALYTIC FUNCTIONS: GENERAL CONFIGURATIONS, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 58, 10p. 1 ref. AFOSR-TN-58-703; AD-162 237.
Order from LC mi$1.80, ph$1.80 PB 137 872

Harvard U. [Cambridge, Mass].
EXPANSIONS IN SERIES OF HOMOGENEOUS POLYNOMIAL SOLUTIONS OF THE GENERAL TWO-DIMENSIONAL LINEAR PARTIAL DIFFERENTIAL EQUATION OF THE SECOND ORDER WITH CONSTANT COEFFICIENTS, by D. V. Widder. Sep 58, 8p. 2 refs. AFOSR-TN-58-706; AD-162 240.
Order from LC mi$1.80, ph$1.80 PB 137 863

Harvard U. [Cambridge, Mass].
EXPANSIONS IN SERIES OF HOMOGENEOUS POLYNOMIAL SOLUTIONS OF THE TWO-DIMENSIONAL WAVE EQUATION, by D. V. Widder. Rept. on Contract AF 18(600)1461. Sep 58, 14p. 2 refs. AFOSR-TN-58-707; AD-162 241.
Order from LC mi$2.40, ph$3.30 PB 137 864

Harvard U., Cambridge, Mass.
NOTE ON APPROXIMATION BY BOUNDED ANALYTIC FUNCTIONS (PROBLEM α), by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 58, 12p. 9 refs. AFOSR-TN-58-701; AD-162 235.
Order from LC mi$2.40, ph$3.30 PB 137 873

Harvard U., Cambridge, Mass.
NOTE ON INVARIANCE OF DEGREE OF POLYNOMIAL AND TRIGONOMETRIC APPROXIMATION UNDER CHANGE OF INDEPENDENT VARIABLE, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 59, 14p. 6 refs. AFOSR-TN-59-593; AD-217 183.
Order from LC mi$2.40, ph$3.30 PB 144 489

The object of this note is to show that various commonly used measures of degree of approximation are invariant under one-to-one analytic transformation of the independent variable, and this is true for both approximation by polynomials in the complex variable and trigonometric approximation in the real variable. The methods used here have already been used several times in the literature, especially by J. H. Curtiss, and Walsh and Sewell, and Walsh, but the present treatment is more unified and more complete, and emphasizes for the first time invariance of degrees of approximation. (Author)

Harvard U., Cambridge, Mass.
NOTE ON LEAST-SQUARE APPROXIMATION TO AN ANALYTIC FUNCTION BY POLYNOMINALS, AS MEASURED BY A SURFACE INTEGRAL, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Aug 58, 13p. 2 refs. AFOSR-TN-58-708; AD-162 242.
Order from LC mi$2.40, ph$3.30 PB 137 926

Harvard U., Cambridge, Mass.
ON DEGREE OF APPROXIMATION BY BOUNDED HARMONIC FUNCTIONS, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Apr 59, 30p. 10 refs. AFOSR-TN-59-235; AD-212 005.
Order from LC mi$2.70, ph$4.80 PB 144 468

If u(x, y) is defined on an analytic Jordan curve C, a necessary and sufficient condition that u(x, y) be of class L(p, α), $0 < \alpha < 1$, on C is that there exist functions $u_n(x, y)$ harmonic in a region D containing C satisfying $|u_n(x,y)| = AR^n$ in D and $|u(x, y)-u_n(x, y)| \leq A_1/n^{p+\alpha}$ on C. This result on Problem α for harmonic functions can be complemented by a result on Problem β precisely analogous to Theorem 1 of TAMS vol. 87 (1958) pp. 467-484 provided f(z) and $f_n(z)$ are supposed analytic on and within each B_j.

Harvard U., Cambridge, Mass.
POLYNOMIALS OF BEST APPROXIMATION ON AN INTERVAL, by J. L. Walsh and T. S. Motzkin (U. of California) Rept. on Contract AF 18(600)1461. Oct 59, 12p. 4 refs. AFOSR-TN-59-854; AD-228 078
Order from LC mi$2.40, ph$3.30 PB 144 494

The present writers have recently studied juxtapolynomials and their relation to polynomials of best approximation to a given function on a real finite point set, especially with reference to oscillation properties. The object of the present note is to indicate, partly without proof, new results on the analogous problems of approximation to a given continuous function on a closed finite interval E. (Author)

Institute for Advanced Study, Princeton, N. J.
ON A PROBLEM OF L. FEJES-TOTH, by B. Graunbaum. Rept. on Contract AF 49(638)253. Sep 59, 4p. AFOSR-TN-59-981; AD-228 282.
Order from LC mi$1.80, ph$1.80 PB 144 471

In Euclidean 3-space, a point is "hidden" by a set of spheres (which do not contain the point) if any ray issuing from the point intersects at least one of the spheres. Fejes-Toth established that six congruent, non-intersecting spheres may hide a point. We prove that five congruent non-intersection spheres may not hide a point.

Institute of Mathematical Sciences, New York U., N. Y.
THE INFLUENCE OF EDGES AND CORNERS ON POTENTIAL FUNCTIONS OF SURFACE LAYERS, by Rolf Leis. Rept. on Contract AF 49(638)229. June 59, 23p. 3 refs. Research rept. no. BR-29; AFOSR-TN-59-943.
Order from LC mi$2.70, ph$4.80 PB 144 766

The potential functions of multiple surface layers behave singularly when approaching the boundary of the surface. The degree of the singularities of these functions and their derivatives are discussed in this paper. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
ON SOME FREDHOLM INTEGRAL EQUATIONS ARISING IN DIFFRACTION THEORY, by C. H. Yang. Rept. on Contract AF 49(638)229. Aug 59, 20p. 7 refs. Research rept. BR-31; AFOSR-TN-59-944.
Order from LC mi$2.40, ph$3.30 PB 144 765

Kernels of integral equations arising in diffraction theory are investigated. These kernels depend on a parameter α. Fredholm's theory shows that the resolvents of the kernels are meromorphic functions of α and, hence, can be expanded into power series of α which are convergent for certain regions. Regions of convergence for α, in which the perturbation method would work, are examined. (Author)

Massachusetts Inst. of Tech., Cambridge.
LORENTZ STRUCTURES ON THE PLANE, by J. Wolfgang Smith. Technical note on Contract AF 49(638)42. [1959] 27p. 3 refs. AFOSR-TN-59-652.
Order from LC mi$2.70, ph$4.80 PB 144 659

Very little is known at present about the global properties of Lorentz manifolds. While these differ from Riemannian spaces ostensibly in the signature of the metric tensor field, one comes to realize quickly that Lorentz geometry in the large will require its own methods and must lead to some unaccustomed results.

Michigan U. [Ann Arbor].
RADIAL CLUSTER SETS AND THE DISTRIBUTION OF VALUES OF MEROMORPHIC FUNCTIONS, by W. B. Woolf. Rept. on Contract AF 49(638)104. Oct 59, 34p. 19 refs. AFOSR-TN-59-1041.
Order from LC mi$3.00, ph$6.30 PB 144 772

This paper is devoted to an investigation of the behavior near a singularity of a function $w = f(z)$ meromorphic in the unit disk. Particular emphasis is placed on the problem of deriving meaningful results for non-isolated singularities.

Minnesota U. [Minneapolis].
CHANGE OF TIME SCALE FOR MARKOV PROCESSES, by Steven Orey. Rept. on Contract AF 49(638)617. 1 Sep 59, 22p. 5 refs. AFOSR-TN-59-1067.
Order from LC mi$2.70, ph$4.80 PB 144 771

Let $\{X_n\}$ be a recurrent Markov chain, $n = 0, 1, \ldots$. A new process $\{X_t\}$, $0 \leq t < \infty$ is obtained from the original process by requiring a wait of duration $\gamma(x)$ after reaching x, for every state x, where $\gamma(x) > 0$. Let $\tilde{X}_t = (X_t, Y_t)$, where Y_t is the elapsed time since the last transition. $\{\tilde{X}_t\}$ is a Markov process; Y_t is a generalized renewal process. Results are obtained about the structure of the $\tilde{X}_t$ - process and the asymptotic behavior of the transition probabilities. The case in which the waiting times are random variables is also treated. (Author)

Missouri U., Columbia.
SOME ASPECTS OF UNSTABLE HOMEOMORPHISMS, by J. F. Jakobsen and W. R. Utz. Technical rept. no. 10 on Contract AF 18(600)1108. Nov 58, 20p. 7 refs. AFOSR-TN-58-1040; AD-206 574.
Order from LC mi$2.40, ph$3.30 PB 138 353

Naval Research Lab., U. of Wisconsin, Madison.
THE EXPANSION AND INTEGRATION OF PRODUCTS OF SURFACE HARMONICS AND OF CERTAIN RELATED QUANTITIES, by M. P. Barnett. Rept. on Contract N7onr-28511. 25 Mar 58, 64p. 16 refs. WIS-ONR-30.
Order from LC mi$3.90, ph$10.80 PB 139 255

Formulae and tables are provided for the expansion of products of trigonometric functions and spherical harmonics as series in spherical harmonics, and for some integrals closely related to these expansion coefficients.

Naval Research Lab., U. of Wisconsin, Madison.
THE POWER SERIES EXPANSION OF A CERTAIN CLASS OF FUNCTIONALS, by M. P. Barnett. Rept. on Contract N7onr-28511. 7 Jan 59, 11p. 3 refs. WIS-ONR-35.
Order from LC mi$2.40, ph$3.30 PB 144 550

The technique described in this report is in effect a generalization of a procedure used in classical astronomy that involved the so-called Newcomb operators. The general procedure is derived in section 2, and is summarized in equations (11), (12), (15), (17), and (18). Section 3 deals with possible extensions of the method and, section 4 contains some comments on the relationship between the present method and the special cases treated previously by earlier workers.

P[erkin]-E[lmer] C[orp., Norwalk, Conn.]
SINGULAR DIFFERENTIAL BOUNDARY PROBLEMS OF A FOURIER TYPE, by Robert W. McKelvey. Rept. on Contract AF 33(616)5649. 30 Apr 59, 40p. 8 refs. WADC Technical rept. 59-288.
Order from OTS $1.00 PB 161 350

Let L be a linear differential operator defined for twice differentiable functions x(t) by $Lx = -x'' + q(t)x$, with q(t) real, continuous, and satisfying $\int_0^\infty t\,|q(t)|\,dt < \infty$. Since the operator L falls under Weyl's "limit point case", it follows that the differential equation $Lx = \lambda x$, the condition that x(t) be integrable-squared on $0 \leq t < \infty$, and the boundary condition $\sin\alpha \cdot x(0) - \cos\alpha \cdot x'(0) = 0$, for fixed α ($0 \leq \alpha < \pi$), determine a non-trivial boundary problem H. Much of the paper is an investigation of the solutions of $Lx = \lambda x$ on $0 \leq t < \infty$ when λ is near zero, and through this, of the nature of the spectral function of H when λ is in a neighborhood of the origin. The results are then applied to a study of the related eigenfunction expansion of an arbitrary summable function f(t). (Author)

Purdue U., Lafayette, Ind.
A CHARACTERIZATION OF MULTICOHERENT PEANO SPACES, by A. Lauria and C. J. Neugebauer. Technical note no. 19 on Analytical Theory of Continuous Transformations, Contract AF 18(600)1484. Nov 59, 15p. 10 refs. AFOSR-TN-59-801.
Order from LC mi$2.40, ph$3.30 PB 144 753

Rome Air Development Center, Griffiss AFB, N. Y.
AN INTRODUCTION TO PROBABILITY THEORY DISCRETE SCHEMES, by F. M. Reza. Aug 59, 74p. 6 refs. RADC-TN-59-129.
Order from LC mi$4.50, ph$12.30 PB 144 485

In a recent report, considerable reliance on a background of probability theory was assumed. In view of the availability of some notes on discrete probability theory (based on a forthcoming book), it was felt desirable to publish these in technical note form. A report on nondiscrete probability may be published in the future. This report treats the fundamental notions of probability using modern concepts of set theory.

Statistical Techniques Research Group, Princeton U., N. J.
ON AN ITERATIVE METHOD FOR FINDING A LOCAL MINIMUM OF A FUNCTION OF MORE THAN ONE VARIABLE, by E. M. L. Beale. Technical rept. no. 25 on Contract DA 36-034-ORD-2297. Nov 58, 45p. 13 refs. OOR rept. 1715.23M.
Order from LC mi$3.30, ph$7.80 PB 144 817

A new approach to the problem of finding a minimum

(or at least a local minimum) of an arbitrary function of several variables is presented. This approach tends to reduce the number of function evaluations required to obtain an adequate approximation to the minimum, at the expense of considerable extra computation between evaluations. It is therefore considered appropriate in situations where each evaluation is a slow or costly process. A complete algorithm based on this approach is described, but some of the details may require modification in the light of further practical experience. (Author)

Virginia Agricultural Experiment Station, Blacksburg.
THE DEVELOPMENT OF STATISTICAL METHODS FOR EXPERIMENTAL DESIGNS IN QUALITY CONTROL AND SURVEILLANCE TESTING, by R. N. Pendergrass and R. A. Bradley. Technical rept. no. 5 (Final) on Ranking in Triple Comparisons, Contract Nonr-2352(01). Jan 59, 41p. 30 refs.
Order from LC mi$3.30, ph$7.80 PB 144 400

Paired comparisons are widely used in subjective testing. While small block-size designs are usually necessary, it is not always desirable to use paired comparisons. This paper deals with methods of analysis for the ranking of t treatments in sets or subsets of the possible $\binom{t}{3}$ triple comparisons formed from t treatments. A mathematical model for triple comparisons has been devised as an extension of the model for paired comparisons. Treatment parameters are postulated and estimated by the method of maximum likelihood and the asymptotic variances and covariances of these estimators are found. Test procedures are also derived. A brief numerical example is included. (See also PB 143 925)

Washington U., St. Louis, Mo.
INTEGRAL p-adic NORMAL MATRICES SATISFYING THE INCIDENCE EQUATION, by J. K. Goldhaber. Final technical rept. for 15 Oct 56-14 Oct 58 on Pairs of Matrices with Property L, Contract DA 23-072-ORD-1051. [1959] 9p. 11 refs.
Order from LC mi$1.80, ph$1.80 PB 138 577

Wayne State U., Detroit, Mich.
STATISTICAL TECHNIQUES IN LIFE TESTING. CHAPTER III. PROBLEMS OF ESTIMATION, by Benjamin Epstein. Technical rept. no. 4 on Contract Nonr-2163(00). 15 Jan 59, 106p. 11 refs.
Order from LC mi$5.70, ph$16.80 PB 144 401

It is frequently important that one make estimates of mean life, rates of failure, probability of survival for a given time, etc, on the basis of data arising from life tests. The data may be generated in many ways; e.g., they may arise from truncated, censored, sequential, replacement, non-replacement, interrupted, or combined experiments; we may or may not know the exact times to failure. We shall try in what follows to give rules and procedures which enable us to give point and interval estimates which are in some sense optimum.

Wisconsin U., Madison.
FOURIER TRANSFORMS OF GENERALIZED FUNCTIONS, by Jacob Kerevaar. Rept. on Contract N7onr-28507. Oct 58, 44p. 10 refs. AD-212 336.
Order from LC mi$3.30, ph$7.80 PB 144 433

Presented at the Symposium on Harmonic Analysis at Cornell U., Ithaca, New York, July 1956.

A symmetric theory of Fourier transforms is discussed for generalized functions or distributions. The class of distributions for which Fourier transforms are defined is the class of distributions of moderate growth. A fundamental sequence $[f_n]$ on $(-\infty,\infty)$ is said to be of moderate growth if there exist an integer $p \geq 0$, as a sequence $[f_n^{(-p)}]$ of antiderivatives of order p of the f_n, and constants A and a such that $|[f_n^{(-p)}(t)]| \leq A(|t|+1)^a$, $-\infty < t < \infty$, $n = 1, 2, \ldots$. A distribution ϕ is said to be of moderate growth if one of its defining fundamental sequences is. The class of distributions of moderate growth is characterized as the class of (generalized) derivatives $[F]^{(p)}$ of arbitrary order p of the integrable functions F which satisfy an inequality of the form $|F(t)| \leq B(|t|+1)^b$, $-\infty < t < \infty$.

Computing Devices

Applied Mathematics and Statistics Lab., Stanford U., Calif.
NUMERICAL METHODS FOR HIGH SPEED COMPUTERS: A SURVEY, by George E. Forsythe. Technical rept. no. 1 on Contract Nonr-225(37). 30 Jan 59, 22p. 20 refs.
Order from LC mi$2.70, ph$4.80 PB 144 556

Avion Div., ACF Industries, Inc., Alexandria, Va.
DESIGN OF A GENERAL PURPOSE DATA STORAGE SYSTEM, by Earl D. Gibson and Howard Knoer. Final rept. for 15 July 57-31 Oct 58 on Contract AF 19(604)2648. [1958] 138p. 44 refs. AFCRC-TR-58-189; AD-160 856.
Order from LC mi$6.90, ph$21.30 PB 138 424

This is the final report on a program of investigation, study, and design of a data storage system as a means of recording the data from a variety of analog computers in a form suitable for analytical study by digital computation. The problems associated with selecting the data to be stored and the sampling rates are considered. A highly flexible system which could be readily adapted to the needs of a wide variety of applications is presented. The basic functions of collecting digitizing, and storing the data are discussed along with several optional, special features. An alternate system is described along with several detailed approaches to some of the key problems.

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY. Rept. for 1 Dec 58-1 Mar 59 on Contract AF 19(604)4947. [1959] 36p. 2 refs. Scientific rept. no. AF-53; AFCRC-TN-59-373; AD-217 826.
Order from LC mi$3.00, ph$6.30 PB 143 026

Contents:
Section 2. Aerodynamic origin of Magnus moment, by Edward Benton. [1958]
Section 3. Discrete array patterns, by James Misho. 10 June 58. Problem rept. no. 115.
Section 4. Tabulation of certain functions in capillary theory, by John W. Seward. 15 Nov 58. Problem rept. no. 116.
Section 5. Tables of spherical Bessel functions, by John W. Seward. [1958] Problem rept. no. 117.
Section 6. Airspeeds, altitudes and Mach numbers, by Charles King and Hugh Hawkes. Jan 55. Problem rept. no. 118.

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY. Rept. for 1 Mar-1 Sep 59 on Contract AF 19(604)4947. 1 Sep 59, 12p. Scientific rept. no. AF-56; AFCRC-TN-59-761.
Order from LC mi$2.40, ph$3.30 PB 144 590

This report concerns an investigation into the fluid mechanism responsible for the Magnus moment on a finned missile. Since almost no data is available on this matter, the object, during the period covered, has been to devise an experimental set-up for the direct measurement of Magnus moment. (See also PB 141 591)

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY. Rept. on Contract AF 19(604)4947. 1 Aug 59, 37p. Scientific rept. no. AF-55; AFCRC-TN-59-760.
Order from LC mi$3.00, ph$6.30 PB 144 591

The functions "x" and "z" which have been tabulated are the solution of the equations

$$\frac{dx}{d} = \rho \cos\phi$$

$$\frac{dz}{d\phi} = \rho \sin\phi$$

$$\frac{1}{\rho} + \frac{\sin\phi}{x} = 2 + \beta z$$

subject to the initial conditions

$$x = z = 0 \text{ and } \rho = 1 \text{ when } \phi = 0.$$

(See also PB 140 098)

David Taylor Model Basin, Washington, D. C.
704 PERTURBATION CALCULATION AML PROBLEM 840-121, by Maxine Jackson. Jan 58, 15p. Rept. 1166; reprint of Applied Mathematics Lab. Technical rept. 60.
Order from LC mi$2.40, ph$3.30 PB 138 431

The three group 704 Perturbation Calculation (P. S.) is a code prepared for the Knolls Atomic Power Laboratory to be used in connection with CURE, their 704 program for two-dimensional reactor design calculations.

General Electric Co., Schenectady, N. Y.
MEASURED RANGE ACCURACY OF THE HERMES A-3 DIGITAL COMPUTER AS AFFECTED BY (a) CERTAIN GUIDANCE SYSTEM TOLERANCES (b) WINDS AND FINITE GROUND LOOP RESPONSE, by P. G. Cushman and J. J. Weinstein. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 10 Sep 51, declassified 17 Mar 58, 15p. 3 refs. Technical information series no. DF 51A0520.
Order from LC mi$2.40, ph$3.30 PB 144 624

Deviations of the Hermes A-3 flight path from the standard trajectory in elevation and azimuth require small corrections to be made in the computed range of the missile. This study was made to determine if the corrections, corresponding to expected flight path deviations, were small enough to be neglected in the digital computer.

Michigan U., Ann Arbor.
LECTURES ON SWITCHING AND AUTOMATA THEORY, by Calvin C. Elgot. Rept. on Contracts Nonr-1224(21) and DA 20-018-ORD-16971. 1958, 80p. 62 refs.
Order from LC mi$4.50, ph$12.30 PB 144 451

These lectures include a study of two-terminal series-parallel relay contact networks, multi-terminal relay contact networks, and sequential networks. General, systematic techniques for the study of series-parallel networks have employed Boolean algebra or propositional calculus. A basic paper on multi-terminal relay contact nets makes use of matrices whose entries are elements of a Boolean algebra. More recent work makes use of the algebraic concepts: lattice, semi-group, group. The concept of ring when suitably specialized is intimately connected with Boolean algebras. This indicates the extent to which algebra is invading the mathematical theory of switching. Much recent work has employed more advanced aspects of logic than the propositional calculus. Indeed, the use of logic and its techniques has already produced significant results and promises still more fruitful ones.

National Research Labs., Ottawa (Canada)
REQUIREMENTS FOR A HYBRID ANALOG-DIGITAL COMPUTER, by D. C. Baxter and J. H. Milsum. Oct 59, 29p. 14 refs. Mechanical engineering rept. MK-7.
Order from LC mi$2.70, ph$4.80 PB 144 508

Conventional analog and digital computers are critically compared as to their relative suitability for scientific and engineering problems. Hybrid computers are defined as those in which computing operations of both types are combined, and the requirements are outlined for such a union to be advantageous. An economical, completely-general-purpose, hybrid computer seems unlikely, but there are many special purpose applications of advantage, and examples are given. (Author)

Stavid Engineering, Inc., Plainfield, N. J.
RESEARCH DIRECTED TOWARDS INSTALLATION, TESTING, DEVELOPMENT, AND MODIFICATION

OF EXPERIMENTAL DATA PROCESSING EQUIPMENT. Final engineering rept. on Contract AF 19(604)3503. Nov 59, 98p. 12 refs. AFCRC-TR-59-355; AD-228 308
Order from LC mi$5.40, ph$15.30 PB 144 425

This report describes the efforts of the contractor during a 17-month period in providing technical and engineering support necessary to the operation of a complex data processing system used as a tool in human research studies. It describes the system used, the problems encountered and their solutions, and the developmental tests toward improvement of equipment and simulation techniques. The report describes the use of equipment in two separate configurations: (1) the use of an experimental tactical air control center system with semi-automatic tracking, intercept, storage, and display provisions for component and system tests in human factor studies; and (2) through the experience gained, its eventual evolution and ultimate reinstallation into an advanced laboratory simulation facility for research on man/machine systems. In the latter configuration, the report places particular emphasis on various techniques used for the simulation and generation of complex tactical situations and corresponding methods of display, readout, and data reduction for purposes of threat evaluation and action selection. Thus, although intended for research in problems of military psychology, the information techniques employed are applicable and should be of interest to those concerned with systems of air traffic control, ground control of interceptors, missile launch, and control and command systems in general.

MECHANICS

Bolt, Beranek and Newman, Inc., Cambridge, Mass.
DAMPING OF BENDING WAVES IN MULTI-LAYER PLATES, by Gunther Kurtze. Rept. on Contract Nonr-2321(00). 27 Feb 59, 88p. 4 refs. Rept. no. 614.
Order from LC mi$4.80, ph$13.80 PB 144 819

Damping of structure-borne noise and vibration requires materials with high internal losses. Unfortunately homogeneous isotropic materials which combine the desired structural rigidity with a high loss tangent are not available for most applications. The desired damping, therefore, is usually obtained by various "damping treatments" in which dissipative coatings or layers are added to the structural elements. The analysis necessary for the design of such damping treatments involves the solving of a system of coupled differential equations, usually of the fourth order and, in addition, a considerable amount of algebra.

Brown U. Div. of Engineering, Providence, R. I.
AN EXPERIMENTAL STUDY OF PULSE PROPAGATION IN ELASTIC CYLINDERS, by D. Y. Hsieh and H. Kolsky. Technical rept. no. 4 on Contract Nonr-562(14). Oct 57, 11p. 9 refs. Nonr-562(14)/4.
Order from LC mi$2.40, ph$3.30 PB 138 909

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE FORMULATIONS OF CONSTITUTIVE EQUATIONS IN CONTINUUM PHYSICS, by A. C. Pipkin and R. S. Rivlin. Technical rept. no. 4, Jan 57-Sep 58, on Application of Invariance Principles in Continuum Mechanics, Contract DA 19-020-ORD-4531. Sep 58, 115p. 13 refs. DA-4531/4.
Order from LC mi$6.00, ph$18.30 PB 138 438

Constitutive equations prescribing a tensor of arbitrary rank in terms of displacement gradients and an arbitrary number of vectors are examined. The restrictions imposed upon such relations by form-invariance under rotation of the physical system are obtained. A method of finding the restrictions due to symmetries of the material is outlined, and this method is used in obtaining explicit results for seven groups of symmetry transformations.

Brown U. Div. of Applied Mathematics, Providence, R. I.
NOTE ON THE EXPANSION IN POWERS OF POISSON'S RATIO OF SOLUTIONS IN ELASTOSTATICS, by Eli Sternberg and Rokuro Muki. Technical rept. no. 6 on Contract Nonr-562(25). Feb 59, 12p. 13 refs. 562(25)/6.
Order from LC mi$2.40, ph$3.30 PB 144 823

This paper examines the power-series development with respect to Poisson's ratio of the solution to the second boundary-value problem (surface tractions prescribed) in three-dimensional classical elastostatics for the case of vanishing body forces. The individual terms of this expansion, by means of steady-state thermoelasticity theory, are found to admit an independent physical interpretation. This interpretation, in turn, permits certain conclusions concerning the dependence upon the elastic constants of solutions to space problems.

Brown U. Div. of Applied Mathematics, Providence, R. I.
ULTRASONIC ATTENUATION IN MILD STEEL UNDER DEFORMATION, by Raymond G. Bayer. Rept. on Contract AF 18(603)136. 15 Sep 58, 42p. 14 refs. AFOSR-TN-58-913; AD-204 567.
Order from LC mi$3.30, ph$7.80 PB 137 930

The losses in mild steel as a function of strain results from the combination of magnetic domain mechanisms and dislocation mechanisms. A heuristic model using known magnetic domain losses and known dislocation losses is proposed to explain the observed dependence.

Institute of Research, Lehigh U. [Bethlehem, Pa.]
PROPAGATION OF ELASTIC AND PLASTIC DEFORMATION IN SOLIDS, by C. W. Curtis. Annual rept. for 1 Sep 57, 31 Aug 58 on Contract DA 36-034-ORD-1456, Supplement 4. [1958] 17p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 138 475

Contributions to the theory of the propagation of elastic strain calculations to determine the effect of varying the time-dependence of the applied pressure. Method of solving problems involving "mixed end conditions."

Michigan U., Ann Arbor.
THE TORSION OF SHAFTS OF VARYING CIRCULAR CROSS SECTIONS, by Hubert L. Hunzeker. Rept. on Contract AF 49(638)104. Oct 58, 85p. 36 refs. AFOSR-TN-58-738; AD-201 504.
Order from LC mi$4.80, ph$13.80 PB 137 839

Contents:
A shaft with a prolate ellipsoidal cavity
The torsion of a shaft with an oblate ellipsoidal cavity
Torsion of hyperboloids of revolution
The torsion of a semi-infinite shaft with a general monotone meridian section

Minnesota U., Minneapolis.
BEAM VIBRATIONS WITH QUASI-ORTHOGONAL BOUNDARY CONDITIONS, by Y. C. Das, L. E. Goodman and A. R. Robinson. Rept. for June-Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. Nov 59, 46p. 8 refs. WADC Technical rept. 59-76.
Order from OTS $1.25 PB 161 348

An exact solution is developed for the transient and steady-state motion of beams when rotational or translational viscous damping enters the boundary conditions. The method is applicable to any structures whose governing differential equations and boundary conditions would, in the absence of energy dissipation, constitute a classical Strum-Liouville system. (Author)

Naval Ordnance Lab., White Oak, Md.
ROTATION INDUCED BY SINUSOIDAL EXCITATION, by Daniel Stern. 9 Sep 57, 26p. 14 refs. NAVORD rept. 5726; AD-157 273.
Order from LC mi$2.70, ph$4.80 PB 144 720

A freely supported rigid rod rests in a tube. The rod of outside radius r, and the tube of inside radius R, are both right circular cylinders. The longitudinal axes of the rod and tube are horizontal. If the tube receives transverse sinusoidal excitations, the rod usually bounces. However, for particular combinations of frequency and acceleration, it is possible for the rod to rotate without bouncing. Experimental results of various rod and tube models are reported. The locus of the rod's center during rotation is derived. A relationship between rotation and exciting frequency is derived. An expression for the period of rotation is developed. An approximate relationship for predicting rotation is also developed. (Author)

Royal Inst. of Tech. (Sweden).
MEASURING ACCURACY IN CREEP TESTS. PART II. INFLUENCE OF THERMAL STRESSES, by Arne Mellgren. Rept. for June-Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 61(052)05. Oct 59, 60p. 10 refs. WADC Technical rept. 59-78, Pt. 2.
Order from OTS $1.50 PB 161 356

In this report the author calculates the thermal stresses induced in cylinders and plates by non-uniform surface temperatures. The relations of thermal stresses to creep are then determined for cylindrical and sheet creep specimens. These relations are expressed mathematically for sinusoidal and square wave surface temperature gradients. Numerical examples are presented and discussed. (Author) (See also PB 151 928)

Aerodynamics and Pneumatics

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ON THE STABILITY OF ONE-DIMENSIONAL VISCOUS FLOWS: SOUND WAVES AND SHOCK WAVES, by Louis G. Kaufman, II and Morris Morduchow (Polytechnic Inst. of Brooklyn). Aug 59, 53p. 29 refs. WADC Technical rept. 59-355.
Order from OTS $1.50 PB 161 318

The solution to the steady one-dimensional Navier-Stokes equations is presented for the case of Prandtl number equal to 3/4 and constant coefficients of specific heats and viscosity. The solution has been shown to be valid for ordinary air flows with free-stream Mach numbers not exceeding about two. The unsteady flow solution is achieved by assuming a small one-dimensional perturbation of the steady flow and thence linearizing the equations. Solutions for the disturbance then vary exponentially with time. Two simultaneous ordinary differential equations for the velocity and temperature disturbances as functions of the space variable, with the complex damping or amplification factor as an eigenvalue depending on the disturbance wave length, are then derived. Disturbed uniform flows of both inviscid and viscid fluids are solved exactly; the resulting characteristic equations have eigenvalues with negative real parts which indicate that the disturbance decreases with time and hence that the uniform flows are stable. These results can be interpreted as indicating the speed of propagation and the rate of damping of one-dimensional sound waves with viscosity and heat conduction. Approximate methods are applied to obtain the characteristic equation for shock-wave flows. All of the several methods used here, which are essentially applications of the methods of collocation and of averages, yield the exact solution results for the special case of sonic flows, and all tend to predict instability for shock-wave flows. The analysis indicates, in particular, that for shock-wave flows there will always exist disturbance wave lengths, namely sufficiently large ones, for which the disturbances will tend to amplify with time. The instability is less pronounced, if at all present, for very small disturbance wave lengths (less than 10^{-4} inches for sea-level atmospheric conditions. (Author)

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION

PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME. BIBLIOGRAPHY, PART II, VOLUME II. MATERIALS, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 328p. 809 refs. WADC Technical rept. 55-99; AD-74 498.
Order from LC mi$11.10, ph$50.10 PB 144 695

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME. BIBLIOGRAPHY. PART II, VOL. 4, METHODS ANALYSIS, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 99p. 343 refs. WADC Technical rept. 55-99; AD-74 500.
Order from LC mi$5.40, ph$15.30 PB 145 064

Contents:
Structural thermodynamic analysis
Loads and stresses
Structural allowables
Dynamic analysis
Creep theories
Thermal shock theories
(See also PB 144 695)

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME. PART II. BIBLIOGRAPHY, VOLUME 5. METHODS OF TEST, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 87p. 289 refs. WADC Technical rept. 55-99; AD-74 561.
Order from LC mi$4.80, ph$13.80 PB 145 001

Contents:
Instrumentation
Fundamental engineering data - Experimental methods
Atmospheric properties
Heat transfer and fluid flow
Materials properties
Developmental testing
Proof testing
Flight testing
(See also PB 144 695)

Arnold Engineering Development Center [Tullahoma, Tenn.]
CALIBRATION OF A 40-INCH CONTINUOUS FLOW TUNNEL AT MACH NUMBERS 1.5 TO 6, by C. J. Schueler and W. T. Strike. Rept. on ARO, Inc., Contract AF 40(600)800. Nov 59, 39p. 9 refs. AEDC-TN-59-136.
Order from LC mi$3.00, ph$6.30 PB 144 585

A test program was conducted to calibrate the von Karman Gas Dynamics Facility"s 40- by 40-in., continuous, supersonic wind tunnel (Tunnel A). Theoretical nozzle contours were adjusted, and local Mach numbers and flow angles were measured within a region of the test section. Results of the calibration at Mach numbers from 1.5 to 6 in half Mach number increments are presented. Included in the nozzle calibration program were tests of two typical models, AGARD Calibration Model B and a 15-deg cone cylinder.

Avco-Everett Research Lab., Mass.
FLIGHT MAGNETOHYDRODYNAMICS, by Arthur R. Kantrowitz. Rept. on Contracts AF 04(647)278 and 49(638)61. Mar 59, 20p. 6 refs. Research rept. 51; AFBMD-TN-59-27; AFOSR-TN-59-882.
Order from LC mi$2.40, ph$3.30 PB 144 785

A brief discussion is given of the possible flight applications of magnetohydrodynamics and the conditions under which they might be practical. A review of previous work is also given. (Author)

California U., Berkeley.
NONLINEAR PARABOLIC EQUATIONS: GENERALIZED FLOW OF GASES THROUGH POROUS MEDIA, by Avner Friedman. Technical rept. no. 3 on Contract Nonr-222(62). Jan 59, 30p. 14 refs.
Order from LC mi$2.70, ph$4.80 PB 144 553

Case Inst. of Tech., Cleveland, Ohio.
INITIAL BEHAVIOR OF A SPHERICAL RAREFACTION WAVE, by K. A. Faymon. Technical rept. no. 3 on Contract Nonr-1141(01). May 57, 158p. 17 refs.
Order from LC mi$7.50, ph$24.30 PB 138 998

The initial behavior of a spherical rarefaction wave is investigated by allowing an initially quiet gaseous sphere to expand into a vacuum. The ensuing motion in different regions of the x, t-plane is investigated by seeking solutions to the spherical equations of motion in the form of power series for the particle and sonic velocities.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ROLLING PULLOUT STUDY. PART II: FLIGHT MEASUREMENT OF VERTICAL AND HORIZONTAL TAIL LOADS DURING A RUDDER LOCKED ROLLING PULLOUT MANEUVER, by D. W. Rhoads. Rept. on Contract W33-038-ac-18517. Jan 52, declassified 27 July 54. 415p. 5 refs. Rept. no. TB-451-F-4; AF Technical rept. no. 6701; ATI-204 300.
Order from LC mi$11.10, ph$63.60 PB 144 525

Flight tests have been conducted on an F-80A airplane for the basic purpose of determining the existing vertical and horizontal tail loads during a typical rudder locked rolling pullout maneuver. In addition to these basic quantities, recorded time histories of the control inputs, rolling and yawing velocities, sideslip angle, normal acceleration, and forward speed change are presented. The tests were made under a variety of geometric and aerodynamic configurations. Such quantities as load factor, Mach number, c.g. position, altitude and lateral moments of inertia were varied in order to present as complete a picture as possible of the responses to be expected under various plausible conditions. All of these tests were conducted well within the safe limits of the airframe, based on structural tests and standard safe load criteria. (See also PB 151 018)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SHOCK TUBE DRIVER TECHNIQUES AND ATTENUATION MEASUREMENTS, by Charles E. Wittliff and Merle R. Wilson. Rept. on Contract AF 18(603)10. Aug 57, 39p. 9 refs. Rept. no. AD-1052-A-4; AFOSR-TN-57-546; AD-136 531.
Order from LC mi$3.00, ph$6.30 PB 144 652

The development of the hypersonic shock tunnel at the Cornell Aeronautical Laboratory, Inc. has been accompanied by a study of various techniques for producing strong shock waves to drive the shock tunnel. The results of this study are described as to technique and relative efficiency of different driver gases, and the resultant attenuation of the shock wave in the low pressure tube. It has been found that as the strength of the shock wave increases so does the amount of attenuation. Furthermore, the more efficient a given driver technique is in producing a shock wave, the larger the degree of attenuation that is observed. A survey of the presently available theories on shock wave attenuation indicates that the theories do not accurately predict the attenuation of shock waves having Mach numbers greater than 2, whereas all of the experimental data reported herein are for shock wave Mach numbers greater than 4. This serves to illustrate the need for a better understanding of the attenuation of strong shock waves. (Author)

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
AN INSTRUMENT FOR THE STUDY OF AERODYNAMIC FLOWS, by Wallis R. Grabowsky. Rept. on Contract Nonr-401(25). [1958] 34p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 144 457

Considerable progress in aerodynamic studies has resulted from the application of instruments measuring flow parameters. The hot wire, pitot tube, interferometer, and schlieren-photograph techniques have all proved to be invaluable assets in these studies. Each of these techniques has application in various free stream velocity ranges, the entire range going from supersonic to subsonic flow speeds. The instrument described was designed to determine quantitatively one flow parameter (the density) within the bounds of the following requirements: (1) It was to be applicable throughout the entire free stream velocity range of all the techniques listed above. (2) It was to extend considerably the lower free stream velocity limit of any of the techniques listed above. (3) It was not to interact with the flow pattern to such a degree that it would make the information obtained as a result of accomplishing requirement (2) difficult to interpret.

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
ON THE "TRIPLE POINT" IN SHOCK-DIFFRACTION PROBLEMS, by Tien-Fun Sun. Rept. on Contract AF 18(600)1523. Sep 56, 129p. 16 refs. AFOSR TN-56-583; AD-115 007.
Order from LC mi$6.30, ph$19.80 PB 138 687

The purpose of the present study is to determine the flow inside the diffracted wave, the position and the strength of the diffracted wave, and in particular how it reinforces or attenuates the incident or the reflected shock at the points - "triple points" where it intersects them.

David Taylor Model Basin, Washington, D. C.
THE DETERMINATION OF THE LOCAL SKIN FRICTION AND THE THICKNESS OF TURBULENT BOUNDARY LAYERS FROM THE VELOCITY SIMILARITY LAWS, by Paul S. Granville. Oct 59, 19p. 22 refs. Rept. 1340; AD-227 625
Order from LC mi$2.40, ph$3.30 PB 144 541

The applicability of pipe calibrations of Preston tubes to boundary layers is discussed on the basis of the logarithmic similarity law and the displacement effect of the tubes. A new logarithmic formula for the boundary-layer thickness of flat plates which is especially useful for high Reynolds numbers is also derived from the similarity laws.

Institute of Aerophysics, U. of Toronto (Canada).
INVESTIGATION OF FREE-MOLECULE AND TRANSITION FLOWS NEAR THE LEADING EDGE OF A FLAT PLATE, by E. L. Harris. Rept. on Contract AF 18(600)1185. Nov 58, 97p. 17 refs. UTIA rept. no. 53; AFOSR-TN-58-1043; AD-206 757.
Order from LC mi$5.40, ph$15.30 PB 144 754

Pressure measurements were made in the flow over a thin flat plate set parallel to the stream in the UTIA low-density wind tunnel. The length of the plate was approximately 7 mean free paths and free-stream speed ratios of 0.55 and 0.78 were used. Pressure measurements were obtained from forward- and backward-facing orifice-type probes, and wall taps. Reasonably good agreement was obtained between orifice impact-pressures measured less than one mean free path from the leading edge and a theoretical pressure calculated on the assumption that molecules entering the orifice probe came from the region upstream of the plate and from the plate surface after a diffuse reflection from it. That is, free molecule flow was shown to exist in a region less than one mean free path downstream from the leading edge.

Institute of Aerophysics, U. of Toronto (Canada).
MEASUREMENT OF TWO-POINT CORRELATIONS OF THE SURFACE PRESSURE ON A CIRCULAR CYLINDER, by V. Prendergast. Rept. on Contract AF 49(638)249. July 58, 32p. 3 refs. UTIA Technical note 23; AFOSR-TN-58-861; AD-203 674.
Order from LC mi$3.00, ph$6.30 PB 144 739

Results of an experimental investigation of the two-point correlations of the surface pressure on a circular cylinder are presented. The cylinder was mounted in a wind tunnel at right angles to the flow and contained within it the two microphones which were used as pressure transducers. The curves of correlation coefficient approached a constant asymptote (approximately 0.2), rather than zero at large hole spacing; this is tentatively regarded as a spurious environmental effect. The curves were accordingly adjusted to a zero asymptote. A plot of correlation

length v, Reynolds number, computed from the adjusted curves, has been presented. (Author)

Institute of Engineering Research, U. of California, Berkeley.
LOW DENSITY SUPERSONIC DIFFUSER PERFORMANCE, by Arthur M. Collins. Master's thesis. Rept. on Contract Nonr-222(45). 15 Jan 59, 49p. 22 refs. Rept. no. HE-150-164; Series no. 20, issue no. 126.
Order from LC mi$3.30, ph$7.80 PB 144 551

The impact pressure and static pressure recoveries of a supersonic, converging-diverging diffuser were measured in the range M = 1.7 - 4.1, Re_L 500 - 3200. The Reynolds number was with respect to the leading edge diameter. It was found that, for subsonic flow in the back end of the diffuser, normal shock static and impact pressure recoveries were the best that could be obtained. Afterglow photographs were taken of the low density flow inside the transparent plastic diffuser.

James Forrestal Research Center, Princeton, N. J.
INVESTIGATION OF THE INTERACTION OF A TURBULENT BOUNDARY LAYER WITH PRANDTL-MEYER EXPANSION FANS AT M 1.88, by K. R. Ananda Murthy and A. G. Hammitt. Rept. on Contract AF 18(600)498. Aug 58, 41p. 3 refs. Rept. no. 434; AFOSR-TN-58-839; AD-203 081.
Order from LC mi$3.30, ph$7.80 PB 144 580

An investigation has been made to study in detail the interaction of expansion fans with a two-dimensional supersonic turbulent boundary layer at a free stream Mach number of 1.88. The angle of expansion, which is the only parameter varied in this experimental setup, varies from 5° to 30°. Schlieren photographs of the flow pattern have been taken to obtain an overall picture of this type of interaction. Static pressure and total head tube measurements have been made to study the interaction in detail. The method of rotational characteristics has been applied to the boundary layer velocity distribution as it expands around the corner to construct the flow field and to calculate the inviscid pressure distribution near the corner as a better approach to the problem than the classical Prandtl-Meyer flow.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCHLIEREN EVALUATION OF A SHOCK TUBE FOR PRESSURE-GAGE PERFORMANCE, by Stuart M. Hauser. Rept. on Contract DA 04-495-ORD-18. 18 Nov 57, 54p. 13 refs. Rept. no. 20-115; AD-159 887.
Order from LC mi$3.60, ph$9.30 PB 144 716

In order to determine the origin of the nonperiodic noise appearing in gage-response records made with the gage-evaluation shock tube of the Jet Propulsion Laboratory, a schlieren system was set up at the end of the shock tube for photographing characteristics of the incident and reflected shock fronts, as well as the flow region following each. The schlieren light source had an effective flash duration of 0.5 μsec, producing schlieren pictures of the shock front which show no noticeable blurring. Sensitivity of the optical system was adequate for detecting pressure gradients as low as 5 psi/in. This was satisfactory for observing features of gage-response traces corresponding to noise steps as low as 5 psi, which occurred in a time less than 20 μsec. Although the shock tube does not produce clean, ideal aerodynamic flow, the investigation revealed that the undesirable features of gage-response records are not associated with observed nonideal characteristics of the shock front or of its interactions with the end of the shock tube. Consequently, it may be concluded that the shock tube is a satisfactory instrument for the investigation of the frequency response of pressure gages. The frequency range extends from 100 cps to well beyond 100,000 cps. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
AN EXPERIMENT ON THE INSULATING PROPERTIES OF BOUNDARY LAYERS, by Frank H. Durgin. Rept. on Contract AF 18(603)82. July 59, 142p. 54 refs. Technical rept. 218; AFOSR-TN-57-392; AD-132 467.
Order from LC mi$7.20, ph$22.80 PB 144 422

An experimental investigation of the "insulating properties" of laminar and turbulent boundary layers has been conducted. The test was undertaken as part of a more general program in which the effects of mass transfer through a porous wall to a boundary layer are being studied. The purpose of the present test was to determine which of several theories was best able to predict the insulating properties of the boundary layer. The model was a cone. The forward half was cooled uniformly to about 100°F below recovery temperature. Theoretical methods due to Baron, Lighthill, and Libby and Morduchow have been used to predict the temperature decay over the aft part of the cone for the laminar case. Lighthill's theoretical results are in very close agreement with the experimental results. Methods due to Seban, Rubesin, and Hill have been applied to the turbulent case. The experimental results fall about halfway between the predictions of Seban and Rubesin. In calculating the theoretical results it is shown that the methods of Lighthill, Seban, Rubesin, and Hill can all be reduced to an integral of the same form and a solution for this integral is given.

National Research Labs., Ottawa (Canada).
AN EXPERIMENTAL STUDY OF ROTATING STALL IN A TWO-STAGE AXIAL COMPRESSOR, by R. F. Myer. Aug 59, 57p. 15 refs. Aeronautical rept. LR-259.
Order from LC mi$3.60, ph$9.30 PB 144 507

The stalling behaviour of an Orenda CT-100, experimental, two-stage axial compressor was studied at the constant operating speed of 3000 r.p.m. Rotating stall was observed to commence at a mass flow coefficient of 0.435 and as the mass flow was reduced several different patterns of rotating stall were observed. In two ranges of operation "steady" patterns consisting of three rotating stalls were observed, in two other ranges of operation rotating stall was observed but the stall patterns were continually changing, while for very low mass flow operation the flow over the whole of the annulus appeared to be stalled. Reversed flow within the stalls was found to be an important feature of rotating stall. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
THE HETEROGENEOUS, LAMINAR, BOUNDARY LAYER, by Judson R. Baron. Rept. on Contract AF 18(600)82. [June 57] 30p. 6 refs. Technical rept. no. 236; AFOSR-TN-57-398; AD-132 474.
Order from LC mi$2.70, ph$4.80 PB 145 023

Study is made of the general mass transfer situation for which the fluid introduced into the high speed boundary layer differs appreciably in physical properties from those of the external fluid flow. The descriptive system of equations are deduced from Enskog's solution of the Boltzmann equation and include provision for component mass conservation, energy migration resulting from specific enthalpy differences, and thermodynamic coupling between the transport phenomena. A similarity analysis is presented for laminar flows with and without pressure gradients and numerical results are given for helium and carbon-dioxide as foreign gases in a primarily air boundary layer flowing over a flat plate. It is shown that the injection of relatively low density fluid yields considerable alleviation of the thermal levels normally encountered at supersonic Mach numbers. A qualitative argument is offered to explain the effects on the basis of available thermal capacity. The related sublimation problem is considered briefly. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
THE USE OF HELIUM FOR COOLING NOZZLES EXPOSED TO HIGH TEMPERATURE GAS STREAMS, by Antonio Ferri and Paul A. Libby. Rept. on Contract AF 33(616)17. July 55, reissued Nov 58, 25p. 3 refs. WADC Technical note 55-318; AD-94 314.
Order from LC mi$2.70, ph$4.80 PB 144 903

The results of preliminary theoretical analysis and tests of the use of helium as a cooling gas in hypersonic wind tunnel and rocket motor nozzles are presented. The helium is introduced tangential to the exposed surface from a slot located where the local Mach number is about 0.4. Thereby, an insulating layer of helium is formed between the exposed surface and the high temperature gas stream. Helium appears to be the most appropriate insulating gas because of its high sonic velocity and because of its chemical inertness. The theoretical analysis indicates that the method should be applicable over a wide range of stagnation conditions.

Polytechnic Inst. of Brooklyn, N. Y.
ANALYSIS OF TIP-CLEARANCE FLOW IN TURBOMACHINES, by Chung Hua Wu and Wen Wu. Technical rept. no. 1 on Contract Nonr-839(04). July 54, 63p. 23 refs. AD-36 783.
Order from LC mi$3.90, ph$10.80 PB 145 033

A basic analysis of the blade tip flow phenomena is presented. The analysis is based on a steady relative flow of a viscous incompressible fluid. A rotating cylindrical coordinate system which moves with the blade at the same speed is used. An order-of-magnitude analysis reduces the basic equations to a set of simplified equations for both low and high Reynolds number. Expressions are given for the determination of the distributions of pressure and velocity in the clearance space and the mass flow across the tip clearance space. The computation of the velocity distribution is relatively simple and three methods of solution for the pressure distribution are presented. (Author)

University of Southern California. Engineering Center, Los Angeles.
SOME FURTHER RESULTS ON HEATING A SUPERSONIC GAS STREAM WITH A RADIO FREQUENCY DISCHARGE, by Frederick O. Smetana. Technical note on Contract AF 18(603)95. 1 Nov 59, 20p. 7 refs. Rept. 56-207; AFOSR-TN-59-1127.
Order from LC mi$2.40, ph$3.30 PB 144 781

Results of further experiments with RF discharge heating of a supersonic gas stream are reported. Temperature increases of at least 600°F were recorded although the presence of strong electrical fields made it extremely difficult to interpret temperature indications. The action of the ionized gas and the strong field limits the type of materials which may be used for nozzle materials. Qualitative indications of the decay of active species, N-N recombination, wall heating, effect of pressure, nozzle configuration, and electrode configuration were also obtained. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

California Inst. of Tech., Pasadena.
VISCOUS EFFECT ON SURFACE WAVES GENERATED BY STEADY DISTURBANCES, by T. Yae-tsu Wu and R. E. Messick. Rept. on Contract Nonr-220(28). Feb 58, 33p. 9 refs. Engineering Div. rept. no. 85-8; AD-154 372.
Order from LC mi$3.00, ph$6.30 PB 138 276

A linearized theory is applied to investigate the viscous effect on water waves generated and maintained by a system of external disturbances which is distributed over the free surface of an otherwise uniform flow. The flow is taken to be in the steady state configuration. The analysis is carried out to yield the asymptotic expressions for the surface wave when the Reynolds number of the flow is either large or small.

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
INTERFACIAL INSTABILITY OF FLUIDS OF ARBITRARY ELECTRICAL CONDUCTIVITY IN UNIFORM MAGNETIC FIELDS, by I. C. T. Nisbet. Rept. on Contract Nonr-401(25). [1958] 57p. 22 refs.
Order from LC mi$3.60, ph$9.30 PB 144 456

The stability to small sinusoidal disturbances of an infinite plane interface separating an electrically conducting fluid from a lighter non-conducting fluid is investigated in the case where both fluids are in-

compressible and inviscid, gravity and a uniform magnetic field act on the system permits study of the effects of variation of the conductivity of the upper fluid and the direction of the applied field.

Diamond Ordnance Fuze Labs., Washington, D. C.
DEVELOPMENT OF A SONIC FLOWMETER FOR STEEL PIPE, by Don R. Pardue, James C. McDade, and Frank Vrataric. 15 Dec 58, 49p. 5 refs. TR-663; AD-209 129.
Order from LC mi$3.30, ph$7.80 PB 144 635

The flowmeter described in this report was developed to measure flow rates from 3000 to 8000 gpm through a thick-walled steel pipe. The "upstream-downstream" method is used whereby the phase difference of an ultrasonic wave is measured in both directions to determine rate of flow. An FM system, whose modulation rate is equivalent to the delay time between transducers, is utilized to minimize undesirable "leakage" signals.

Institute of Engineering Research, U. of California, Berkeley.
A NOTE ON THE LINEARIZED DEEP WATER THEORY OF WAVE PROFILE AND WAVE RESISTANCE CALCULATIONS, by J. K. Lunde. Technical rept. no. 4 on Contract Nonr-222(30). Dec 57, 121p. 12 refs. Series no. 82, issue no. 4; AD-153 809.
Order from LC mi$6.30, ph$19.80 PB 138 110

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
OBSERVATIONS ON CAVITATION BUBBLE COLLAPSE, by Albert T. Ellis. Rept. on Contract N6onr-24420. Dec 52, 81p. 25 refs. Rept. no. 21-12; AD-7615.
Order from LC mi$4.80, ph$13.80 PB 145 035

The methods of generating bubble cavities which were studied included (1) pressure variation by flow over submerged bodies and (2) direct variation of the hydrostatic pressure. Observations were made in a high-speed water tunnel and in a small sample of stationary water. In the experiments, collapsing bubbles showed increasing departures from the spherical shape with decreasing radius. The collapse time of the bubbles was longer than predictions based on the extended Rayleigh theory. The theoretical explanation of this fact lies in the asymmetry of the collapse shapes. The general effect of large coupling between radial and translational bubble motion was to produce an increase in the translational motion in the direction of decreasing pressure. Rebounding and nonrebounding bubbles were observed. The latter type was believed to be a more important source of cavitation damage and noise than the bubbles containing permanent gas with their cushioned collapse. The observations indicated that bubble growth is more stable than bubble collapse.

St. Anthony Falls Hydraulic Lab., U. of Minnesota [Minneapolis]
EXPERIMENTAL STUDIES OF SUPERCAVITATING FLOW ABOUT SIMPLE TWO-DIMENSIONAL BODIES IN A JET, by Lorenz G. Straub and Edward Silberman. Proj. rept. no. 59 on Contract Nonr-710(24). Apr 58, 38p. 15 refs.
Order from LC mi$3.00, ph$6.30 PB 138 550

A two-dimensional free-jet water tunnel is described briefly. Results of experimental measurements on a two-dimensional cup, symmetrical wedges, inclined flat plates, and a circular cylinder in the tunnel are given. Measured force coefficients at zero cavitation number are in good agreement with theory. Shapes of the cavities were computed for one of the wedges and for one of the plates at zero cavitation number; the observed shapes are also in good agreement with the theory.

METALLURGY

Battelle Memorial Inst., Columbus, Ohio.
HIGH-TEMPERATURE-ALLOY CUTTING PROGRAM, by J. E. Clifford, D. E. Semones, and J. McCallum. Final engineering rept. on Contract AF 33(600)35440. 18 Jan 59, 153p. 11 refs. AMC TR-59-7-617; AD-210 979.
Order from LC mi$7.50, ph$24.30 PB 144 650

New methods for cutting high-temperature alloys included chemical machining, chemical cutting by high-velocity jets, abrasive slurries, ultrasonics, electro-arc and electrospark machining, explosive cutting, and electrolytic machining. Multiple cutoff by electrolytic machining was selected for development. A survey made of industrial methods for billet cutoff permitted economic comparisons of new with existing methods and pinpointed important specifications.

Kaiser Aluminum and Chemical Co., Spokane, Wash.
THE IMPROVEMENT IN WELD SOUNDNESS BY THE USE OF HALOGENS AND HALIDES IN INERT GAS METAL ARC WELDING OF ALUMINUM, by A. R. Pfluger and M. B, Kasen. Phase rept. 1 on Welding of High Strength Aluminum Alloys, Contract DA 04-200-ORD-333. 30 Dec 55, 72p. 2 refs. Interim project rept. no. MS PR 55-68; AD-107 075.
Order from LC mi$4.50, ph$12.30 PB 144 646

A study was made of the effect of the additions of Cl, $AlCl_3$, $MgCl_2$ or $TiCl_4$ to the arc area during the inert gas metal arc (MIG) welding of Al alloys. Chlorine was added to the argon shielding gas in amounts of 0.05 to 0.25 vol-% and resulted in improvement in weld soundness and an increase in the tensile strength and ductility of the weld metal. Plates, 1/2 and 3/4 in. thick, were used in the tests. The optimum Cl addition was 0.063% for a total shielding gas flow of 60 cu ft/hr. A reduced quantity of dross and entrained (gas) porosity in the weld was accomplished. Excessive spatter was noted during the MIG welding of Al alloys containing Mg when welded in the presence of halide or halogen additions to the arc area. The use of shorter arc lengths (arc voltage) and higher currents decreased the tendency of the spatter to agglomerate into globules. Difficulty was encountered in attempts to introduce $AlCl_3$ into the weld area. Welds made with a

cored wire containing 1/2% $MgCl_2$ compared favorably with welds achieved by the use of Cl additions to the shielding gas but produced a great amount of spatter and an erratic arc. The use of $TiCl_4$ additions to the protective atmosphere resulted in increased weld soundness and gave better arc characteristics than were obtained by using Cl, $AlCl_3$, or $MgCl_2$.

Lockheed Aircraft Corp., Sunnyvale, Calif.
ELECTRON BOMBARDMENT MELTING AND CASTING OF BERYLLIUM, by H. T. Sumsion and C. O. Matthews. Rept. on Contract NOrd-17017. 7 Nov 58, 44p. 4 refs. LMSD-48330; AD-208 004.
Order from OTS $1.25 PB 161 327

Electron-bombardment furnace and process for melting and casting 3-inch diameter beryllium ingots are described. The ultimate objective is to produce a beryllium or beryllium-alloy ingot which can be fabricated into plate. Initial metallurgical evaluations of the cast ingots have been made by visual inspection, metallographic examination, chemical and X-ray diffraction analyses, machinability, hardness, tensile, and bend tests. Effect of variations in melt stock and process variables, including composition, on ingot structure have been investigated. Data are given for ingots evaluated to date

Powder Metallurgy Lab., Stevens Inst. of Tech., [Hoboken, N. J.]
A SURVEY OF ULTRA FINE POWDERS AND POWDER MIXTURES, by Frank W. Heck, Donald P. Ferriss, and others. Final rept. on Subcontract NOas-54-519. 30 Nov 56, 28p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 145 029

Cooling pyrophoric iron and mixed ultra-fine powders to about -250F permits their being safely handled and compacted in air. A method of reducing oxygen in these powders to less than 0.02% without sintering has been devised. Some experimental powders exhibit unusual strength and/or ductility after simple compacting and sintering. Others require hot pressing or hot coining to establish solid state bonding. (Author)

Titanium Metallurgical Lab., Battelle Memorial Inst., Columbus, Ohio.
THE DETERMINATION OF HYDROGEN IN TITANIUM AND ITS ALLOYS; A CRITICAL REVIEW, by T. D. McKinley (E. I du Pont de Nemours & Co.). 23 Sep 57, 25p. 27 refs. Titanium Metallurgical Lab. memo.
Order from LC mi$2.70, ph$4.80 PB 144 564

Theory, operational characteristics, and indicated precision and accuracy of analytical methods based on vacuum extraction, equilibrium pressure, and combustion approaches are reviewed. At the present time, vacuum extraction at 1400 C and the equilibrium pressure method are recommended for determination of hydrogen in titanium and titanium-rich alloys.

Utah U., Salt Lake City.
KINETICS OF OXIDATION OF METAL POWDERS, by Harold H. Boehm and H. Edward Flanders. Technical rept. no. 3 on Contract DAI 04-495-501-ORD(P)-19. 16 May 58, 75p. 23 refs. AD-208 077.
Order from LC mi$4.50, ph$12.30 PB 144 562

When spherical magnesium particles were oxidized below the ignition temperature in a range of 400-600° C, it was observed that internal oxidation amounted to a larger percentage than external scale formation. Density determinations were undertaken before and after oxidation of the particles in an effort to study the mechanism of internal oxidation.

Ferrous Metals

Crucible Steel Co. of America, Pittsburgh, Pa.
DEVELOPMENT OF HIGH-TEMPERATURE IRON-BASE ALLOYS, by A. Kasak, V. K. Chandhok, and E. J. Dulis. Rept. for Apr 58-May 59 on Metallic Materials, Contract AF 33(616)5428. Oct 59, 71p. 5 refs. WADC Technical rept. 59-353.
Order from OTS $2.00 PB 161 337

An investigation was conducted to develop steels that have very high strengths at ambient temperature and at temperatures approaching 1200 F. The results show that with proper balancing of the composition and optimum heat-treatment the objective of the program could be attained. Up to 1100 F the steels developed had higher strengths than any other steel known today. The highest strengths were obtained on steels that contained 0.35-0.40% C, 7-9% Cr, 0.5-1.0% V, 5-7% Mo, 5-8% Co, up to 1% Ti, up to 1% Ta+Cb, up to 1.5% W, and up to 0.01% B. One steel that contained 0.36% C, 7.72% Cr, 1.15% V, 5.71% Mo, 4.93% Co, and 0.009% B had a tensile strength of 310,000 psi at room temperature and 201,000 psi at 1100 F; the 100-hr creep-rupture strength at 1100 F was 98,000 psi. Also, excellent strengths were obtained at 1200 F. Beneficial effects on strength and ductility were sometimes derived from using a novel heat-treating schedule. Microscopic studies indicated that the fracture behavior and the creep-rupture strength were significantly influenced by the formation and coalescence of carbides at the grain boundaries. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF HIGH-STRENGTH STEELS BY WORKING OF METASTABLE AUSTENITE, by F. R. Morral. 30 Nov 59, 24p. 18 refs. DMIC memo. 39.
Order from OTS $0.50 PB 161 189

On hot-cold-worked steels, as in steels conventionally heat treated to martensite, there is a trend of rising strength and falling ductility with increasing carbon content. The greater the deformation of the metastable austenite, the better the yield and tensile strength properties. Tensile strengths of 400,000 psi have been obtained with deformations on rolling of the order of 90 per cent reduction in cross section. For the aircraft and missiles industries, the steels containing 0.30 to 0.40 carbon seem to be the most suitable. The effect of particular alloying elements on

the behavior of the deformed metastable austenite is not known. The tempering sequence depends on the steel used. If subcritical deformation of metastable austenite is to become a commercial process, development of plant techniques is necessary. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DRILLING HIGH-STRENGTH STEELS HEAT TREATED TO 330 TO 560 BRINELL HARDNESS, by A. F. Gerds, Carl T. Olofson, and F. W. Boulger. 24 Aug 59, 17p. 4 refs. DMIC Memo-31; AD-225 672.
Order from OTS $0.50 PB 161 181

Successful drilling of hardened steels requires adequate power, rigidity, and appropriate drills. Drilling speeds and feeds range from 7 to 40 feet per minute, and 0.0005 to 0.005 inch per revolution, respectively. Feeds must be positive. Idling in the hole without cutting work hardens the steel below the drill point, making further drilling virtually impossible. Rigid setups between work and drill, and the use of short, heavy-duty drills are emphasized. These factors increase drill life and hole accuracy, and frequently allow the use of less expensive high-speed steel drills. A back-up plate is often important for added support, especially when drilling through holes. The composition and geometry of the drill have pronounced effects on successful drilling of high-strength steels, but the available information does not warrant specific recommendations on these two factors. This report, however, describes conditions and tools which were reported to be suitable for use with various workpieces. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
HEAT TREATMENT OF HIGH-STRENGTH STEELS FOR AIRFRAME APPLICATIONS, by R. J. Fiorentino, D. B. Roach, and A. M. Hall. Rept. on Contract AF 18(600)1375. 27 Nov 59, 111p. 29 refs. DMIC rept. 119.
Order from OTS $2.50 PB 151 076

This report is a summary of the information gathered from four steel producers and twenty-four steel consumers on the status of the heat treatment of high-strength steels for airframe applications. The materials covered in the report are (1) the low-alloy hardenable engineering steels, (2) the hot-work die steels (3) the martensitic stainless steels, (4) the martensitic precipitation-hardenable stainless steels, (5) the semi-austenitic precipitation-hardenable stainless steels, (6) the austenitic precipitation-hardenable stainless steels, and (7) the cold-rolled austenitic stainless steels. The topics covered under each material include illustrative heat treatments, uses, fabrication, atmospheres, protective coatings, cleaning, and descaling. Also included is a list of some large-capacity heat-treating-furnace equipment available throughout the country. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
MECHANICAL- AND PHYSICAL-PROPERTY DATA ON MODIFIED 12 PER CENT CHROMIUM MARTENSITIC STAINLESS SHEET STEELS FOR AIRFRAME APPLICATIONS, by J. G. Hoag, D. B. Roach, and A. M. Hall. 18 Apr 59, 56p. 1 ref. DMIC memo. 15.
Order from OTS $0.50 PB 161 165

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
MILLING OF HIGH-STRENGTH STEELS IN THE HARDNESS RANGE OF 330-560 BRINELL, by C. T. Olofson. 17 Aug 59, 40p. 30 refs. DMIC memo. 30; AD-225 673.
Order from OTS $0.50 PB 161 180

Carbide tool materials best suited for use include the C-2, C-3, C-6, and C-7 grades. Carbide cutter design utilizes 0- and 15-degree negative rake angles, depending on the hardness of the steel being milled. Corner angles from 30 to 45 degrees are employed to lengthen the cutting edge so uniform tool wear is obtained. Relief angles from 6 to 10 degrees are used as a compromise between the best cutting-edge support and the longest tool life per tool regrind. Carbide cutters, operating at 0.001 to 0.010 inch per tooth feed and at depths of cut up to 0.10 inch, employ cutting speeds between 50 and 700 feet per minute, depending on the milling operation and the hardness of the steel. High-speed-steel cutters appropriate for milling high-strength steels include the molybdenum types of M-3, Type 2, M-10, M-4, and M-7, and the cobalt grade, M-34. Tungsten high-speed steel with 5 per cent cobalt (T-15) seems to give the best tool life, on the basis of limited data. High-speed-steel cutter design employs 0- to 35-degree positive rake angles, 30- to 45-degree corner angles, and 5- to 10-degree clearance angles, depending on the milling operation. These tools operate at feeds between 0.001 and 0.010 inch per tooth, depths of cut up to 0.25 inch, and speeds between 6 and 120 feet per minute. (Author)

Martin Co., Baltimore, Md.
AUTOCLAVE TESTING OF TYPE 304 STAINLESS STEEL, ADDENDUM, by L. Frank and P. Eisenberg. Addendum to Contract DA 44-009-eng-3043, Task 1, phase 2. Nov 58, 15p. 6 refs. MND-E-1322-I; AD-209 929.
Order from LC mi$2.40, ph$3.30 PB 144 522

The oxygen concentration in the steam phase should be the prime concern in relation to environmental conditions contributing to stress corrosion cracking. Strain gage measurements were made on U-bend specimens used in the autoclave tests. Stress values resulting from loading the specimen ranged to about 39,000 psi in the bend. (See also PB 151 149)

Light Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
HEAT CAPACITY OF BERYLLIUM, by J. W. Holladay. 19 Oct 59, 11p. 23 refs. DMIC memo. 36.
Order from OTS $0.50 PB 161 186

This memorandum collects the data available to the Defense Metals Information Center on the heat capacity of beryllium. Heat capacity as a function of temperature and the effect of impurities on the heat capacity are discussed.

James Forrestal Research Center, Princeton U., N. J.
THE THERMODYNAMIC ACTIVITY OF CADMIUM IN MAGNESIUM-CADMIUM ALLOY, by Richard J. Borg and C. Ernest Birchenall. Technical rept. no. 2 on Contract Nonr-1858(08). 16 Apr 58, 12p. 8 refs. Metallurgy rept. no. 15.
Order from LC mi$2.40, ph$3.30 PB 138 612

Vapor pressures for eight compositions of Mg-Cd have been determined by the Knudsen effusion technique. Measurements were made at several temperatures for each alloy and the results interpolated to a common temperature for the calculation of the activities. (See also PB 138 899)

New York U. Coll. of Engineering, N. Y.
THE INFLUENCE OF PRIOR PLASTIC STRAIN AND INTERSTITIAL CONTENT ON THE AGING BEHAVIOR AND MECHANICAL PROPERTIES OF ALPHA-BETA TITANIUM ALLOYS, by R. F. Bunshah. Final rept. on Contract DA 30-069-505-ORD-1779. Aug 58, 103p. 21 refs. WAL no. 401/258; AD-210 521.
Order from LC mi$5.70, ph$16.80 PB 144 561

A study of the effect of prior plastic strain on the aging behavior of Ti-8Mn & Ti-16V base alloys at various interstitial levels. The influence of interstitials in both sets of alloys is to increase the maximum hardness produced on aging. In the Ti-8Mn base alloys, the addition of 0.2%O_2 to the base composition delayed the overaging process. 0.1% C addition acted the same way. The addition of 0.015%H_2 and 0.025%H_2 increased the initial aging rate and the over aging rate.

Nonferrous (except light) Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
A BRIEF REVIEW OF REFRACTORY METALS, by R. I. Jaffee. 3 Dec 59, 37p. 24 refs. DMIC memo. 40.
Order from OTS $0.50 PB 161 190

In this paper the refractory metals will be taken as the metals with melting points equal to or higher than that of chromium, 1875 C.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
FABRICATION OF PURE COLUMBIUM, by W. D. Klopp and Webster Hodge. 11 Sep 59, 9p. 10 refs. DMIC memo. 34; AD-226 046.
Order from OTS $0.50 PB 161 184

The fabrication of pure columbium is readily carried out cold with conventional tools. Precautions must be taken, when extreme-pressure processes are used, to prevent sticking by the use of very smooth die finishes and proper lubricants. Since the metal is rapidly contaminated by all common gases at elevated temperatures, welding operations must be performed in an atmosphere of helium or purified argon, and annealing operations in a high vacuum. Solid-solution alloys may be handled, in general, like pure columbium. (Author)

Sylvania Research Labs., Bayside, N. Y.
STUDY OF THE PROPERTIES OF ULTRA PURE NICKEL, by G. W. Hees, L. Castleman and G. H. Morrison. Scientific rept. no. 1 for 1 Jan-30 Sep 59, on Contract AF 19(604)5213. 15 Dec 59, 43p. 8 refs. TR59-104-205-704.3; AFCRC-TN-59-966.
Order from LC mi$3.30, ph$7.80 PB 144 972

The floating zone technique is an excellent method for melting nickel without risking contamination from a crucible and thus can be used to consolidate the chemical extraction product and remove volatile impurities. A survey was made of chemical methods of purification of nickel. The general techniques that were investigated included solvent extraction, ion exchange, precipitation and electrodeposition. Various trace analytical techniques are discussed with the relative applicability of each to the determination of trace impurities in high purity nickel.

Structural Metallurgy and Corrosion

Crest Research Labs., Inc., Santa Fe Springs, Calif.
MECHANISM OF CORROSION AND CORROSION INHIBITION OF STEEL IN WEAK ACID SOLUTION: DETERMINATION OF QUANTITATIVE LOCAL CELL POLARIZATION CURVES, by Willard R. Scott, Gilson H. Rohrback and Harold A. Parker-Jones. Final technical rept. on Contract Nonr-2113(00). 2 Feb 59, 124p. 30 refs.
Order from LC mi$6.30, ph$19.80 PB 144 576

An apparatus and a procedure were developed for precise measurement of the mixed electrode potential, interface resistance, and interface capacitance of a corroding metal surface in the presence of polarizing current. Studies were made on mild steel corroding freely in oxygen-free salt water at pH 4 - 6, and on this electrode in the presence of several different types of corrosion inhibitors.

Crucible Steel Co. of America, Pittsburgh, Pa.
DEVELOPMENT OF A CORROSION-RESISTANT

BEARING STEEL FOR SERVICE IN AIRCRAFT AT TEMPERATURES UP TO 1000F, by G. Steven and T. V. Philip. Rept. for Apr 58-July 59 on Metallic Materials, Contract AF 33(616)5428. Oct 59, 70p. 10 refs. WADC Technical rept. 59-390.
Order from OTS $1.75 PB 161 338

Corrosion resistance has been added to the high initial hardness, adequate temper resistance (600-900 F), and good dimensional stability of a high-speed type bearing alloy. To produce secondary hardening, the base composition of a quench hardenable stainless steel, 440C, was modified with V, W, Mo, and Co. The following composition is recommended for use as a stainless bearing steel for 500 hr of operation up to 900 F: 1.10-1.15% C, 0.15% max Mn, 0.15% max Si, 13.5-14.5% Cr, 2.5-3.0% V, 2.0-2.5% W, 3.75-4.25% Mo, 5.0-5.5% Co. For best performance, the steel should be heat-treated as follows: heat to 2200 F, oil quench, and refrigerate to -105 F. Rockwell "C" 66 is achieved (2% retained austenite) by tempering the steel for 1+1+2 hr at 1000 F with intermediate sub-zero cooling after the first and second draws. Tempering twice for 2 hr at 1000 F also results in a useful structure. After 500 hr at 900 F the hardness drops to R_C 65 (hot hardness of R_C 57), and the structure contracts 13 µin./in. After three cycles of a water-vapor corrosion test, the surface of fully heat-treated WADC66 is only slightly more pitted than that of annealed 430 stainless steel. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PROCEDURES FOR ELECTROPLATING COATINGS ON REFRACTORY METALS, by John G. Beach and John A. Gurklis. 9 Oct 59, 28p. 37 refs. DMIC memo. 35.
Order from OTS $0.50 PB 161 185

The purpose of this memorandum is to bring together a partial selection of procedures that have been employed to electroplate various metals onto the refractory metals, in an attempt to answer the question of how to produce sound, adherent electroplates on the refractory metals. Refractory metals covered are: vanadium, columbium, tantalum, tungsten, titanium, and molybdenum.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PROCEDURES FOR THE METALLOGRAPHIC PREPARATION OF BERYLLIUM, TITANIUM, AND REFRACTORY METALS, by R. D. Buchheit and G. A. Wheeler. 26 Oct 59, 38p. 1 ref. DMIC memo. 37.
Order from OTS $0.50 PB 161 187

It is the purpose of this memorandum to provide some basic information for such companies who wish to establish and practice satisfactory procedures for the metallographic preparation of the following metals: beryllium; chromium; columbium; molybdenum; platinum group: platinum, palladium, ruthenium, rhodium, iridium, and osmium; rhenium; tantalum; titanium; tungsten; and vanadium.

Dynamic Properties Lab., Calif. Inst. of Tech., Pasadena.
STUDY OF THE YIELD PHENOMENON IN ZINC SINGLE CRYSTALS, by K. R. King. Technical note no. 4 on Contract AF 18(600)490. Nov 58, 28p. 8 refs. AFOSR-TN-58-1023; AD-162 288.
Order from LC mi$2.70, ph$4.80 PB 137 812

Static and rapid loading shear tests on single crystals of 99.99+ per cent purity zinc were performed. A system was devised for the testing of single crystal specimens in compression which produces a uniform shear stress on the slip planes suitable for rapid load testing as well as static testing. Distinct upper yield points are exhibited by annealed specimens tested in compression.

Engineering Materials Research Lab., Brown, U., Providence, R. I.
A THEORY OF THE NON-LINEAR INFLUENCE OF NORMAL STRESS ON FATIGUE UNDER COMBINED STRESSES, by J. D. Coleman and W. N. Findley, Masters thesis. Technical rept. no. 4 on Basic Research on Fatigue Failures under Combined Stress, Contract DA 19-020-ORD-3520. Nov 56, 31p. 14 refs. EMRL-5; OOR rept. 1348.5E; AD-117 366.
Order from LC mi$3.00, ph$6.30 PB 137 865

The possible effect of anisotropy is considered. A non-linear theory is developed and compared with other theories and with results of tests of SAE 4340 steel at a hardness of Rockwell C-25.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DISLOCATIONS IN DEFORMED SINGLE CRYSTALS OF ALPHA BRASS. PART I. GENERAL OBSERVATIONS, by J. D. Meakin and H. G. F. Wilsdorf. Rept. on Contract AF 49(638)162. Dec 59, 28p. 33 refs. Interim rept. I-A2027-1; AFOSR-TN-59-1047; AD-229 609.
Order from LC mi$2.70, ph$4.80 PB 144 570

Using a combined decoration and etching technique the dislocation structure of annealed and deformed α-brass has been studied. Using slip line data, the mean path of a dislocation and the configuration of groups along an active slip plane have been deduced.

James Forrestal Research Center, Princeton, N. J.
KINETICS OF FORMATION OF POROUS OR PARTIALLY DETACHED SCALES, by C. E. Birchenall. Rept. on Contract AF 18(600)967. July 54, 30p. 2 refs. Metallurgy rept. no. 1; OSR-TN-54-286, AD-49 866.
Order from LC mi$2.70, ph$4.80 PB 144 557

This report examines the variety of kinetic relations which may be found for the oxidation of solid metals when porosity forms in the oxide or at the metal-oxide interface according to several systematic procedures. Particular attention is given to the time sequence in which various rate laws may govern the process. The need for more careful correlation of microstructures with rate measurements is emphasized. The possible role of plastic deformation is also considered. (Author)

Minerals Research Lab., U. of California, Berkeley.
ACTIVATION ENERGIES FOR CREEP OF SINGLE ALUMINUM CRYSTALS FAVORABLY ORIENTED FOR CUBIC SLIP, by Y. A. Rocher, L. A. Shepard, and J. E. Dorn. Technical rept. no. 5 on Contract Nonr-222(49). 20 Dec 57, 23p. 16 refs. Series no. 103, issue no. 5; AD-153 469.
Order from LC mi$2.70, ph$4.80 PB 138 112

Creep activation energies for single aluminum crystals favorably oriented for shear by (010) [101] glide were determined over the temperature range from 78°K to 900°K. From 800°K to 900°K, unusually high activation energies ranging from 28,000 to 54,000 cal./mole were obtained. The maximum activation energy was attributed to recrystallization.

Naval Boiler and Turbine Lab., [Philadelphia, Pa.]
FUEL OIL ASH CORROSION RESISTANCE OF CHROMIUM METAL, by J. R. Witmeyer. Evaluation rept. 29 July 57, 22p. (1 color photograph will not reproduce) NBTL Test R-255; AD-147 471.
Order from LC mi$2.70, ph$4.80 PB 144 919

Relative corrosion resistance of commercially pure chromium metal and 25Cr:20Ni, alloy to synthetic fuel oil ash was tested using high vanadium and high sodium corrodents, at 1700, 2000 and 2200 F. The chromium showed better corrosion resistance than 25Cr:20Ni. Cyclic tests at 2000 F revealed the poor oxidation resistance of the chromium compared to 25Cr:20Ni. Brittleness and grain growth increased as the temperature. (Author) (See also PB 136 267)

Naval Engineering Experiment Station, Annapolis, Md.
SEA WATER CORROSION OF VARIOUS MATERIALS TESTED IN SEVEN 20-TUBE MODEL CONDENSERS, by J. L. Basil and J. S. Whelan. 21 Mar 58, 142p. 6 refs. Research and Development rept. 910027A.
Order from LC mi$3.30, ph$7.80 PB 144 651

Seven 20-tube model condensers were tested for corrosion and erosion resistance by pumping natural sea water through the tubes at 10 ft/sec. One was an all-aluminum condenser. The others had 70-30 and 90-10 copper-nickel tubes with water boxes and tube sheets of various alloys. The report describes the condition of the units after destructive examination.

New York U. Coll. of Engineering, N. Y.
MINIMIZATION OF THE INFLUENCE OF RESIDUAL HYDROGEN ON BRITTLENESS IN ALPHA-BETA TITANIUM ALLOYS, by P. A. Farrar and H. Margolin. Final rept. on Contract NOas-55-955-d. Oct 59, 93p. 22 refs.
Order from LC mi$5.40, ph$15.30 PB 144 575

The Ti-10%Mo-H system was investigated. The effect of variation of amounts of α and β in Ti-Mn alloys on the embrittlement by hydrogen has been investigated, using the Ti-3, 8 and 12%Mn alloys. The effect of heat treatments at temperatures above the eutectoid temperature of the Ti-H system have been investigated for the Ti-6Al-4V-H alloys after prior plastic strain.

Northwestern Technological Inst., Evanston, Ill.
THE STRENGTH OF ALUMINUM SILVER ALLOYS, by Anthony Kelly. Rept. on Contract AF 18(600)1468. 7 Nov 58, 5p. 9 refs. AFOSR-TN-58-912; AD-204 568.
Order from LC mi$1.80, ph$1.80 PB 137 847

Single crystals of aluminum - 6 at.% silver quenched from the δ-phase field and aged at room temperature show a critical resolved shear stress at 0°C of 7-8 kgs. mm.$^{-2}$

Rensselaer Polytechnic Inst., Troy, N. Y.
PROPERTIES OF MAGNESIUM AND MAGNESIUM ALLOY SINGLE CRYSTALS AT ROOM AND OTHER TEMPERATURES, by E. D. Levine, W. F. Sheely and R. R. Nash. Final rept. for 1 July 54-31 Dec 57 on Contract DA 30-115-ORD-546. 30 Apr 58, 163p. 62 refs. AD-200 875.
Order from LC mi$7.80, ph$25.80 PB 144 529

Single crystals specimens of magnesium and magnesium alloys containing indium, cadmium, thallium, aluminum, zinc, lithium, and thorium were prepared in both cylindrical and spherical form. Examination of stress-strain curves illustrated that the most important factor in solution strengthening of these alloys is an interaction between solute atoms and substructural boundaries in the crystals.

Rock Island Arsenal Lab., Ill.
EMULSIFIABLE AND FIRE RESISTANT RUST PREVENTIVES, by Van Y. S. Hong. 21 Apr 59, 73p. 44 refs. Rept. no. 59-1103; AD-214 943.
Order from OTS $2.00 PB 161 352

An emulsifiable and fire resistant type of rust preventive compound was developed. Suitable test methods and requirements were evolved for the evaluation of this type of material. Protection afforded to Ordnance materials, such as small hardware items under accelerated weather conditions, was found to be adequate. Advantages of this type of material over current types of rust preventive compounds were ascribed to their fire resistant property, protection efficiency, and economy. A discussion of the limitations of this type of compound from the standpoint of practical application was made. Practical and theoretical aspects on the resolution of these problems were suggested.

Springfield Armory, Mass.
ULTRASONIC STUDIES OF DIE BLOCK MATERIALS, by R. D. Korytoski. 15 June 59, 24p. 7 refs. SA-TR19-1502.
Order from LC mi$2.70, ph$4.80 PB 144 567

Basic studies were conducted using ultrasonic vibration principles in nondestructive evaluation die block material. These studies included (1) ultrasonic reflection investigations, (2) destructive metallurgical examinations of materials ultrasonically tested, (3) evaluation of material performance in forging application. (Author)

Yale U., New Haven, Conn.
ROTATION TESTS IN PLASTICITY, by Aris Phillips and Shan Yuan Yu. Technical rept. no. 3 on Contract Nonr-609(12). Dec 57, 25p. 8 refs. AD-153 838.
Order from LC mi$2.70, ph$4.80 PB 138 079

Ten rotation tests on thin-walled tubes of aluminum alloy 3S-0 show that the assumption of isotropic strain-hardening is only approximately valid in the range of small plastic strains. In these tests plane states of stress α_1, α_2 ($\alpha_1 > \alpha_2$) existing on the outside surface of a thin-walled tube were rotated to various angles (up to 90°) about the radial direction. During the rotation the values α_1 and α_2 remained unchanged. Authors found that the plastic strain components increase during the rotation, but that the directions of the principal axes of plastic strain remain practically constant in most cases.

Yale U., New Haven, Conn.
A THEORY OF IDEAL LOCKING MATERIALS, by Aris Phillips. Technical rept. no. 4 on Contract Nonr-609(12). Feb 58, 20p. 6 refs. AD-153 839.
Order from LC mi$2.40. ph$3.30 PB 138 253

The concept of the ideal locking material, is extended to cover materials which have two different equations of state, one for the change in volume and the other for the change in shape. Possible stress-strain relations are discussed. The concepts of volumetric locking and of distortional locking are introduced, and it is shown by means of an example that there are cases in which these two modes of locking are incompatible over the same region. The problem of locking of a hollow sphere is discussed in detail.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Alco Products, Inc., Schenectady, N. Y.
METHODS FOR CALCULATION OF THERMAL MULTIPLICATION CONSTANT, RESONANCE ESCAPE PROBABILITY AND FAST FISSION FACTOR FOR LOW ENRICHMENT REACTORS, by B. J. Byrne. Rept. on Contract DA 44-009-eng-2868. 25 Jan 57, 42p. 1 ref. APAE memo. no. 82; AD-210 689.
Order from LC mi$3.30, ph$7.80 PB 145 024

This report describes methods used for the calculation of thermal multiplication constant, resonance escape probability, and fast fission factor for a low enrichment reactor. These parameters are used in a modified two-group calculation of the effective multiplication constant. Previously, a homogeneous model has been used for calculation of these parameters. The methods presently being used incorporate the effect of heterogenity into the calculation of thermal multiplication constant and resonance escape probability. The fast fission factor is still calculated on the basis of a homogeneous model, but a new correlation has been chosen which gives a better fit to available experimental data. (Author)

Hebrew U. (Israel).
DETERMINATION OF RELATIVE ABUNDANCE, RATIO OF MAGNETIC MOMENTS, RATIO OF CAPTURE CROSS-SECTIONS OF GADOLINIUM ISOTOPES BY MEANS OF PARAMAGNETIC RESONANCE SPECTRUM, by W. Low and D. Shaltiel (Israel Inst. of Tech.). Technical note no. 5 on Contract AF 61(052)59. Nov 58, 12p. 6 refs. AFOSR TN-59-84; AD-210 144.
Order from LC mi$2.40, ph$3.30 PB 138 711

Naval Radiological Defense Lab., San Francisco, Calif.
IONIZATION RATE AND PHOTON PULSE DECAY OF FISSION PRODUCTS FROM THE SLOW-NEUTRON FISSION OF U^{235}, by C. F. Miller and P. Loeb. 4 Aug 58, 91p. 5 refs. Research and development technical rept. USNRDL-TR-247.
Order from LC mi$5.40, ph$15.30 PB 144 727

Computation giving the theoretical ionization rate and response of the AN/PDR-39(TIB) radiac at 3 feet above an infinite plane uniformly contaminated with fission products from 10^4 fissions of U^{235} per sq. ft. are presented as a function of time after fission. The response of the USNRDL 4-pi ionization chamber and the photon pulse rate for the fission products are also presented as a function of time after fission. Disintegration-rate multipliers for each fission product nuclide per d/s of the nuclide are given; the multipliers were used to obtain the contribution of each fission product nuclide to the gross response. The theoretical ionization rate decay curve was integrated to obtain the gamma dose from the fission product mixture for various periods of time after fission. (Author)

New York U. Coll. of Engineering, N. Y.
A STUDY OF DEAD TIME AND RESOLVING TIME IN A PROPORTIONAL COUNTER, by William Reidy. Rept. on Contract AF 18(600)1555. Jan 59, 58p. 21 refs. AFOSR-TN-59-501; AD-215 926.
Order from LC mi$3.60, ph$9.30 PB 144 492

Measurements were made on a helium isobutane counter, which determined the variation of dead time and resolving time with voltage and pulse amplitude. The purpose of this investigation, was to determine the dead time and resolving time of the counter when operated in the proportional region and contrast this with operation in the geiger region. Results were obtained from photographs and direct measurements of the counter pulse as displayed on an oscilloscope. In addition, measurements were made by the two-source method to determine the resolving time of a proportional counter and its associated electronic counting system.

Elementary Particles

Maryland U., College Park.
AN ATTEMPT AT UNIVERSAL FOUR-FERMION INTERACTION, by J. C. Pati and S. Oneda. Rept. on Contract AF 49(638)24. June 59, 47p. 31 refs. Physics Dept. Technical rept. no. 139; AFOSR-TN-59-630; AD-218 820.
Order from LC mi$3.30, ph$7.80 PB 144 429

An attempt is made to explain the various decays of strange particles on the basis of vector and axial-vector four-fermion interaction. The existence of (V+A) currents as well as (V-A) currents is considered as a possibility and the interaction is assumed to have the form $f(J_a^{(+)} J_a^{(+)} + J_a^{(-)} J_a^{(-)}) + h.c.$, where f is the coupling constant, $J_a^{(-)}$ is composed of all charged currents which have negative chirality, $A\gamma_a(1+\gamma_5)B$, and $J_a^{(+)}$ of those charged currents which have positive chirality, $C\gamma_a(1-\gamma_5)D$. The leptonic currents necessarily belong to the $J_a^{(-)}$ group since the neutrion has a negative helicity.. We have studied the appropriate assignment of chiralities to various possible charged baryonic currents in order to explain the characteristics of hyperon decays in the framework of global symmetry for the pion interactions. The virtual pionic or kaonic effects outside the loop are neglected. Results show that there are 3 solutions which can explain reasonably well the branching ratios and asymmetry parameters of hyperon decays. One of the solutions seems to be the best since it explains rather well the rates of hyperon decays and $\pi \to 1 + \gamma$ decay at the same time. Signs of asymmetry parameters of hyperon decays are important to distinguish these solutions.

Purdue U., Lafayette, Ind.
DECAY OF HYPERONS AND MESONS FROM THE UNIVERSAL FERMI INTERACTION, by Akihiko Fujii and Masaaki Kawaguchi. Rept. on Contract AF 18(600)1579. [1958] 22p. 8 refs. AFOSR-TN-58-921; AD-204 559.
Order from LC mi$2.70, ph$4.80 PB 137 844

The decay of the hyperon, charged pion and kaon except $K_{\pi 3}$ is investigated on the basis of the universal V-A Fermi interaction together with the idea of the Gell-Mann tetrahederon, by treating the virtual baryon-antibaryon pair effect in a phenomenological way. It is shown that the decay rate of $K^{+}_{\pi 2}$ calculated by the parameters adjusted to the decay of π^{+}, $K^{+}_{\mu 3}$, and K^{+}_{e3} is in agreement with experiment, thus suggesting a possible consistent picture of the model. (Author)

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
PRECISION SCATTERING OF NUCLEAR PARTICLES. THE NUCLEAR SHELL MODEL, I, by J. B. French. Technical rept. no. 9, Pt. 1, on Contract N7onr-32505. Mar 58, 176p. 70 refs.
Order from LC mi$8.10, ph$27.30 PB 138 573

See also PB 140 099

Uppsala U. (Sweden).
ANTIPROTONS IN NUCLEAR EMULSIONS, by A. G. Ekspong, S. Johansson and B. E. Ronne. Technical rept. on Contract AF 61(514)1015. Phase A. [1957] 27p. 2 refs. AFOSR TR-58-25; AD-152 200.
Order from LC mi$2.70, ph$4.80 PB 138 491

Effort was concentrated on two problems, the properties and behavior in matter of (1) the antiprotons, and (2) the negative K-mesons.

Radioactivity

Air Force Cambridge Research Center, Bedford, Mass.
GLOBAL FALLOUT AND ITS VARIABILITY, by E. A. Martell. Oct 59, 37p. 84 refs. Geophysical Research Papers no. 65; AFCRC-TR-59-268.
Order from OTS $1.00 PB 161 345

Ba^{140}/Sr^{90} activity ratio data for individual rains are discussed to show means of distinguishing between the stratospheric or tropospheric origin of fallout. Sr^{89}/Sr^{90} activity ratio data allow approximate estimation of the fallout contribution from major test series. Evidence for variation in stratospheric storage times, transport paths, and fallout distribution areas is discussed. Estimated residence times are 6 months to 1 year for Soviet tests, 1 to 2 years for debris in the lower equatorial stratosphere, and 5 to 10 years for the CASTLE tests. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
DECONTAMINATION OF FISSION PRODUCTS AND OTHER ATOMIC BOMB DETONATION DEBRIS, by C. F. Miller, R. Cole and others. 24 Nov 53, declassified 29 Jan 59, 46p. 7 refs. USNRDL-439.
Order from LC mi$3.30, ph$7.80 PB 145 026

The decontamination of simulated atomic bomb detonation radioactivity in a synthetic seawater contaminant medium has been investigated. The effects of initial level and time of cleaning on the decontamination of Navy gray paint surfaces using a stirrer and a spray chamber were observed where the data could be best represented by the general equation

$$F = aI^{n-1} + \frac{I}{1+K_2}$$

in which F is the fraction of contamination remaining, I is the initial level, and a, n, and K_2 are functions of the time at which the decontamination is performed. The first term of this equation was associated with sorption phenomena while the second term was derived for a solubility mechanism. The equation was applied to previous data which the authors had obtained using the same contaminant medium on paint surfaces for various decontaminating reagents. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Quartermaster Research and Engineering Center, Natick, Mass.
LAUNDERING CHARACTERISTICS OF ENVIRONMENTAL HEADGEAR: ARMY CAP, FIELD, COTTON, OG 107 AND NAVY CAP, INTERMEDIATE, COLD WEATHER, by Jean H. Crosson. Oct 59, 18p. 4 refs. Clothing Branch Series rept. no. 12.
Order from LC mi$2.40, ph$3.30 PB 144 534

The investigation was to compare the laundering characteristics of two similar types of Army and Navy environmental headgear in order to determine the effects of laundering on sizing, fit and appearance. The study showed that both types of caps shrank, excessively in the case of the Navy item, and the appearance of each was poor, with the lowest rating accorded the Army Model. To overcome the laundering and appearance problems, development of new material has been undertaken and caps incorporating the first approach, namely, a Dacron/Rayon fabric in a Gabardine weave, have been procured for User Test.

PHYSICS

Avco Corp., Wilmington, Mass.
RESULTS OF AN APPROXIMATION METHOD TO THE MIE THEORY FOR COLLOIDAL SPHERES, by R. Penndorf. Scientific rept. no. 1 on Research on Aerosol Scattering in the Infrared, Contract AF 19(604)5743. Sep 59, 45p. 11 refs. Technical rept. RAD-TR-59-36; AFCRC-TN-59-608; AD-227 660.
Order from LC mi$3.30, ph$7.80 PB 144 438

An approximation method is outlined for computing the total Mie scattering coefficient K in aerosols using infrared light sources. The method is valid for any size parameter α, from small to very large spheres and any arbitrary real refractive index $n \leq 2$. Analytical expressions are developed for the phase and the amplitude of K at the maxima and minima. The constants in these analytical expressions are determined from existing data computed by the exact Mie theory. Finally, a graphical interpolation process allows for determination of K for any arbitrary size. This method leads to an accuracy of ± 2 or 3 percent for K as compared with results obtained by the Mie theory. This approximation method is then applied to 14 refractive indices n between 1.05 and 2.0. The results for smoothed $\overline{K}$ values are listed for the range $\alpha = 0.2(0.2)\,30(0.5)40$, which is considered sufficient for most applications. For very large spheres, the laws of geometrical optics can be used successfully. Graphical representations of all cases are also included. From these figures, the appropriate $\overline{K}$ value can be read off directly for any given size parameter, and also for any given radius of the aerosol particle, if the wavelength of the incoming infrared radiation is selected.

Maryland U., College Park.
SOLID STATE THEORY. Final rept. on Contract AD 18(600)1015. Oct 58, 8p. 32 refs. AFOSR-TR-58-147; AD-205 094.
Order from LC mi$1.80, ph$1.80 PB 137 932

A listing of technical reports published or in preparation on this contract.

Naval Avionics Facility, Indianapolis, Ind.
TEMPERATURE CONVERSION TABLES, by Wayne A. Brodhecker. Nov 59, 85p. NAFI-TP-99.
Order from OTS $2.25 PB 161 354

The platinum resistance thermometer used as a primary standard in the Standards and Calibration Laboratory at the U. S. Naval Avionics Facility, Indianapolis is calibrated in degrees Celsius (centigrade), and many of the thermometers used at NAFI are in degrees Fahrenheit. There was a need for a method of converting degrees C to degrees F without having to perform the mathematical calculations for each point checked on a thermometer. The tables were calculated on an IBM 650 Computer; using the basic formula ($^oC = 9/5\ ^oF + 30^o$). This formula was used instead of the formula ($^oF = 5/9\ (^oC - 32^o)$) in order to make use of the three-place accuracy obtained in using the resistance thermometer and at the same time to keep the tables small enough to be of practical use. By interpolation three-place accuracy may be obtained in degrees F when going from degrees C to degrees F. Range is -100^oF to 300^oF. Calculation is to 3 decimal places.

Acoustics

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ACOUSTIC PROPAGATION IN A DIATOMIC GAS SUBJECT TO THERMAL OR CHEMICAL RELAXATION, by Walter E. Gibson and Franklin K. Moore. Rept. on Contract AF 18(603)19. Dec 58, 70p. 14 refs. Rept. no. HF-1056-A-2; AFOSR-TN-58-1057; AD-206 988.
Order from LC mi$3.90, ph$10.80 PB 144 523

A theory of acoustic propagation in a gas subject to relaxation phenomena is presented. In most applications of the thoery to diatomic gases, only one degree of freedom need be considered, all the others being either frozen or in equilibrium. An acoustic equation is obtained herein for small disturbances from an equilibrium state of rest; this equation applies equally well to unsteady one-dimensional waves or to steady two-dimensional disturbances. The problem of two-dimensional airfoil in a supersonic flow of relaxing gas is considered. From the acoustic equation, the law of decay of shock waves and the values of the flow properties on the surface of the airfoil are derived. Furthermore, the asymptotic behavior of the flow field is obtained far from the airfoil so that the formation of an equilibrium wave is described.

Naval Ordnance Lab., White Oak, Md.
NUMERICAL SOLUTION OF THE WAVE EQUATION FOR A POINT SOURCE IN SHALLOW WATER, by B. L. Hord. 23 Sep 57, 30p. 4 refs. NAVORD-5716; AF-157 276.
Order from LC mi$2.70, ph$4.80 PB 144 722

Numerical integrations have been made of the wave equation solution for a point source in shallow water. Difficulties in making evaluations for the case $c_1 < c_2$ were considered but no computations were made for this case. Values were obtained for several source frequencies and two different source-receiver geometries for the case $c_1 > c_2$. The results show a smooth transition between two asymptotic values for the normal incidence configuration. Values for the second configuration were computed for several source frequencies up to 450 cps. Higher frequencies require prohibitive computation times on the IBM 650 computer. (Author).

Naval Research Lab., Washington, D. C.
THE THEORY OF THE THICK-SHELL HOLLOW-PIEZOCERAMIC-SPHERE UNDERWATER SOUND TRANSDUCER, by S. Hanish. Interim rept. 10 Dec 59, 33p. 10 refs. NRL rept. 5405.
Order from LC mi$3.00, ph$6.30 PB 142 854

A thick-shell hollow piezoceramic sphere electroded completely on both inside and outside surfaces and polarized radially can be used as a source (and receiver) of underwater sound. Restricting the theory to moderately thick shells, the text analyzes the acoustic performance of this structure. Derivations are obtained of electromechanical equations of displacement in the radial extensional mode under forced electrical drive, electromechanical coupling, acoustic power, receiving sensitivity, and input electrical admittance. Low-frequency and thin-shell approximations are also formulated, and results are compared with published literature. (Author)

Psycho-Acoustic Lab., Harvard U., Cambridge, Mass.
PERIODIC STATUS REPORT 32. Rept. for 16 May-15 Nov 58 on Contract Nonr-1866(15) and National Science Foundation Grant G-2668. 15 Nov 58, 18p. 69 refs. PNM-80.
Order from LC mi$2.40, ph$3.30 PB 144 685

See also PB 138 819

Willow Run Labs., U. of Michigan, Ann Arbor.
A BIBLIOGRAPHY ON ACOUSTIC SOURCES AND THEIR RELATED FIELDS, by George B. Thurston and Raya Stern. Rept. on Contract Nonr-1224(24). Feb 59, 69p. 347 refs. Rept. no. 2784-2-S.
Order from OTS $1.75 PB 161 330

This report is a bibliography on acoustic sources and their related fields. Both single sources and arrays of sources have been considered. The abstracts are arranged into a detailed subject outline having four major topics: Single Sources and Receivers; Arrays of Sources and Receivers; Transducer Properties; Acoustic Fields. Articles published during the period from 1935 to 1958 are reviewed principally.

Willow Run Labs., U. of Michigan, Ann Arbor.
A BIBLIOGRAPHY ON PROPAGATION OF SOUND THROUGH PLATES. by George B. Thurston and Raya Stern. Rept. on Contract Nonr-1224(24). Feb 59, 170p. 991 refs. Rept. no. 2784-1-S.
Order from OTS $3.00 PB 161 329

This report is a bibliography on propagation of sound through plates. The abstracted material is organized in accordance with a detailed subject outline having five major topics: Transmission Through Plates; Wave Propagation; Properties of Materials; Vibrating Surfaces and Plates; General References. Literature surveyed is principally in the period from 1929 to 1958. Approximately 450 abstracts are given.

Electricity and Magnetism

Atomics International, Canoga Park, Calif.
RESEARCH ON ELECTRON ENERGY STATES IN TRANSITION METALS, by Ted G. Berlincourt, Guy W. Lehman, and R. R. Hake. Final rept. for 1 May-30 June 57 on Contract AF 18(600)1575. 31 July 58, 42p. 35 refs. AI-3051; AFOSR-TR-58-109; AD-201 611.
Order from LC mi$3.30, ph$7.80 PB 137 811

Hall effect, resistivity, and magnetoresistivity of Cu, Zr, Ti, and Nb at temperatures between 1^oK and room temperature and in magnetic fields up to 30 kilogauss. Anomalous behavior was observed in the Hall effect of Cu in that size effects were evident for sample thicknesses considerably greater than the generally accepted mean free path. Strong temperature dependences were observed in the Hall coefficients of Cu, Ti, and Zr, the coefficients of Zr and Ti were found to be extremely sensitive to impurity content.

Diamond Ordnance Fuze Labs., Washington, D. C.
DEPENDENCE OF METAL-TO-SEMICONDUCTOR CONTACT RESISTANCE UPON CONTACT LOADING, by Alford L. Ward. 30 July 59, 53p. 14 refs. TR-731.
Order from LC mi$3.60, ph$9.30 PB 144 565

The spreading resistance has been shown to be modified by the injection of minority carriers at the contact. The piezoresistance matrix is used to study the effect of contact stress on the semi-conductor resistivity. The mechanism of a large observed change of contact resistance with loading has been shown to be due to the change of the effective contact area.

Harvard U., Cambridge, Mass.
PARAMAGNETISM IN DIAMAGNETIC MOLECULES, by William Weltner, Jr. Rept. on Contract N5ori-76, T. O. 14. [1957] 29p. 43 refs. AD-153 016.
Order from LC mi$2.70, ph$4.80 PB 138 447

The experimental and theoretical determinations of the Van Vleck paramagnetic contribution to the sus-

ceptibility of diamagnetic molecules are considered. The data on the hydrogen molecule are reviewed, and the mean square orbital angular momentum is recalculated using Newell's wave function.

Philips Labs., Irvington-on-Hudson, N. Y.
RESEARCH INVESTIGATIONS OF MAGNETIC MATERIAL, PERMANENT CERAMIC TYPE, by Frank G. Brockman. Final technical rept. for 1 Aug 54-30 June 55 on Contract DA 36-039-sc-56759. 18 July 55, 26p. 5 refs. Research Lab. Technical rept. no. 93.
Order from LC mi$2.70, ph$4.80 PB 144 521

Producing a ceramic permanent magnet of composition type $M^{II}O(Fe_2O_3)_6$ with an energy product, $(BH)_{max}$, exceeding 3×10^6 gauss-oersteds. Studies made to locate and eliminate the causes of non-reproducibility.

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
COMMUNICATION BY PARTICLE BEAMS, by William M. Preston (Harvard U.) and S. Gruber. Sep 59. 24p. AFCRC-TR-59-189; AD-228 528.
Order from LC mi$2.70, ph$4.80 PB 144 418

It is shown that the use of particle beams is impractical for communications, whether the particles are charged or uncharged, and whether evaluation is based on generation, transmission, or detection.

Diamond Ordnance Fuze Labs., Washington, D. C.
A UNIFIED THEORY OF BREAKDOWN AND THE GLOW DISCHARGE, by A. L. Ward and M. J. Reddan. 16 Oct 59, 24p. 10 refs. Technical rept. TR-784.
Order from LC mi$2.70, ph$4.80 PB 144 759

Townsend's basic ionization equations for cold-cathode discharges between parallel plates are modified by Poisson's equation to account for the distortion of the field by space charges. Numerical calculations of voltage vs current-density static characteristics have been carried out on the IBM 704 computer. The regions of validity of earlier breakdown approximations are indicated. The subnormal, normal and abnormal glow regions are shown to develop as the current is progressively increased. Although comparison with experimental data is made difficult by the changing area of discharges, data both from DOFL and from other laboratories indicate the validity of the calculations. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
GENERALIZED ENERGY RELATIONS OF NONLINEAR REACTIVE ELEMENTS, by Chai Yeh. Memo. on Project Michigan, Contract DA 36-039-sc-78801. Sep 59, 8p. 1 ref. 2900-97-R.
Order from LC mi$1.80, ph$1.80 PB 144 502

This memorandum generalizes the theory of energy relations of nonlinear reactive elements from its original form of two applied frequencies by Manley and Rowe to any number of nonharmonically related frequencies. The derivation of equations follows a pattern similar to the one established by Manley and Rowe with the exception that a Fourier summation of r variables is used. (Author)

Molecular Physics and Spectroscopy

Aeronutronic, Newport Beach, Calif.
SPECTRAL EMISSIVITY OF HYDROGEN CHLORIDE FROM 1000-3400 CM^{-1}, by V. Robert Stull and Gilbert N. Plass. Scientific rept. no. 5 on Contract AF 19(604)2166. 15 May 59, 31p. 9 refs. Publication no. U-461; AFCRC-TN-59-467; AD-228 303.
Order from LC mi$3.00, ph$6.30 PB 144 412

The spectral emissivity of hydrogen chloride from 1000 - 3400 cm^{-1} is calculated as a function of temperature, pressure, and amount of radiating gas. The emissivity was calculated with the aid of an electronic computer from the usual expressions for the energy and intensity taking into account up to 2900 spectral lines at 2400°K. The harmonic oscillator approximation was used to evaluate the electric dipole matrix element for the higher vibrational states where no experimental measurements have been made. The emission from HCl^{35}, HCl^{37}, DCl^{35}, and DCl^{37} was included in the calculation. The statistical model and the random Elsasser model were used to calculate the emissivity from the line strengths. The characteristic shift of the emission to lower frequencies as the temperature increases is quantitatively explained. The emission in this frequency region of any flame containing HCl can readily be obtained from the results given here.

Catholic U. of America, Washington, D. C.
A STUDY OF NH RADICAL BY THE LCAO-SCF MOLECULAR ORBITAL METHOD [AND] A MOLECULAR ORBITAL TREATMENT OF SIMPLE OPEN SHELL MOLECULAR SYSTEMS, by Virginia Griffing, Marjorie Boyd and Bernard J. Ransil. Technical rept. no. 4 on Contract Nonr-1220(00). 15 Feb 58, 60p. 66 refs.
Order from LC mi$3.60, ph$9.30 PB 138 340

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech, Pasadena.
SPECTROSCOPIC STUDIES OF HEATED SALTS BEHIND SHOCK FRONTS, by H. Takeyama and V. C. D. Dawson. Technical rept. no. 8 on Contract AF 18(603)2. Nov 58. 27p. 5 refs. AFOSR-TN-58-1079; AD-207 589.
Order from LC mi$2.70, ph$4.80 PB 138 350

The spectra of heated solids behind shock fronts are similar to spark and arc spectra and are strongly dependent upon the shock conditions. Experimental studies of emission intensities as a function of time indicate that excessive cooling occurs in the shock tube and that population temperatures of electronically excited atoms and positive ions cannot be determined reliably.

Harvard U., Cambridge, Mass.
A NOTE ON THE DETERMINATION OF MOLECULAR STRUCTURE FROM SPECTROGRAPHIC DATA, by Victor W. Laurie. Rept. on Contract N5ori-76, T. O. 14. [1957] 12p. 34 refs. AD-153 017.
Order from LC mi$2.40, ph$3.30 PB 138 446

The problem of the change upon isotopic substitution of "effective" bond lengths and angles involving hydrogen is considered. Evidence is presented that in certain cases such variation is largely due to vibration of the heavy atoms rather than of the hydrogens. A method of calculating this effect is presented which utilizes a parameter similar to the "quantum defect" $\Delta = I_c - I_a - I_b$ observed in planar molecules.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
MICROWAVE SPECTRUM OF $CH_2DCH{:}CH_2$; EQUILIBRIUM CONFORMATION OF PROPYLENE, by Dudley R. Herschbach and Lawrence C. Krisher. Rept. on Contract N5ori-T866, T. O. 14. [1957] 5p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 138 449

A sample of $CH_2DCH{:}CH_2$ was prepared by reacting allyl chloride with D_2O in the presence of Zn dust and excess Ac_2O. The frequencies were observed and recorded. Two isomers were observed, and the spectra were in excellent agreement with initial predictions. The relation $I_a + I_b - I_c = I(CH_3)$ was satisfied for the species assigned as sym-I which indicated that it had a plane of symmetry containing the D atom.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
MICROWAVE SPECTRUM OF PROPYLENE OXIDE. Rept. on Contract N5ori-1866, T. O. 14 Feb 58, 11p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 138 450

Massachusetts Inst. of Tech., Cambridge.
SOLID-STATE AND MOLECULAR THEORY GROUP, by J. C. Slater. Quarterly progress rept. no. 31 on Contract Nonr-1841(34). 15 Jan 59, 57p. 20 refs.
Order from LC mi$3.60, ph$9.30 PB 144 229

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Iron series atoms and ions
I. B. M. 704 program for generating the irreducible representations of the group of spin coordinate permutations
Spinor waves in a crystal
Interaction of a hole with mobile lattice ions in KCl
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Auxiliary computer techniques
Programs for evaluation of molecular integrals
Kinetic theory of moderately dense gases
Simulation of river systems by digital computer
Multi-center integral programs for I. B. M. 704 computer
(See also PB 143 224)

Naval Research Lab., U. of Wisconsin, Madison.
THE ANATOMY OF MOLECULAR PHYSICS, by Joseph O. Hirschfelder. Rept. on Contract NOrd-15884. 14 Oct 57, 12p. 1 ref. CM-915; AD-149 478.
Order from LC mi$2.40, ph$3.30 PB 137 942

An effort is made to explain the inter-relations between the fundamental laws of physics, the molecular properties, the bulk properties of materials, and the various types of experimentation. These inter-relations are becoming extremely important as interests widen to encompass extreme conditions of temperature, pressure, etc., and as experimentation becomes more precise.

Ohio State U. Research Foundation, Columbus.
FURTHER DEVELOPMENTS IN THE THEORY AND USE OF THE ELECTRON SPECTROMETER, by Edwin N. Lassettre, Sam Silverman, and Marvin E. Krasnow. Scientific rept. no. 11 on Contract AF 19(122)642. July 57, 24p. 3 refs. AFCRC-TN-58-235; AD-220 107.
Order from LC mi$2.70, ph$4.80 PB 139 429

The equations used for the determination of electronic collision cross sections by means of an electron spectrometer have been described and discussed in a previous report. The construction and performance of a spectrometer suitable for this purpose has also been described. Since the preparation of these reports several of the factors which affect the accuracy of the measured cross sections have been examined in greater detail from both an experimental and theoretical viewpoint. Those factors which will be treated in detail in this report are the pressure dependence of the scattering, the determination of cross sections by the study of the scattering due to a mixture of the gas under consideration and the calibrating gas, and, finally, a study of the effect of incident beam divergence on the accuracy of the measured cross sections. The discussion of these matters will serve to confirm the validity of the procedures heretofore used and will indicate some ways in which the technique may be further improved. This report supplements Scientific Report No. 2 of this series.

Syracuse U. Research Inst., N. Y.
THE DIPOLE MOMENT FUNCTION OF DIATOMIC MOLECULES, by John Trischka and Harold Salwen (Harvard U.) Technical rept. on Contract Nonr-669(09). 1 Jan 59, 30p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 144 458

The connection between the dipole moment function and its matrix elements has been studied for the one-dimensional model of a diatomic molecule.

[Syracuse U., N. Y.]
MOLECULAR BEAM RADIOFREQUENCY SPECTRA OF MOLECULES, by J. W. Trischka. Final rept. on Contract N6onr-248, T. O. 11. Nov 57, 6p. 12 refs. AD-147 105.
Order from LC mi$1.80, ph$1.80 PB 137 886

The main object was to study the radiofrequency spectra of the alkali halides by the molecular beam electric resonance method. Studies were made of phenomena which contributed to the use of the molecular beam method, to develop theories important to the interpretations of the results and to design specialized pieces of apparatus which contributed to the advance of the art.

Optics

Air Force Cambridge Research Center, Bedford, Mass.
ATMOSPHERIC REFRACTION OF INFRARED RADIATION, by Thomas P. Condron. Oct 59, 20p. 5 refs. GRD Research Notes no. 23; AFCRC-TN-59-617.
Order from OTS $0.50 PB 161 342

This note contains preliminary calculations of approximate infrared irradiance values in the neighborhood of caustic surfaces; these caustics are predicated from ray calculations based on the ARDC Model Atmosphere. The caustics which should occur at 1500 km skip-distances are caused by the downward refraction of a small bundle of rays emitted from a source at nearly horizontal inclination to the earth's surface at various altitudes. The predicted increases in irradiance in these annular caustic regions indicates that the phenomenon may be useful for long-range missile detection. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
THE "CLAM SHELL" THERMAL IMAGE DEVICE (THERMAL IMAGER) by George P. Ploetz. Sep 59, 9p. AFCRC-TN-59-759.
Order from LC mi$1.80, ph$1.80 PB 144 587

A novel thermal imaging device is described. Two identical reflecting paraboloids are mounted face to face so that the focal point of each falls at the vertex of the other. This arrangement allows both the source and image to be external to the optical system. The benefits of the device include: improved images, higher temperatures, and increased power transfer. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
STUDY OF A PHOSPHOR LIGHT PULSER, by Michael R. Zatzick. Sep 59, 26p. 10 refs. Instrumentation for Geophysics and Astrophysics no. 10; AFCRC-TR-58-274.
Order from OTS $0.75 PB 161 343

A short persistence 5RP-15A cathode-ray tube and a simple optical system (lens, ultraviolet pass filter, and adjustable slit) were used with moderate success to produce variable "square wave" light pulses of predictable rise time and duration. Absence of the expected near ultraviolet emission peak of the P-15 limited observable pulse durations to ~7 μsec instead of an expected ~0.1 μsec since preliminary RCA data did not mention that only one out of fifty P-15 coatings emit the near ultraviolet peak. Rise times of ~0.1 μsec were possible, but the transient response of the photometer for increasing light levels, ~300 v/μsec, permitted observation of only 2.5 μsec rise times (10 to 90 percent). When neither the phosphor nor photometer limitations entered, the measured pulse shape was reproducible within the 5-percent expected error. Improvements in the design of the light pulser are suggested for attaining faster light pulses. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE BEHAVIOR OF A LIGHT RAY PENETRATING A SUPERSONIC FLOW FIELD, by Harald A. Melkus. Oct 59, 58p. 6 refs. AFMDC-TR-59-39.
Order from LC mi$2.60, ph$9.30 PB 144 594

Data on deflections of a light ray penetrating a supersonic flow field have been requested by the Guidance and Control Division, Directorate of Advanced Technology, Holloman Air Force Base. The data are important for estimates of aerodynamically induced errors in schemes for measuring angular positions of a guidance platform during motion on a sled at supersonic speeds. (Author)

Anderson Physical Lab. [Champaign, Ill.]
THE DETERMINATION OF NEAR INFRARED SPECTRA, by Scott Anderson, Raymond Isaac, and Myra Blankenship. Rept. for 1 May 58-30 Apr 59 on The Determination of Near Infrared Spectra, Contract AF 33(616)5283. Sep 59, 32p. 22 refs. WADC Technical rept. 59-344.
Order from OTS $1.00 PB 161 336

Near infrared spectra of organic compounds of interest to the Air Force Research and Development Program, were determined between the region 0.7 to 3.2μ on a Beckman DK-2 Ratio Recording Spectrophotometer. Modification of the instrument's recording, to accommodate a chart which presents spectra at a single scale expansion of 2x, is discussed. Rapid sorting of spectra was provided with the use of Wyandotte-ASTM structure and name-formula IBM cards. (Author)
(See also PB 151 309)

Bausch and Lomb Optical Co., Rochester, N. Y.
INFRARED FILM STUDIES, by L. Hurtle. Quarterly technical rept. no. 3, 23 Oct 56-23 Jan 57, on Contract DA 44-009-eng-2876. 8 Mar 57, 13p.
AD-202 426.
Order from LC mi$2.40, ph$3.30 PB 144 645

A stable, stress-free, unsupported foil or film is obtained by controlling the thickness of each individual layer of InS and MgF_2. Two new methods of controlling this film thickness were tried. In the first method, the film was continuously deposited on a Ta ribbon and the change in color was observed as a function of time. The filament of Ta could then be purged by passing a current through it and made ready for a second measurement. In the second method a section of a previously made unsupported foil or a very thin mica flake was mounted along the edge of the rotating sample. Films condensing on this foil or flake would cause it to bend either under compression or tension. Hence the rate of deposition of each material could be suitably adjusted to produce a stress-free foil.

Cruft Lab., Harvard U., Cambridge, Mass.
THE ELECTROMAGNETIC THEORY OF LIGHT. I, by Tai Tsun Wu. Scientific rept. no. 9 on Contract AF 19(604)786. 5 Apr 57, 20p. 11 refs. AFCRC TN-57-371; AD-117 073.
Order from LC mi$2.40, ph$3.30 PB 138 777

A theoretical study. Previous theories on diffraction phenomena do not appear to be deducible from Maxwell field equations. An attempt is made to remedy this.

Diamond Ordnance Fuze Labs., Washington, D. C.
A NEAR INFRARED PHOTOMETER, by Louis Melamed. 20 Nov 59, 11p. Technical rept. TR-759.
Order from LC mi$2.40, ph$3.30 PB 144 755

An infrared photometer using a lead sulfide detector was designed specifically to monitor the day-to-day variation in intensity of ambient sky light in the 0.8 to 2.8μ region. A sensitivity of 3930 μv (μw/cm^2) has been achieved using very simple circuitry and readily available components. (Author)

Upper Air Lab., U. of Colorado, Boulder.
MULTILAYER INTERFERENCE FILTERS FOR INFRARED, by Vern N. Smiley. Scientific rept. no. 3 on Contract AF 19(604)1899. Oct 59, 169p. 26 refs. AFCRC-TN-59-601; AD-228 287.
Order from LC mi$7.80, ph$25.80 PB 144 434

The basic theory of interference filters is discussed starting with the simple Fabry-Perot filter. Methods of calculating the transmittance and reflectance of a multilayer stack are discussed with emphasis on an analog computer method. A derivation of a nearly exact expression of the bandwidth and an expression for the fraction of power transmitted between half-maximum points for an all-dielectric Fabry-Perot filter are given. Band-pass filters of a type containing more than one multiple half-wave layer are examined in detail by calculated curves for several different configurations; they are shown to be superior to the Fabry-Perot dielectric filters. A five-layer dielectric Fabry-Perot filter designed for use as a low-pass filter is treated in detail. A method of analysis consisting of replacing any multilayer system by one layer with two effective interfaces is used to explain the operation of band-pass and low-pass filters. Methods of making experimental filters are discussed, including the experimental difficulties involved. An example of a five layer experimental filter is given.

Solid State Physics

Brown U. Div. of Applied Mathematics, Providence, R. I.
ROTATING DISKS: INSENSITIVITY OF DESIGN, by Jacques Heyman. Technical rept. no. 29 on Contract Nonr-562(10). Dec 57, 19p. 3 refs. C11-29; AD-154 469.
Order from LC mi$2.40, ph$3.30 PB 138 078

The plastic method of design of rotating disks leads to profiles very similar to those generated by conventional elastic methods. The minimum weight disk is investigated and it is shown that a practical disk approximates very closely in its leading dimensions to the minimum weight disk. In particular, the axial length of a disk at its bore is insensitive to the precise form of profile, which makes an elastic trail and error method workable. This insensitivity is examined by using a plastic analysis.

Fulmer Research Inst., Ltd. (Gt. Brit.).
THE SPACING OF SLIP LINES IN METALS, by J. T. Barnby, J. S. Steel and E. A. Calnan. Annual technical rept. no. 2, Apr 58-Apr 59, on Contract DA 91-508-EUC-175. Apr 59, 39p. 15 refs. Research rept. R. 113/5; AD-220 168.
Order from LC mi$3.00, ph$6.30 PB 143 118

An electron microscopic study of the spacing of slip lines in polycrystalline O. F. H. C. copper and high purity brasses containing 5, 15, 30 and 37 per cent zinc is described. Copper specimens showed well defined peaks in the distribution diagrams for slip line spacing, at about 300A. The change in slip-line spacing with zinc content is discussed in terms of current theories of solid solution hardening. Experiments have been directed at producing thin films of copper and brass for transmission electron microscopy, and studying in these specimens the effects of quenched-in vacancies.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
HIGH PRESSURE EFFECTS IN SEMICONDUCTORS; INTERBAND SCATTERING IN GERMANIUM, by Marshall I. Nathan. Technical rept. HP-1 on Contract Nonr-1866(10). 1 Feb 58, 116p. 63 refs.
Order from LC mi$6.00, ph$18.30 PB 138 445

There are minima in the conduction bands of germanium and silicon along the (111) and the (100) directions in k-space. The (111) minima at an energy E_g are the lowest minima in the conduction band of germanium; while the (100) minima at an energy E_s are lowest in silicon. Results of the measurement of the pressure variation of the electrical conductivity of n-type germanium at several temperatures between 0°C and 82°C to 18,000 kg/cm^2 and at 76°C to 30,000 kg/cm^2 are presented. The interband scattering theory is extended to predict the pressure behavior of the galvanomagnetic effects in n-type germanium. (See also PB 140 386)

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
DISLOCATION STRUCTURES OBSERVED IN HIGH-PURITY RECRYSTALLIZED ALUMINUM BY X-RAY DIFFRACTION, by A. R. Lang and G. Meyrick (U. of Bristol). Technical rept. no. 1 on Contract Nonr-1866(39). 17 Feb 59, 7p. 4 refs.
Order from LC mi$1.80, ph$1.80 PB 144 578

Honeywell Research Center, Hopkins, Minn.
THE RELATIONSHIP BETWEEN PLASTIC FLOW AND THE FRACTURE MECHANISM IN MAGNESIUM OXIDE SINGLE CRYSTALS, by T. L. Johnston, R. J. Stokes and C. H. Li. Technical rept. no. 4 on Contract Nonr-2456(00). Feb 59, 34p. 8 refs. HR-59-419.
Order from LC mi$3.00, ph$6.30 PB 144 579

Magnesium oxide crystals plastically deformed under a three point load develop internal slits coplanar with the (110) slip plane and parallel to the [001] bending axis in the tension region. If microcracks form in the early stages of plastic flow their growth is unrestricted and the material is brittle. If the crystal is first plastically deformed to introduce sufficient slip the growth of the microcracks is impeded in certain directions and they develop into narrow slits. For brittle specimens fracture starts from a point, whereas for ductile specimens the fracture appears to start from one of the narrow slits.

Illinois U., Urbana.
HALL EFFECT FOR ELECTRONS IN SILVER CHLORIDE, by Koichi Kobayashi and Frederick C. Brown. Rept. on Contract AF 18(600)662. Aug 58, 27p. 21 refs. AFOSR-TN-57-743; AD-201 509.
Order from LC mi$2.70, ph$4.80 PB 137 540

The drift mobility of electrons in single crystal silver chloride has been investigated over a wide temperature range by means of transit time techniques. Results of these measurements are in reasonable agreement with the theory of electron mobility in polar crystals down to about 80°K but show a wide discrepancy at lower temperatures. The present experiments were carried out to determine whether this effect is due to scattering by imperfections or to multiple trapping effects, and to extend mobility data into the very low temperature range.

Illinois U., Urbana.
A METHOD FOR MEASURING MAGNETIC FIELDS IN SUPERCONDUCTORS, by H. R. Lewis, J. F. Cochran and others. Rept. on Contract AF 18(603)49. Nov 59, 18p. 12 refs. AFOSR-TN-59-1154.
Order from LC mi$2.40, ph$3.30 PB 144 568

In order to measure the magnetic field in a superconductor, a suitable radioisotope is embedded at the desired depth. The rotation of the angular correlation pattern is then used to determine the magnetic field at the nuclear site.

Institute of Optics, U. of Rochester, N. Y.
THE FUNDAMENTAL ABSORPTION EDGE IN CADMIUM SULFIDE, by David Dutton. Technical rept. 14 on Contract AF 18(600)193. June 58, 33p. 32 refs. AFOSR-TN-58-545; AD-158 362.
Order from LC mi$3.00, ph$6.30 PB 137 715

The absorption and reflection spectra of CdS have been determined in the temperature range 90° - 340°K by photoelectric measurements on single crystals, using polarized light.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
SOME PROPERTIES OF QUENCHED MAGNESIUM FERRITES [AND] TEMPERATURE-DEPENDENT LAG IN POLYCRYSTALLINE YTTRIUM-IRON GARNET, by J. D. Epstein and B. Frackiewicz. Rept. on Contracts Nonr-1841(10) and AF 30(635)2872. Jan 59, 22p. 17 refs. Technical repts. 134 and 135.
Order from LC mi$2.70, ph$4.80 PB 144 482

Magnetic properties of magnesium ferrites where the fraction of magnesium ions in tetrahedral sites, varies from 0.14 to 0.26. Properties examined are: saturation moment, Curie point, initial permeability and coercive force. Samples quenched from 1100°C and then tempered at 600° require somewhat less than 16 h. to attain an equilibrium cation distribution at the latter temperature. Certain samples of polycrystalline yttrium-iron garnet are characterized by a room-temperature permeability spectrum having two regions of dispersion, one at microwave, the other at radio frequency. The former dispersion is identified as gyromagnetic in origin. The radio-frequency dispersion, which exhibits a temperature-activated shift to lower frequency with decreasing temperature, appears due to an electron-diffusion controlled domain-wall relaxation. The activation energy for the process is 0.38 ev.

Naval Ordnance Lab., Corona, Calif.
THE EFFECT OF LINEAR LOADING CAPACITANCES UPON THE SWITCHING TRANSIENT OF COLEMANITE, by David J. White. 12 Sep 58, 36p. 1 ref. NOLC rept. 314; NAVORD rept. 5922; AD-138 640.
Order from LC mi$3.00, ph$6.30 PB 138 640

The polarization-reversal, transient of ferroelectric colemanite shows a discrepancy on the order of 20% from the empirically developed relations for

$BaTiO_3$. The source of the discrepancies in the experimental switching transient of ferroelectric colemanite must be sought in the nature of the ferroelectric colemanite itself.

Naval Ordnance Lab., White Oak, Md.
SOLID STATE DIVISION ANNUAL REPORT FOR 1957, ed. by Robert Talley. 1 July 58, 47p. 61 refs. NAVORD rept. 6193.
Order from LC mi$3.30, ph$7.80 PB 145 027

Most of the work was performed in the field of magnetism with emphasis on antiferrimagnetism and magnetic resonance; and on semiconductors, primarily photo-effects and bulk properties of PbS, PbSe, PbTe, and InAs. (Author)

Naval Ordnance Test Station, China Lake, Calif.
A KINETIC STUDY OF OXYGEN CHEMISORPTION ON PbS LAYERS, by K. Laws and V. R. Honnold. 19 June 58, 20p. 6 refs. NOTS-1623; NAVORD rept. 5378; AD-200 917.
Order from LC mi$2.40, ph$3.30 PB 144 876

Experiments were conducted to study the kinetics of oxygen chemisorption on evaporated layers of PbS. In general the rate of chemisorption, as determined by measuring the resistance of the layers, increased with increasing temperature and oxygen pressure. The data indicates that O^- ions are being formed predominantly in the ranges of temperature and pressures utilized for the experiments. The relationship of the results obtained to the problem of oxygen photosensitization of PbS is discussed. (Author)

Paris U. (France).
STUDIES OF DISLOCATIONS IN METALS BY X-RAY METHODS, by André Guinier. Annual summary rept. no. 1, 1 Jan 58-1 Jan 59, on Contract AF 61(052)51. [1959] 10p. 13 refs. AFOSR-TN-59-348; AD-213 668.
Order from LC mi$1.80, ph$1.80 PB 144 519

The atomic structure of a dislocation was studied by means of diffuse X-ray scattering. Suitable specimens were obtained with single Cu crystals so that only one system of slip lines would be visible. Theoretical calculations showed that scattering is concentrated in the immediate vicinity of the normal nodes of the reciprocal lattice. The scattering due to the thermal agitation is also maximum around the nodes, and its intensity is larger than the expected scattering from the dislocations even at low temperatures. Localization of the imperfections or dislocations in a crystal was investigated by X-ray techniques. Two extreme theoretical cases which were studied are the perfect crystal with dynamical theory and the mosaic crystal with the cinematical theory. The predicted reflecting power is much smaller for the perfect crystal.

Pittsburgh U., Pa.
THE CLOCK PARADOX AND THE PHYSICS OF DISCONTINUOUS GRAVITATIONAL FIELDS, by T. M. Donahue and C. B. Leffert. Technical rept. no. 1 on Contract Nonr-624(06). Oct 57, 28p. 8 refs. AD-146 664.
Order from LC mi$2.70, ph$4.80 PB 137 547

The motion of the clocks as represented in a solution of the clock paradox offered by C. Moller (The Theory of Relativity, p. 258, Oxford University Press, London, 1952) is studied in detail. It is found that in the non-inertial rest frame of the accelerated clock the free clock suffers discontinuities in velocity whenever the "gravitational field" in that frame abruptly changes. Although these discontinuities occur at points of discontinuity of the metric tensor, examination of a case in which the gravitational field is turned on smoothly reveals that the effect is a real one within the framework of the general theory of relativity. By the principle of equivalence it follows that even in a real gravitational field when that field changes in time velocity dependent terms in the acceleration of a particle exist. These become impulsive for abruptly changing fields and can even cause an acceleration in the direction "opposite" to the field.

Rice Inst., Houston, Tex.
THE EFFECT OF VIBRATIONS ON ORDERING IN A COPPER-GOLD ALLOY, by H. C. Burghard, Jr. and Franz R. Brotzen. Technical rept. no. 2 on Contract AF 49(638)78. 1 Oct 58, 31p. 19 refs. AFOSR-TN-58-915; AD-204 564.
Order from LC mi$3.00, ph$6.30 PB 137 846

Experiments were performed to determine the effects of mechanical vibrations on ordering in CuAu. The effects of 5, 10 and 15 kc vibrations were investigated over a range of ordering temperatures of 280 to 360°C. A decrease in the rate of ordering was observed at all frequencies and ordering temperatures. This retarding effect is attributed to the interference of moving dislocations with growth of ordered domains. (Author)

Stockholm U. (Sweden).
STUDIES ON THE CRYSTAL CHEMISTRY OF TITANIUM, VANADIUM AND MOLYBDENUM OXIDES AT ELEVATED TEMPERATURES, by Arne Magnéli, Sten Andersson and others. Final technical rept. no. 1 for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-935. Oct 59, 142p. 15 refs.
Order from LC mi$7.20, ph$22.80 PB 144 408

The work reported in this document has been performed in continuation of X-ray studies previously conducted by members of this research group on the crystal chemistry at elevated temperatures of titanium, vanadium and molybdenum oxides. The atomic arrangement of the ordered phase Ti_3O occurring within the solubility range of oxygen in α-titanium, has been determined. A study has been made of structural and geometrical relations between the δ-titanium oxide and several other phases. An analysis has been performed of the phase relations of the vanadium-oxygen system within the $VO_{0.25}$-$VO_{1.5}$ region at 800°C. Accurate atomic coordinates have been determined for Ti_2O_3 and V_2O_3 at room temperature and for Ti_2O_3 at ∿260°C. The crystal structure of the high-temperature modification of Ti_3O_5 has been determined from single-crystal data regis-

tered at 175°C. The crystal structure of V_3O_5 has been refined to a considerable degree of accuracy. General expressions have been derived for structural properties of the homologous series M_nO_{2n-1} (M = Ti, V or (Ti and Cr)). The phase relations of the MoO_2-MoO_3 region of the molybdenum-oxygen system have been investigated within the temperature range 500° -870°C.

Technisch Documentatie Centrum voor de Krijgsmacht (Netherlands).
BIBLIOGRAPHY ON PHOTOELASTICITY. SUPPLEMENT 1, by B. Dijkshoorn. Aug 58, 56p. 233 refs. TDCK-14396; AD-202 162.
Order from LC mi$3.60, ph$9.30 PB 144 826

Items have been arranged in sections according to year of publication, commencing with 1957, and alphabetically by author name within each section. In some cases only the first author is given. Author and subject indexes are included at the back.

Theoretical Physics

Avco [Everett] Research Lab. [Mass.]
IONIZATION PHENOMENON OF SHOCK WAVES IN OXYGEN-NITROGEN MIXTURES, by S. C. Lin. Rept. on Contract AF 04(645)18. June 58, 25p. 15 refs. Research rept. 33; AD-201 912.
Order from LC mi$2.70, ph$4.80 PB 144 736

An experimental method is described for the study of ionization phenomenon associated with shock waves in gases. By proper choice of experimental conditions, this method should allow a direct and unambiguous determination of the electron density and the averaged electron-molecule (and atom) interaction cross section as a function of distance behind the shock front. Preliminary results obtained for shock waves in a number of oxygen-nitrogen mixtures are presented.

California U., Berkeley.
ELIMINATION OF GHOSTS IN PROPAGATORS, by P. J. Redmond. Rept. on Contract DA 04-200-ORD-171, T. O. 11. 21 July 58, 16p. 18 refs. OOR rept. 1353. 14P; AD-220 865.
Order from LC mi$2.40, ph$3.30 PB 137 909

Within the general framework of perturbation theory a method for calculating modified propagators in terms of proper Feynman diagrams is derived. This method differs from previous approaches in that one insists that the propagator have the correct analytical behavior as a function of p^2. As a result one gets an expression for the propagator which is similar to a conventional term by term perturbation theory expansion except that it is only necessary to consider proper diagrams and that the iteration of the proper diagrams is represented by a damping factor.

Cornell U., Ithaca, N. Y.
ULTRA-SMALL-ANGLE X-RAY SCATTERING, by L. G. Parratt, J. O. Porteus and others. Technical rept. no. 2 on Contract AF 49(638)402. 20 Dec 58, 16p. 18 refs. AFOSR-TN-58-781; AD-202 002.
Order from LC mi$2.40, ph$3.30 PB 137 936

A new double two-crystal spectrometer is proposed. It is believed that with this instrument, with a high-energy synchrotron as an x-ray source, with either perfect crystals on the spectrometer for the ultra-small angles or with deliberately imperfect crystals for the conventional angular range, and with the newly developed unfolding procedures to correct for the residual instrumental effects, the techniques of small-angle scattering would be advanced to new levels of usefulness in many problems of structural analysis.

Fairchild Engine Div., Deer Park, N. Y.
SOME PROPERTIES OF A HYDROGEN PLASMA, by Charles L. Eisen and Robert A. Gross. Rept. on Contract AF 49(638)15. June 59, 41p. 9 refs. AFOSR-TN-59-588; AD-216 770.
Order from LC mi$3.30, ph$7.80 PB 144 449

The chemical equilibrium composition of a hydrogen mixture is determined over the temperature range from 10^3 °K to 10^6 °K and pressures from 10^{-6} to 10^6 atmospheres. The species recognized are, H_2, H, H^+, H^- and e^-. Equilibrium and frozen values of γ, C_p and the speed of sound are presented in the dissociation and ionization regimes. Electrical conductivity and bremsstrahlung power radiation data are also given.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE WAVE MOTIONS OF SMALL AMPLITUDE IN A FULLY IONIZED PLASMA. PART I. WITHOUT EXTERNAL MAGNETIC FIELD, by S. I. Pai. Rept. on Contract AF 49(638)401. Nov 59, 27p. 12 refs. Technical note BN-191; AFOSR-TN-59-1271.
Order from LC mi$2.70, ph$4.80 PB 144 778

Wave motions of infinitesimal amplitude in a fully ionized plasma, consisting of singly charged ions and electrons, have been investigated. A two-fluid theory has been used in this paper. There are no externally applied electromagnetic fields. (See also PB 143 387)

Institute of Field Physics, U. of North Carolina, Chapel Hill.
COVARIANT COMMUTATORS FOR THE QUANTIZED GRAVITATIONAL FIELD, by Bryce S. DeWitt. Rept. on Contract AF 49(638)563. Oct 59, 8p. 3 refs. Publication no. 4; AFOSR-TN-59-1080; AD-226 875.
Order from LC mi$1.80, ph$1.80 PB 144 487

The derivation of covariant commutators for the quantized gravitational field provides an important application of the theory of bi-tensor Green's functions. Because of the coordinate invariance of general relativity, well defined commutators can be obtained only if we (1) introduce some form of invariant coordinates, and (2) succeed in finding an explicit expression which can be used to define an arbitrary external source. These two requirements are related.

Johns Hopkins U., Baltimore, Md.
PLASMA DYNAMICS, by Francis H. Clauser. Final rept. on Contract AF 18(600)671. Aug 59, 79p. AFOSR-TR-59-125; AD-227 708.
Order from LC mi$4.50, ph$12.30 PB 144 732

It is found that in the flow of a gas consisting of charged particles such as electrons, the non-linearity of the equations introduces several new concepts to the lore of fluid mechanics. The behavior of such a gas is investigated without recourse to linearization for the full range of Mach numbers. It is found that the gas can behave in several different ways for the same set of boundary conditions. (Author)

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
OPTIMUM POWER GENERATION FROM A MOVING PLASMA, by Joseph L. Neuringer. Rept. on Contract AF 49(638)552. Apr 59, 25p. 5 refs. SRS(PPL) rept. 105; AFOSR-TN-59-515; AD-216 280.
Order from LC mi$2.70, ph$4.80 PB 144 491

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
OPTIMUM POWER GENERATION USING A PLASMA AS THE WORKING FLUID, by J. L. Neuringer. Rept. on Contract AF 49(638)552. May 59, 52p. 4 refs. SRS(PPL) rept. 114; AFOSR-TN-59-571; AD-217 005.
Order from LC mi$3.60, ph$9.30 PB 144 490

With the possibility of controlled thermonuclear fusion in the future, the question arises whether it would be possible to use the plasma itself as the working fluid to generate electric power by electro-magnetic induction. The problem considered here is the steady one-dimensional motion of a plasma in a channel of arbitrary and slowly varying cross section. (See also PB 144 491)

Syracuse U., N. Y.
CONSERVATION LAWS IN NON-LINEAR FIELD THEORIES, by Robert Penfield and Henry Zatzkis. Technical rept. no. 4 on Contract N6onr-248(06). Jan 50, 12p. 6 refs. AD-201 065.
Order from LC mi$2.40, ph$3.30 PB 137 922

In this paper we have applied the concepts of "strong" and "weak" conservation laws in non-linear field theories as set forth in recent papers. Only if the strong conservation laws are available in a theory, can we treat situations in which matter is present in discrete regions of space without possessing detailed knowledge of the internal structural laws of the matter itself.

Thermodynamics

Brown U. Div. of Engineering, Providence, R. I.
ON TRANSIENT THERMAL STRESS IN LINEAR VISCOELASTICITY, by Eli Sternberg. Technical rept. no. 3 on Contract Nonr-562(20). Nov 57, 31p. 21 refs. 562(20)/3; AD-149 766.
Order from LC mi$3.00, ph$6.30 PB 137 531

The principle of correspondence appropriate to the linear theories of elasticity and viscoelasticity is extended to account for the presence of a time-dependent temperature field, and is applied to the quasi-static determination of transient thermal stresses in a general, linear, homogeneous and isotropic, infinite viscoelastic medium with a spherical cavity. It is assumed that the body is free from loading and that the stress-inducing temperature distribution has polar symmetry about the center of the cavity. An exact solution to this problem is established in integral form on the assumption that all physical parameters are independent of the temperature. Closed explicit solutions, in terms of error functions, are deduced for the special instance in which the material is either a Maxwell or a Kelvin solid, if the temperature field obeys the heat-conduction equation and is generated by a suddenly applied, steadily maintained, heating (or cooling) of the boundary. (Author)

Michigan U., Ann Arbor.
ON THE STRUCTURE OF DETONATION WAVES, by T. C. Adamson, Jr. Rept. on Contract Nonr-1858(25). Apr 58. 20p. 5 refs. Proj. Squid Technical rept. MICH-4-M.
Order from LC mi$2.40, ph$3.30 PB 138 608

National Bureau of Standards, Washington, D. C.
TABLES OF THERMODYNAMIC PROPERTIES OF AIR INCLUDING DISSOCIATION AND IONIZATION FROM 1500°K TO 15,000°K, by Joseph Hilsenrath, Max Klein and Harold W. Woolley. Rept. on ARO, Inc., Contract AF 40(600)800. Dec 59, 147p. 21 refs. AEDC-TR-59-20 MIPR-AEDC-2; OSS 59-24.
Order from OTS $2.75 PB 161 311

Tables are presented, at close spacing in density ($\Delta \log \rho/\rho_0 = 0.2$ from -7. to +2.), of the thermodynamic properties of air from 1,500°K to 15,000°K. The properties tabulated are: the number of moles, $Z^* = PV/RT$, the dimensionless functions for internal energy, E^*/RT, enthalpy, H^*/RT, entropy, S^*/R, and the pressure, P, in atmospheres. Here the asterisk indicates that the properties are for the equilibrium mixture treated as an ideal gas (without so-called van der Waals effects). The underlying equations for this work and the input data are discussed briefly. A comparison is made between the reported values and the work of Gilmore, of the Rand Corporation, and of Predvoditelev and associates, of the U. S. S. R. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge, Mass.
AN INVESTIGATION OF POROUS WALL COOLING, by Richard P. Bernicker. Rept. on Contract AF 49(638)245. June 59, 59p. 10 refs. Technical rept. 393; AFOSR-TN-59-873; AD-227 555.
Order from LC mi$3.60, ph$9.30 PB 144 473

Equations are developed to describe the thermal exchange when a coolant is forced through a heated porous wall, and solutions are obtained on the basis of a simplified model consisting of identical cylindrical

channels replacing the actual capillary-like passages. The solutions depend upon Reynolds and Prandtl numbers, geometric parameters involving wall porosity and pore size, and Nusselt number. Experiments were performed with one family of porous materials, and Nausselt numbers were correlated in terms of Reynolds and Prandtl numbers, and porosity. Nusselt number varies almost linearly with Peclet number. Temperature distributions obtained indicate a very small difference between solid and coolant temperatures at the exit surface.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
SUBLIMATION OF A HEMISPHERE IN SUPERSONIC FLOW, by Robert Weiss. Rept. on Contract AF 49(638)245. July 59, 63p. 38 refs. Technical rept. 391; AFOSR-TN-59-870; AD-227 553
Order from LC mi$3.90, ph$10.80 PB 144 496

Mass transfer cooling with a light gas has been shown to reduce the large heat transfer rates to a body that is moving rapidly through the atmosphere. The possibility of using a subliming body so as to provide self governing mass transfer cooling has been suggested. To make a preliminary evaluation of this approach, an investigation of the heat transfer rates to several subliming bodies of hemispherical shape has been carried out. Tests were run at a Mach number of 3.5 with solid carbon-dioxide, naphthalene and camphor, three relatively "heavy" materials. Additional tests with camphor models determined the effect of Reynolds number on the heat transfer rate. It was found that heat transfer was reduced in proportion to the mass-injection rate, and that a greater reduction was effected with a lesser weight material; and that increasing Reynolds number also produced a lower level of heat transfer coefficient. The bodies tended to assume a conical shape, a phenomenon more noticeable with increasing Reynolds number; only one model appeared to have reached a state of equilibrium. The investigation indicated both the feasibility of conducting an experiment of this nature and the applicability of subliming bodies both in reducing and absorbing aerodynamic heating.

Plasmadyne Corp., Santa Ana, Calif.
FLEXURE OF A TWO-DIMENSIONAL ARC UNDER FORCED CONVECTION, by Paul G. Thiene. Rept. on Contract AF 49(638)334. 25 Aug 59, 74p. 4 refs. T 2TN089-334; AFOSR-TN-59-947; AD-228 540
Order from LC mi$4.50, ph$12.30 PB 144 488

A rudimentary inquiry is conducted into the nature of the physical mechanisms which maintain an arc in the presence of forced convection. The basic fluid-mechanical and electromagnetic equations are developed for the case of a dilute, three-component quasineutral arc plasma. The basic equations, in particular the equation of energy balance, are then applied to a simple model of a two-dimensional arc in a low-Mach-number subsonic flow. The proposed model is based on the notion of a definite, localized zone of ohmic heating. An analogy is qualitatively drawn between the convection-loaded arc model and a structural beam with a distributed load. The equation of energy balance provides the temperature distribution through the arc model from which the curvature, "flexural rigidity" and deflection curve are determined. Also included is a tentative criterion for blowout. (Author)

Wave Propagation

Ballistic Research Labs., Aberdeen Proving Ground, Md.
PRELIMINARY INVESTIGATION OF THE SHOCK WAVE PROPAGATED FROM THE OPEN END OF A CYLINDRICAL SHOCK TUBE, by Glenn P. Beichler and Leonard P. Grady. Jan 54, 17p. 3 refs. Technical note no. 843; AFSWP no. 768.
Order from LC mi$2.40, ph$3.30 PB 138 676

By means of an array of gauges mounted beyond the open end of a shock tube, pressure-time records were obtained. The results indicate a tendency toward formation of a spherical wave front covering a wide solid angle at a distance from the end of the tube. When a pseudo-spherical front has been formed, similarities exist between the positive phase of pressure-time records obtained from free-air explosions and those obtained by this method but durations and pressure decay with distance do not scale with those of free-air explosions.

Columbia U. School of Engineering, New York.
HE_{11} EXCITED DIELECTRIC SURFACE WAVE RADIATORS, by S. P. Schlesinger and A. Vigants. Technical rept. no. 1 on Contract AF 19(604)3879. 1 June 59, 76p. 20 refs. AFCRC-TN-59-573; CU-5-59-AF-3879-EE; AD-228 309.
Order from LC mi$4.50, ph$12.30 PB 144 420

A solution is presented, using Huyghens' Principle formulated in terms of a Green's function approach, to the radiation problem for the dielectric image line of finite length on an infinite image surface, or the equivalent full round rod, excited in the HE_{11} mode. The integration of appropriate electric and magnetic current sources over the sides and end of the dielectric element yields an expression for the radiation intensity. This is modified to include a weighting function and a reflection coefficient to account for launching effects and the rod end discontinuity. A comparison with earlier simplified theory is made, and the extent to which the results may predict such properties as side lobe characteristics and E- and H-plane differences is presented.

Institute of Mathematical Sciences, New York U., N. Y.
A NEW METHOD FOR THE DETERMINATION OF FAR FIELDS WITH APPLICATIONS TO THE PROBLEM OF RADIATION OF A LINE SOURCE AT THE TIP OF AN ABSORBING WEDGE, by F. C. Karal, Jr. and S. N. Karp. Rept. on Contract AF 19(604)5238. Sep 59, 31p. 9 refs. Research rept. no. EM-145; AFCRC-TN-59-596.
Order from LC mi$3.00, ph$6.30 PB 144 435

A new simple operational method for the determination of the diffracted far field for wedges with impedance boundary conditions is presented. The exterior angle of wedge is $2\pi - \frac{\pi}{2n}$, where n is an integer. The excitation may be either an incident plane wave or a line source. The method is described in detail for the case of an absorbing wedge with a line source located at the tip. Several examples are given to illustrate the method. It is also shown that the method can be applied directly to the classical problem of perfectly conducting wedges.

Institute of Mathematical Sciences, New York U., N. Y.
ON THE DETERMINATION OF THE FREE ELECTRON DISTRIBUTION OF AN IONIZED GAS, by Irvin Kay. Rept. on Contract AF 19(604)3495. Sep 59, 33p. 8 refs. Research rept. no. EM-141; AFCRC-TN-59-591.
Order from LC mi$3.00, ph$6.30 PB 144 436

A standard simplified model of the problem of determining the free electron distribution in an ionized gas by radio sounding experiments is discussed, and a relation between the elements of the corresponding scattering matrix is derived. Under the conditions assumed, a closed form expression for the charge distribution in terms of a reflection coefficient which is a rational function of frequency is obtained.

Institute of Mathematical Sciences, New York U., N. Y.
REFLECTION AND TRANSMISSION BY A CLASS OF CURVED DIELECTRIC LAYERS, by S. N. Karp. Rept. on Contract AF 19(604)5238. Aug 59, 20p. 2 refs. Research rept. no. EM-140; AFCRC-TN-59-584.
Order from LC mi$2.40, ph$3.30 PB 144 427

We consider the reflection and transmission of electromagnetic waves by a special class of curved dielectric layers. The layers in question are bounded by two non-intersecting confocal parabolas, and between these boundaries, the dielectric constant, which may be complex, has a special form of space dependence. It is found that layers of this type have striking properties. If a plane wave is normally incident on such a layer, from the convex side, then the reflected field can be expressed as a product of two factors. The first factor is the field which would be reflected by a conducting parabola coincident with the surface of the layer. The second factor has no space dependence; it depends only upon the spacing of the shell boundaries, the frequency and the special choice of dielectric constant. The transmitted wave has an especially simple form. It is a plane wave. The configuration thus has properties similar to those of a plane dielectric slab. In fact, the plane slab is a limiting case of the geometry we have described.

Ionosphere Research Lab., Pennsylvania State U., University Park.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF THE LOW FREQUENCY POLARIZATION AT 60, 75 AND 150 KC/S, by A. J. Ferraro. Scientific rept. no. 121 on Ionospheric Research, Contract AF 19(604)4563. 13 July 59, 100p. 15 refs. AFCRC-TN-59-632.
Order from LC mi$5.40, ph$15.30 PB 144 440

The instrumentation for recording the state of polarization of 60 kc/s and 75 kc/s echoes for vertical incidence radio soundings is described in detail. Basically, the equipment resolves the polarization ellipse into its two circularly polarized components: the ordinary and extraordinary modes. The results of thirteen months of recording in the intervals of December 1956 to April 1957 on 75 kc/s and October 1957 to May 1958 on 60 kc/s are presented as monthly averages. In addition, a few typical daily curves of polarization for magnetically quiet and disturbed days are discussed.

A catalogue of 25 ionospheric models for which the group height, phase height, absorption, and polarization have been computed for 60-75 kc/s and 150 kc/s are presented.

Ionosphere Research Lab., Pennsylvania State U., University Park.
IONOSPHERIC INVESTIGATION FROM SATELLITE RADIO OBSERVATIONS. 1. DOPPLER EFFECT RECORDING INSTRUMENTATION, by W. J. Ross. Scientific rept. no. 120 on Ionospheric Research, Contract AF 19(604)4563. 30 June 59, 86p. 14 refs. AFCRC-TN-59-631; AD-227 909.
Order from LC mi$4.80, ph$13.80 PB 144 439

A brief survey is made of the main features of satellite transmitters and of the ionospheric propagation effects produced in the radio waves from them. From these considerations the desirable properties of the transmitter are summarized and the necessary properties of the receiving apparatus are inferred. Detailed descriptions of the various units of the receiving instrumentation are then given, followed by the presentation of a sample record analyzed to yield electron content of the ionosphere.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
GUIDED WAVES ON SINUSOIDALLY MODULATED REACTANCE SURFACES, by A. A. Oliner and A. Hessel. Rept. on Contract AF 19(604)2031. 14 Sep 59, 32p. 6 refs. Research rept. R-777-59; PIB-705; AFCRC-TN-59-771.
Order from LC mi$3.00, ph$6.30 PB 144 423

A rigorous solution is derived for the propagation characteristics and field distributions of waves guided by a plane surface which possesses a surface reactance modulated sinusoidally in the propagation direction. The explicit field amplitudes and the determinantal equation for the propagation wavenumber are expressed in a continued fraction form which is rapidly convergent for all values of modulation. Numerical results are obtained for both surface wave (modal) and leaky wave (non-modal) solutions. The relevance of these studies to high gain modulated surface wave antennas is discussed.

National Bureau of Standards, Boulder, Colo.
COMMUNICATION THEORY ASPECTS OF TELEVISION BANDWIDTH CONSERVATION, by William C. Coombs. Aug 59, 27p. 10 refs. Technical note no. 25.
Order from OTS $0.50 PB 151 384

New concepts of communication bandwidth utilization and conservation are in prospect through difference signal modulation systems in which only relative changes information is transmitted in lieu of absolute amplitudes. By these systems, the changes data function is made one of time as well as of amplitude, so that better advantage can be taken of redundancies in the video signal. Advantageous conversions of information rate are made feasible by reason of a tremendous disparity existing between the extremely high information capacity of conventional television systems and the relatively very low perception capability of a human observer channel. Information conversions more consistent with perception capabilities of the human channel are achieved in difference signal modulation without usual great expansion of bandwidth that would be required to reproduce every possible absolute amplitude of each datum in the whole video picture mosaic directly. Conversion to binary digital form accrues the further advantages of binary systems, including greater immunity to noise, greater adaptability to discrete data storage media, greater ease of scrambling for security, and greater amenability of encoding to optimum parametric controls for most advantageous transmission. (Author)

National Bureau of Standards, Boulder, Colo.
DESIGN OF SINGLE FREQUENCY FILTERS, by Forrest F. Fulton, Jr. 20 Aug 59, 10p. 1 ref. Technical note no. 23.
Order from OTS $0.50 PB 151 382

Efficient procedures are shown for designing filters formed by a number of identical resonant circuits loosely coupled together, and which are required to accept one narrow band of frequencies and reject another narrow band somewhat removed in frequency, without any special requirements on the shape of the attenuation curve in between these regions. The design is based on using a large number of sections. (Author).

National Bureau of Standards, Washington, D. C.
FREQUENCY DEPENDENCE OF VHF IONOSPHERIC SCATTERING, by James C. Blair. Apr 59, 17p. 11 refs. Technical note no. 9.
Order from OTS $0.75 PB 151 368

This report contains data obtained by recording received signal intensities simultaneously at five frequencies over the 1295 km path between the Long Branch transmitting station at Long Branch, Illinois, and the receiving site at Boulder, Colorado (Table Mesa field station). The data presented here cover the period of September 1, 1957 to June 30, 1958 (except for some later data on meteor bursts and sudden ionospheric disturbances). Good simultaneous signal intensity records were obtained for most of this period on 30, 40, 50 and 74 Mc. The available transmitter at 108 Mc was not suitable for continuous reliable records prior to June 5, 1958. A set of high-speed records was made for 10-minute intervals at different times during one day and analyzed for amplitude-distribution and fading-rate. Also, a low-sensitivity recording was made for the study of meteor bursts. Data presented here show the measured results of frequency dependence of average received power and illustrate how the level of average received power is influenced by meteoric ionization, sporadic-E ionization, and ionospheric and magnetic disturbances. A summary of hourly median and upper and lower decile values on all frequencies is included, as well as data on amplitude distributions and fading rates.

National Bureau of Standards, Boulder, Colo.
A HISTORY OF VERTICAL-INCIDENCE IONOSPHERE SOUNDING AT THE NATIONAL BUREAU OF STANDARDS, by Sanford C. Gladden. Sep 59, 140p. 191 refs. Technical note no. 28.
Order from OTS $2.00 PB 151 387

National Bureau of Standards, Boulder, Colo.
RADIO NOISE DATA FOR THE INTERNATIONAL GEOPHYSICAL YEAR JULY 1, 1957-DECEMBER 31 1958, by W. Q. Crichlow, C. A. Samson and others. 27 July 59, 239p. 1 ref. Technical note no. 18.
Order from OTS $2.50 PB 151 377

During the International Geophysical Year, radio noise measurements were made by a world-wide network supervised by the National Bureau of Standards. The months in which usable data were obtained are shown, and the results of the measurements are summarized. Month-hour data for each station are given first, followed by the seasonal-time-block values. In order to conform to the seasonal pattern used in CCIR Report No. 65, the data for June 1957 and January and February 1959 have been included.

National Bureau of Standards, Boulder, Colo.
RADIO WAVE PROPAGATION IN AN INHOMOGENEOUS ATMOSPHERE, by James R. Wait. 10 Sep 59, 21p. 20 refs. Technical note no. 24.
Order from OTS $1.00 PB 151 383

A self-contained treatment of the theory of radio waves in an inhomogeneous atmosphere is given. The refractive index is assumed to vary with height above the earth in a monotonic fashion. Variation according to an exponential law is used for illustration of general principles. For this case, rigorous series formulas are developed for the distance to the horizon for an elevated point in the atmosphere. (Author)

National Bureau of Standards, Boulder, Colo.
SURVEY OF CENTRAL RADIO PROPAGATION LABORATORY RESEARCH IN TROPOSPHERIC PROPAGATION 1948-1956, by J. W. Herbstreit and P. L. Rice. Sep 59, 464p. 360 refs. Technical note no. 26.
Order from OTS $4.00 PB 151 385

This report summarizes and abstracts publications concerned with the National Bureau of Standards tropospheric propagation research program dating back to the formation of the Central Radio Propagation Laboratory. Some technical papers are reproduced here as supplements to this report and excerpts from some of the longer technical reports are also included.

National Bureau of Standards, Boulder, Colo.
SERVICE AREA OF AN AIRBORNE TELEVISION STATION, by M. T. Decker. Oct 59, 46p. 9 refs. Technical note no. 35.
Order from OTS $0.75 PB 151 394

As a step in the evaluation of a proposed airborne television network, the service to be expected from an airborne station has been calculated for a wide variety of operating conditions. The use of basic transmission loss to describe the radio propagation effects enables the results to be used when equipment parameters are changed as system requirements and economic considerations dictate.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Fansteel Metallurgical Corp., North Chicago, Ill.
INFORMAL MONTHLY PROGRESS REPORT TO NEPA PROJECT, by Ralph Wehrmann. Rept. for 21 Jan - 20 Feb 49. 5 Apr 49, 10p. NEPA 911-FAN-21; AD-203 996.
Order from LC mi$1.80, ph$1.80 PB 138 323

See also PB 138 322.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
UNIVERSITIES IN TRANSITION, by A. von Hippel. Dec 58, 10p. Technical rept. 132.
Order from LC mi$1.80, ph$1.80 PB 144 654

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS, APRIL-JUNE, 1954. Nov 54, 53p. 7 refs. NOLC rept. 211.
Order from LC mi$3.60, ph$9.30 PB 144 558

Contents:
Ferromagnetic resonance
DC-FM converter
Infrared sources
Small antenna investigation
Perfluoroorganic derivatives
(See also PB 143 789)

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS SPONSORED BY BUREAU OF ORDNANCE. Quarterly rept. for period ending 31 Dec 53. Apr 54, 37p. 7 refs. NOL-Corona rept. 135, pt. 1.
Order from LC mi$3.00, ph$6.30 PB 144 528

Contents:
Multimode transmission
Ferromagnetic resonance
DART
DC-FM converter
Infrared sources
Small antenna investigation
Ground-scrutinizing radar

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly rept. for Apr-June 59. Sep 59, 74p. 12 refs. NAVORD rept. 5963; NOLC rept. 464.
Order from LC mi$4.50, ph$12.30 PB 144 479

Contents
Communication stochastics, by R. L. Conger
Ferromagnetic resonance, by R. L. Conger and R. W. Sharp
High-temperature polymer program, by D. L. Herring, C. Douglas, and J. Konecny
Infrared atomic spectra, by C. J. Humphreys and E. Paul, Jr.
Organoaluminum and aluminum hydride chemistry, by B. Bartocha, A. J. Bilbo, D. E. Bublitz, C. M. Douglas, N. R. Fetter, and M. Y. Gray
(See also PB 143 249)

Ohio State U. Research Foundation, Columbus.
THE EVOLUTION AND RATIONALE OF THE ICAO WORD-SPELLING ALPHABET, by Henry M. Moser. Technical rept. no. 52 on Contract AF 19(604)4575. 1959, 88p. 9 refs. AFCRC-TN-59-54; AD-227 639.
Order from LC mi$4.80, ph$13.80 PB 144 681

The development of the word-spelling alphabet is traced, and research methods and findings which led to the recommendation of the ICAO alphabet as an optimum list for international communications are summarized. Questions regarding the desirability and efficiency of the new alphabet are discussed, with the view to presenting what the alphabet intends to accomplish. Some 200 word alphabets of the world are appended. (Author)

Photographic Equipment

Ballistic Research [Labs.] Aberdeen Proving Ground, Md.
A SHORTENED METHOD OF STAR-REDUCTION, FOR CALIBRATING BALLISTIC CAMERAS, by R. d'E. Atkinson. 8 Jan 46, 42p. Rept. no. 593.
Order from LC mi$3.30, ph$7.80 PB 145 062

A method is given for reducing the zenith to the equator and equinox of any standard catalogue, so as to eliminate the reductions of individual stars to the apparent equator and equinox of date. The aberration is handled by an approximate method, but the errors introduced by this are very small. Secondly, the standard coordinates, referred to an astronomical azimuth, are now given directly by closed formulae, so that it is no longer necessary to solve explicitly for azimuth and zenith distance for each star. The number of references per star to seven figure trigonometrical tables is reduced by this from eleven to three, and the total amount of computation is correspondingly cut down.

Rome Air Development Center, Griffiss AFB, N. Y.
AUTOMATIC CAMERA CONTROL SYSTEM, by

James B. Hickey, Joseph P. Gendron, and John R. Bratge. Sep 59, 19p. RADC-TR-59-136.
Order from LC mi$2.40, ph$3.30 PB 144 407

This report presents the theory of operation and a technical description of an automatic camera control system designed and fabricated by the QRC Branch of the Rome Air Development Center.

SOCIAL SCIENCES

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
A STUDY OF SALES FLUCTUATIONS IN TERMS OF PROBABILITY DISTRIBUTIONS, by Sharu S. Rangnekar and Charles C. Holt. ONR Research memo. no. 46 on Planning and Control of Industrial Operations, Contract Nonr-760(01). Aug 56, 23p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 138 505

In order to make decisions regarding production and inventory in a manufacturing concern or regarding inventory in a distributing concern, it is necessary to predict the future sales. When the future sales are uncertain - which is the usual case - some knowledge of the probable forecast error is also needed for arriving at an optimum decision. One approach to the sales forecast problem is to try to forecast the mean (average) sales rate and treat the deviation from the mean as an (unforcastable) random variable with a known probability distribution. This paper is concerned with this random component of sales. The prediction of mean sales is not considered.

Stanford U., Calif.
WELFARE ECONOMICS AND EXISTENCE OF AN EQUILIBRIUM FOR A COMPETITIVE ECONOMY (II) by Takashi Negishi. Technical rept. no. 65 on Contract N6onr-25133. 23 Dec 58, 8p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 144 672

This is a sequel to "Welfare Economics and Existence of an Equilibrium for a Competitive Economy I". In this is given another proof of the existence of a competitive equilibrium as an efficient state of the system by the more objective, measurable concepts such as incomes and expenditures. (See also PB 143 843)

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Feb 60.
Order from OTS $1.25, $10.00/year PB 161 278

Contents:
Articles:
The profile of the solar Lyman-alpha line of hydrogen, by C. R. Detwiler, J. D. Purcell, and R. Tousey
Aus-worked 12% chromium steel with high yield strength and fracture resistance, by J. E. Srawley and T. C. Lupton
Electron probe measurements of evaporated metal films, by W. E. Sweeney, Jr., R. E. Seebold, and L. S. Birks
Scientific program:
Astronomy and Astrophysics: Airglow emissions in the night sky. Ultraviolet radiations from celestial sources; small extreme ultraviolet telescope flown for the first time in NRL rocket astronomy experiments
Chemistry: Chemical constituents of submarine atmospheres
Mechanics: Validity of using uncorrected velocity meter records to compute shock spectra
Metallurgy and Ceramics: Titanium alloy ingots fabricated into wrought form, without contamination, by a hot extrusion process. Determination of phosphorus in titanium. Heat treatment of Mn-V-Mo age-hardening austenitic steel
Nuclear and Atomic Physics: Stark broadening of hydrogen lines in a plasma for the temperature range 10,000°K to 40,000°K. Calculation of energy absorbed by organic materials exposed to high-intensity radiation fields
Optics: Infrared transmission of the atmosphere
Radio: Newly developed submarine rescue buoy transmits tone-modulated Morse code distress signals readable at ranges from 25 to 83 nautical miles. Transfer characteristics of a gated strip of i-f amplifiers
Solid State Physics: Redesigned thermoluminescent dosimeter responds linearly to doses from 1 milliroentgen up to at least 1000 roentgens. Development of colloids in additively colored sodium chloride
Sound: Theoretical analysis of echo formation in the fluctuation environment of the sea
Supporting Techniques:
A seal for lithium fluoride windows

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Biology and Medicine

Uptake of radioisotopes and their transfer through food chains by marine organisms, by S. J. Townsley, D. F. Reid, and W. T. Ego. University of Hawaii. Hawaii Marine Laboratory, Honolulu, Hawaii. 1958-1959. Contract AT (04-3)-56. 47p. Order from LC. Mi $3.30, ph $7.80. AECU-4350

Turnover of labeled amino acids and proteins in cancerous tissues and mammals. Literature search, by M. Comstock. Brookhaven National Laboratory, Upton, N. Y. Oct 58. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4357

Effect of proton and deuteron irradiation on biological material. Bibliography, by M. Comstock. Brookhaven National Laboratory, Upton, N. Y. Sep 58. 2p. Order from LC. Mi $1.80, ph $1.80. AECU-4358

Respiratory pathways in fungi and actinomycetes. Final report for January 1, 1956 to June 30, 1959, by V. W. Cochrane. Wesleyan University, Middletown, Conn. Sep 59. Contract AT(30-1)-1813. 29p. Order from LC. Mi $2.70, ph $4.80. AECU-4366

Studies of the effects of ionizing radiation on the ultrastructure of developing nervous tissue as revealed by electron microscopy. Annual report for November 1, 1958 to October 31, 1959, by H. Fernandez-Moran. Massachusetts. General Hospital. Mixter Laboratories for Electron Microscopy, Boston, Mass. 1959. Contract AT(30-1)-2278. 36p. Order from LC. Mi $3.00, ph $6.30. AECU-4405

Study of long-term pathologic effects of radioactive isotopes of calcium and strontium in bone and soft tissues, especially with reference to bone tumor production. Final technical report for May 16, 1958-August 31, 1959, by J. F. Kuzma and G. E. Zander-Principati. Marquette University. School of Medicine, Milwaukee, Wis. 1959. Contract AT(11-1)-105. 63p. Order from LC. Mi $3.90, ph $10.80. AECU-4409

The development of radiochemical analyzers for non-radioactive gases and study of radioactive clathrates. Yearly report, by D. J. Chleck and others. Tracerlab, Inc., Waltham, Mass. July 59. Contract AT(30-1)-2204. 41p. Order from OTS. $1.25. AECU-4493

Radiological Physics Division semiannual report for January through June 1959, by J. E. Rose and L. D. Marinelli. Argonne National Laboratory, Lemont, Ill. Oct 59. Contract W-31-109-eng-38. 101p. Order from OTS. $2.50. ANL-6049

Medical gamma-ray spectrometry, by D. A. Ross. Oak Ridge Institute of Nuclear Studies, and Basic principles of scintillation counting for mdeical investigators, by C. C. Harris, D. P. Hamblen, and J. E. Francis. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 72p. Order from OTS. $2.00. ORNL-2808/ORINS-30

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The determination of chlorine in polyurethane plastic, by A. L. Henicksman, E. H. VanKooten, R. D. Gardner, and W. H. Ashley. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Dec 59. Contract W-7405-ENG-36. 11p. Order from OTS. 50 cents. LA-2362

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Modified zirflex process for dissolution of zirconium- and niobium-bearing nuclear fuels in aqueous fluoride solutions: Laboratory development, by T. A. Gens and F. G. Baird. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 30p. Order from OTS. $1.00. ORNL-2713

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Transducer system response tests, by R. Masnovi. Westinghouse Electric Corp. Atomic Power Division, Pittsburgh, Pa. Oct 58. 26p. Order from LC. Mi $2.70, ph $4.80. WAPD-TH-450

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Thermodynamic properties of carbides at high temperatures. Annual report and renewal proposal, by S. Fujishiro and N. A. Gokcen. University of Pennsylvania, Philadelphia, Pa. Sep 59. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4346

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Casting of zirconium containing small internal cooling holes, by D. S. Parker. General Electric Co., Atomic Product Division, Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Nov 59. Contracts AT(11-1)-171 and AF 33(600)-38062. 11p. Order from OTS. 50 cents. APEX-538

High-temperature irradiation of a zirconium-hydride-2 w/o uranium alloy, by G. E. Lamale and others. Battelle Memorial Institute, Columbus, Ohio. Dec 59. Contract W-7405-eng-92. 37p. Order from OTS. $1.25. BMI-1401

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Beat factors for an accelerator with a general magnetic field, by G. Parzen. Midwestern Universities Research Association, Madison, Wis. Sep 59. Contract AT(11-1)-384. 5p. Order from OTS. 50 cents. MURA-513

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Project NR 153-093, Technical Report 20.

Washington State Coll., Pullman.
THE EFFECTS OF SOUNDS OF VARYING INTENSITIES ON CHICKENS AND HATCHING EGGS, by William G. Stadelman and Igor L. Kosin, Feb 1957. 54 p. WADC TR 57-87 Contr.AF-33(616)-2552. AD-118038.
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POPULATION GENETICS OF DROSOPHILA, by Hampton L. Carson et al. Oct 15, 1956. 3 p. Contr. Nonr 816(05).
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Wisconsin U., Madison.
THE EFFECT OF GRID LINES IN THE FIELD OF VIEW UPON PERCEPTION OF MOTION, by H. W. Leibowitz and J. F. Lomont, Mar 1954. 12 p. WADC TR 54-201. Contr.AF18(600)-54.
AD-38210.
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Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.
A METHOD FOR SIMULATED NIGHT FLYING DURING DAYLIGHT HOURS, by Richard E. Horn, Oct 1954. 22 p. WADC TR54-505.
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REFLEX EFFECTS OF ACUTE HYPERTENSION IN THE PULMONARY VASCULAR BED OF THE DOG, by S. E. Downing, 1955 or later, 16 p.
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EFFECTS ON LIVING TISSUES BY PRIMARY COSMIC RAY PARTICLES, by Jakob A. G. Eugster, Feb 1956. 35 p. Contr. AF 61(514)898; AFOSR TR-56-19.
AD-87528.
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Biochemistry

Army Medical Research Laboratory, Fort Knox, Kentucky.
DIFFUSION OF PROGESTERONE AND DESOXYCORTICOSTERONE INTO NITROCELLULOSE ("LUSTEROID"), by V. F. Westphal, 3 May 1957. 21 p. AMRL 274.
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2. Hydrodynamic and thermodynamic properties of bovine serum albumin at low pH, by G. I. Loeb and H. A. Scheraga.

Inst. for Cancer Research, Philadelphia, Penn.
PROTEIN SYNTHESIS AND DEGRADATION IN LIVING BACTERIA, by Gerrit Tolnnies, 27 Dec 1956. 9 p. Contr. Nonr-244(00).
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Liege U. (Belgium).
STUDIES ON THE MINERAL FRACTION OF BONE AND TEETH, by M. J. Dallemagne, Claudine Fabry, et al. 31 May 1957. 81 p. AF OSR TN 57-405; Contr. AF 61 (514)-940. AD-132483.
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AMINO ACID METABOLISM OF MAN IN HEALTH AND DISEASE, by Anthony A. Albanese, 29 Nov 1956. 12 p. Annual Report 1956 on Contract Nonr-1167(00).
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THE BIOCHEMISTRY OF TISSUE TRAUMA, by Richard A. Seibert and Patricia Brooks, May 1957. 5 p. AF SAM 57-95.
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A MODIFICATION OF TECHNICS FOR ASSAY OF ANTIDIURETIC SUBSTANCE IN URINE, by Neville P. Clarke, George I. Zuidema, et al. Oct 1956. 11 p. WADC TR-56-561. AD-110505.
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PRODUCTIVITY OF FLORIDA SPRINGS, by J. L. Yount and H. T. Odum, Jan 1, to Dec 31, 1955. 62 p. Contr. Nonr 580 (02).
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NUTRITIVE VALVE OF THE WOOD-ROTTING FUNGI AND THEIR SYNTHETIC PRODUCTS, by

M. W. Jennison, 1 Jan to 31 Dec 1956. 3 p. TR-6; Contr. Nonr-669(06).
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RESEARCH IN MARINE FUNGI, by Helen S. Vishniac, S. E. Mills, etc., 31 Aug 1956. 5 p. Contr. Nonr 609(07).
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Control Systems Lab., U. of Illinois, Urbana.
INFORMATION THEORY IN BIOLOGY, by Henry Quastler and Leroy Augenstine, 1953. 279 p. Contr. DA-11-022-ord-721.
Order from LC mi $11.10, ph $42.60 PB 130742

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2a. Fundamental Biological Units: Structural Analysis.
2b. Fundamental Biological Units: Functional Analysis.
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HARBOR TESTS OF MARINE BORER INHIBITORS, by, H. Hochman and T. Roe, Jr., 24 July 1956. 6 p. NCEREL TN-N-271.
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DEVELOPMENT OF LIGHTWEIGHT LEGS FOR LITTERS, PART I, DEVELOPMENT OF BACK-REST FOR LITTERS, PART II, by C. F. Schuessler, Nov 1948. 13 p. AF SAM Proj. 21-02-016-E. AF SAM Proj. 21-02-016-M.
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School of Aviation Medicine, Randolph Air Force Base, Tex.
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STUDIES ON THE ENERGETICS OF CILIATED CELLS, by R. R. Ronkin, 1 Feb 1957. 6 p. Contr. Nonr-1506(00).
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A STUDY OF METHODS FOR CHEMICAL FRACTIONATION OF VIRUSES, by T. G. Metcalf and W. J. Hausler, Jr., Dec 31, 1956. 29 p.
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Final Report.

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STUDIES ON THE SYSTEMATICS AND ECOLOGY OF LAELAPTID RODENT ECTOPARASITES IN EGYPT, WITH OBSERVATIONS ON THE EPIDEMIOLOGY OF HAEMATOGOAN JACULI BOLFOUR, by C. E. Yunker, Dec 31, 1956. 8 p. Contr. Nonr-1809 (00).
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MARINE BORER INVESTIGATIONS, by F. G. Walton Smith, Dec 1956. 32 p. Contr. NOy 81879.
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DIFFERENTIATION OF MICRO-ORGANISMS BY INFRARED SPECTRA. FINAL REPORT PREPARED FOR BIOLOGICAL DEPT., ARMY CHEMICAL CORPS, CAMP DETRICK, MARYLAND, submitted by F. R. Senti, E. H. Melvin, etc. July 18, 1956. 189 p. Contracts CD 3-119 and CD 4-400.
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EFFECT OF IRRADATION ON CLOSTRIDIUM BOTULINUM TOXIN SUBJECTED TO ULTRACENTRIFUGATION, by G. M. Dack, 1 Apr 1954 to 30 Sept 1956. 19 p. 5505, Rept. 7.
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A BACTERIOTOXIC SUBSTANCE IN AUTOCLAVED CULTURE MEDIA CONTAINING GLUCOSE AND PHOSPHATE, by Richard A. Finkelstein, Ph.D. and Charles E. Lankford, Ph.D. Dec 1956. 9 p. AF SAM 57-17.
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57-5-Preliminary evaluation using stock organism.
57-6-Modifications in technic.
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57-10-Application to chemical specimens from ophthalmic infections.

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ENZYMATIC STUDIES ON THERMOPHILIC BACTERIA, by L. Leon Campbell, Jr., and Gilbert B. Manning, Feb 1 to Dec 31, 1956. 30 p. Contr. Nonr-1856(00).
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A TYPICAL HEAT STROKE WITH HYPERNATREMIA, ACUTE RENAL FAILURE, AND FULMINATING POTASSIUM INTOXICATION, by C. R. Baxter and Paul E. Teschan, Mar 1958. 18 p. MEDEW RS 3-58.
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AD-129 920.
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School of Aviation Medicine, Randolph Air Force Base, Tex.
THE CEREBRAL SURVIVAL TIME OF RABBITS IN ANOXIA I. THE DEVELOPMENT AND EVALUATION OF A STANDARD PROCEDURE, by W. Noell and H. I. Chinn, Nov 1948. 18 p. AF SAM Proj. 21-02-071, Report No. 1.
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Pharmacology and Toxicology

Chemical Warfare Labs., Army Chemical Center, Md.
THE ACUTE TOXICITY OF VAPORS FROM A RED FUMING NITRIC ACID HYDROFLUORIC ACID MIXTURE, by Emil A. Pfitzer and Earle A. Greene, 23 July 1956. 10 p. CWLR-2043.
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FIELD PROCEDURES FOR THE DETERMINATION OF BLOOD CHOLINESTERASE LEVELS. II VISUAL METHODS FOR ESTIMATION OF WHOLE BLOOD, RED BLOOD CELL, AND PLASMA CHOLINESTERASE, by Joseph H. Fleisher and G. Stanley Woodson, June 1956. 28 p. CWLR 2044.
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PULMONARY EFFECTS OF SARIN, by R. P. Johnson, Oct 1957. 17 p. CWLR-2186.
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Industrial Test Lab., Philadelphia Naval Shipyard, Penn.
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Institute of Medical Research, Huntington Memorial Hospital, Pasadena, Calif.
PROPERTIES OF THE VENOM OF THE STINGRAY, by Findlay E. Russell, M. D., 1 Nov 1956. 20 p. Contr. Nonr 1708(00). Final Report.
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PROGRESS REPORT ON CONTRACT NO. DA-18-108-CML-5473, by Charles S. Petty, 25 Feb 1957. 31 p.
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Public Health Service, Cincinnati, Ohio.
TOXICOLOGIC STUDIES OF TWO ALKYL DIAMINES AND AN ACETYLENIC DERIVATIVE, by Herbert E. Stokinger and William T. Rockhold. Rept. on Contract AF 33(616) 54-9. Apr 1955. 24 p. WADC TR-55-250;
AD-97535.
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ANAPHYLACTIC SHOCK IN THE MOUSE PASSIVELY SENSITIZED WITH HOMOLOGOUS ANTISERUM, by Perry Morgan, Noble P. Sherwood, et al. Feb 1957. 5 p. AF SAM 57-60.
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Radiobiology

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
RESPONSES OF THE RAT TO THERMAL RADIATION, by James D. Hardy and Alice M. Stoll, Oct 30, 1956. 22 p. Proj. NM 001 103 301, Reptill; NACD MA 5613.
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Naval Research Lab., Washington, D. C.
DOSIMETRY OF X-RAYS AND GAMMA RAYS, by J. H. Schulman, 26 Sept 1950. 12 p. NRL 3736.
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Northwestern U., Chicago, Ill.
EFFECT OF IRRADIATION ON P^{32} UPTAKE BY BONE MARROW AND SPLEEN, by W. A. Ramboch Apr 1952. 7 p. AF SAM Proj.-21-23-029 Report No. 1, Contr. AF 33 (038)-17731.
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School of Aviation Medicine, Randolph Air Force Base, Tex.
BIPHASIC HYPERFERREMIA INDUCED IN RATS BY X-IRRADIATION, by G. S. Melville, Jr. and F. P. Conte, Mar 1957. 4 p. AF SAM 57-74.
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THE COMBINED EFFECTS OF IONIZING RADIATION AND LOW TEMPERATURE ON THE METABOLISM, LONGEVITY, AND SOFT TISSUES OF THE WHITE RAT, by L. D. Carlson and W. J. Scheyer, Mar 1957. 17 p. AF SAM 57-78-and 57-79.
AD-136285.
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AN APPARATUS FOR STUDYING THE BURNING OF DUST CLOUDS, by Lloyd E. Line, Jr. and Wendall J. Clark, 30 July 1956. 22 p. AF OSR TN 56-280; Contr. AF18(600)-1508.
AD-89490.
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THE PHOTOCHEMICAL SYNTHESIS OF ENDOTHERMIC COMPOUNDS FINAL REPORT, by Harry E. Gunning, 31 Aug 1956. 8 p. Contract N7onr-329 (15).
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PHOTOCHEMICAL SYNTHESIS OF ENERGY-RICH COMPOUNDS, by Harry E. Gunning, 1 Feb 1957 to 31 Aug 1957. 7 p. AF OSR TN 57-588; Contr. AF 49(638)-39.
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OBSERVATIONS ON THE RARE EARTHS: CHEMICAL AND ELECTROCHEMICAL STUDIES OF SOLUTIONS OF RARE EARTH METAL SALTS IN ANHYDROUS DIMETHYLFORMAMIDE, by Therald Moeller and Valentine David Galasyn. Rept on Contract AF 18(600)-1535, Apr 1958. 101 p. AFOSR TN 58-158.
AD-152184.
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TRANSIENT PHOTOCONDUCTIVITY IN AgCI AT ROOM TEMPERATURE, by Roger Van Heyningen, 1958. 103 p. AF OSR TN 58-124.
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PERFORMANCE OF VARIOUS CHROMATE SUPPLEMENTARY FILMS ON ELECTRODEPOSITED ZINC COATINGS, by H. L. Katz, Jan 1957. 59 p. ITL 347-832.
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VOLUME CHANGE OF INDIUM ANTIMONIDE DURING FUSION, by Norman H. Nachtrieb and Noriko Clement, Feb 1958. 15 p. AFOSR TN 58-71; Contr. AF 18(600)-1489. AD-148114.
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KINETICS OF THE OXIDATION OF WUSTITE AND MAGNETITE, by J. D. Mackenzie and C. E. Birchnall, 23 July 1957. 19 p. Contr. AF18(600)-967. AFOSR TN-57-451. AD-136441.
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James Forrestal Research Center, Princeton, N. J.
PROJECT SQUID SEMI-ANNUAL PROGRESS REPORT, 1 Oct 1956. 127 p. Contr. N6-ori-105(03).
Order from LC mi $6.30, ph $19.80 PB 130671

Contents:
I. Fluid Mechanics.
II. Fluid Properties.
III. Heat Transfer.
IV. Combustion Phenomena.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPOSITION DISTRIBUTION IN A FLAME HELD BY A BLUFF BODY FLAME HOLDER, by F. H. Wright, 1 Feb 1956. 14 p. CIT JPL 20-286; Contr. DA-04-495-ORD 18.
Order from LC mi $2.40, ph $3.30 PB 129961

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QUARTERLY PROGRESS REPORT 22, by L. C. Allen and A. M. Karo, 15 Oct 1956. 62 p. Contr. N 5 ori-07856.

1. Polarization Effects in the Fluorine Ion and Electronic Wave Functions for the Hydrogen Fluoride Molecule.
2. The Lithium Hydride Molecule.
3. He Configuration Interaction.
4. Atomic Wave Functions Including $r_1 j$.
5. Energy Bands of Two Di-mensional Graphite.

6. Electronic Structure of KC 1 and KC 1 with V-Center.
7. Electron-Lattice Interactions.
8. Magnetic Hyperfine Structure of Lithium.
9. Spherical Harmonic Representations of the Point Groups.
10. Band Structure of MnO.
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RELATIVISTIC EFFECTS IN THE COHESIVE ENERGIES OF THE ALKALI METALS, by Joseph Callaway, Roger D. Woods, etc., May 1957. 21 p. AF OSR-TN-57-208; Contr. AF 49(638)-62. AD-126505. File 40-37.
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PIEZOBIREFRINGENCE IN STRONTIUM TITANATE, by Armando A. Giardini, 24 Sep 1956. 98 p.
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MICROWAVE PRECISION POWER STANDARD, by Leonard R. Sweet, 12 July 1956. 46 p. RADC TR 56-122; MRI R511-56; PIB-441; Contr. AF-30(602)-988. AD-97814.
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LUMINESCENCE FROM SODIUM CHLORIDE, by Wm. E. Spicer, 1 July 1956. 35 p. Contr. N7onr-292 T. O. 5.
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Study on Sprayed Coatings of Ba O.

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ATOMIC FLAMES: SPECTRA, "TEMPERATURES," AND PRODUCTS, by R. G. Ferguson and H. P. Broida, May 1954. 37 p. WADC TR 54-553; Contr. AF 33(616)-53-3. AD-61307.
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MICROWAVE INSTRUMENTATION FOR MULTI-FREQUENCY ATTENUATION MEASUREMENTS THROUGH PROPELLANT GASES, by W. W. Balwanz and G. D. Morehouse, 13 Feb 1952. 43 p. NRL 3886.
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CHELOMETRIC TITRATIONS WITH POTENTIOMETRIC END-POINT, by D. W. Lamson and R. W. Schmid, June 1957. 19 p. AF OSR-TN-57-473; Contr. AF 18(600)-1160. AD-136465.
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CHEMISTRY OF HYDRAZINE: FREEZING POINT MEASUREMENTS OF HYDRAZINE AND SOLUTIONS OF SALTS IN HYDRAZINE, by N. C. Deno and R. A. Baker, Technical rept. on Contract AF 18 (600)448. 1 Feb 1954. 48 p. AD-106446.
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ELECTRIC DIPOLE MOMENTS OF THE METHYL FLUORO BORANES, by R. K. Uenishi and C. G. Haas, Jr., 18 Oct 1956. 41 p. CCC-1024-TR-206.
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THE THERMAL EXPANSION OF THE LITHIUM FLUORIDE LATTICE AND ITS COMPARISON TO THE LINEAR MACROSCOPIC THERMAL EXPANSION, by E. A. Abramson, Technical Note no. 4 on Contract AF 18(600)-561. June 1957. 47 p. AFOSR TN-57-319; AD-132390.
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ABSORPTION SPECTROPHOTOMETRIC STUDIES OF CHEMICAL CHANGES IN PROPELLANTS, by H. Levitsky, Apr 1957. 28 p. graphs.
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CONVERSION OF CARBONACEOUS FUELS TO ELECTRICAL ENERGY, by Howard L. Recht and Everett Gorin, 26 Aug 1955. 46 p. Contr. DA 36-039-SC-63090.
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Seventh Quarterly Rept.

Pittsburgh Consolidation Coal Co., Pa.
CONVERSION OF CARBONACEOUS FUELS TO ELECTRICAL ENERGY, by E. Gorin and H. L. Recht, 28 May 1956. 29 p. Contr. DA-36-039-SC-63090.
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CONVERSION OF CARBONACEOUS FUELS TO ELECTRICAL ENERGY, by E. Gorin and H. L. Recht, 31 Aug 1956. 28 p. Contr. DA-36-039-SC-63090.
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Ninth Quarterly Rept.

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SOME THERMODYNAMIC AND FLOW PROPERTIES OF CIS-AND TRANS-1, 4-AMINOCYCLOHEXANECARBOXYLIC ACIDS, by William O. Plummer. Doctoral thesis. Technical Rept. 3 on Contracts DA-36-061-ORD-295 and DA 36-061-ORD-472. 1956. 94 p.
Order from LC mi $5.40, ph $15.30 PB 128199

Princeton U., N. J.
ABSORPTION OF HYDROGEN ON GERMANIUM, by Kenzi Tamaree, 1955 or later, 12 p. Contr. N6onr-27018.
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Purdue U., Lafayette, Ind.
PHOTOCONDUCTIVITY IN GERMANIUM, SILICON AND INDIUM ANTIMONIDE, ANNUAL REPORT, by H. Y. Fan, N. D. 32 p. Contr. Nonr-1100(04).
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For period, July 1955 to 15 July 1956.

Redstone Arsenal, Huntsville, Ala.
STEADY-STATE TEMPERATURE DISTRIBUTION IN SOLID PROPELLANT GRAIN DUE TO ATMOSPHERIC TEMPERATURE VARIATIONS, by H. Hinrichs, L. T. Whitehead, et al. 16 Aug 1956. 64 p. OML-3R4P.
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Redstone Arsenal, Huntsville, Ala.
STRUCTURE AND STABILITY OF N-BUTANE-NITROGEN DIOXIDE FLAMES IN AIR, by E. Miller and H. J. Setzer, Oct 1956. 27 p. OML R2R 20F.
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CONSTITUTION OF MOLTEN SALTS, by George J. Janz, May 1957. 59 p. Contract AF 49(638)-50 AF OSR TN-57-239. AD-126536.
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Rensselaer Polytechnic Inst., Troy, N. Y.
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STUDY OF ULTRA HIGH TEMPERATURES: DETONATION VELOCITY OF GASEOUS OZONE, by A. G. Streng and others. Rept. on Contract AF 18 (600)-1475. 5 Dec 1957. 17 p. AFOSR TN-58-14; AD-148052.
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Rhode Island U., Kingston.
MECHANISMS OF DECOMPOSITION OF POTASSIUM SUPEROXIDE, by Douglas Kraus, Ed. 1 June 1952 to 3 May 1956. 5 p. Contr. Nonr 810(00).
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STUDY OF THE SYSTEM NaCl-KCl-LiCl-$AlCl_3$ IN THE REGION OF MOLE RATIO 1:1:1:(3-6), by W. E. Trout, Jr. and W. J. Triner, Jr. 3 Oct 1955. 30 p. CCC-1024-TR-139.
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REACTION BETWEEN METHANOL AND BORON CONTAINING GLASSES, by R. P. Porter, 27 May 1957. 2 p. AF OSR-TN-57-262; AF 18(600)-1528. AD-126560.
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PHASE SEPARATIONS IN THE WP-1 COMPOSITION, by E. R. Allen and S. M. Hirshfield, 6 July 1956. 71 p. Contr. Nonr 404 (07).
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FRICTIONAL ELECTRIFICATION EFFECTS IN FUEL FLOW, by F. M. Ernsberger, Nov 1956. 53 p. WADC TR 55-266; Contr. AF 33(616)-2441. AD-90288.
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ADSORPTION FROM SOLUTION OF STEARIC ACID ON IRON. EFFECT ON ELECTRODE POTENTIAL, by Norman Hackerman and John J. Bordeaux. Rept. on Contract Nonr-375(02). 23 Nov 1956. 48 p.
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University of Southern California, Los Angeles.
ABSORPTION CROSS SECTIONS OF H_2 BETWEEN 550A AND 833A, by A. W. Ehler and G. L. Weissler, Apr 1957. 5 p. Contr. AF 19(604)-2049.
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PHOTOELASTIC ANALYSIS OF A FLAT, FLANGED TENSION SPECIMEN, by F. B. Hyland and F. I. Baratta, 20 Oct 1953. 12 p. WAL 893/162.
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ULTRASONIC TESTING OF SPECIAL CAST ARMOR WITH THE WATERTOWN ARSENAL ULTRASONIC FLAW PLOTTING EQUIPMENT, by Ross W. Buchanan and S. A. Lopilato, 13 June 1955. 77 p. WAL 143/26.
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THE EARTH'S SURFACE CHARGE, by E. A. Cherniavskii, 1948. 17 p. Contr. AF 19(604)-1936.
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MEDIUM-RANGE FORECASTING TECHNIQUES FOR CENTRAL EUROPE PART 1, by Dr. P. Hess and A. Hofmann, June 1956. 46 p. AF CRC TR 57-250; Contr. AF 61 (514)-646-C. AD-110261.
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CLEAR—AIR TURBULENCE FROM 25,000 TO 45,000 FEET OVER THE UNITED STATES, by Leroy H. Clem, July 1957. 15 p. AWS TR 105-147.
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A SYNOPTIC STUDY OF THE INTENSIFICATION MECHANISM OF A DIFFLUENT TROUGH, by Joseph B. Knox, March 1957. 175 p. AF CRC TN 57-270; Contr. AF 19(604)-1286. AD-117153.
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THE DOUBLE FIELD MILL, by J. A. Chalmers and M. S. Middy, 15 Oct 1955 to 14 Oct 1956. 18 p. AF CRC TN-56-885; Contr. AF61(514)-891. AD 110251.
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SYMPOSIUM ON AURORAL OBSERVATIONS DURING THE INTERNATIONAL GEOPHYSICAL YEAR, by Joseph W. Chamberlain and Vidya Pesch, 17-26 Sep 1956. 46 p. AF CRC TN 56-883; Contr. AF 19 (122)-480.
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Technical Report No. 22.

ENGINEERING

Aeronautical Engineering

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SCATTER OF FATIGUE LIFE AND FATIGUE STRENGTH IN AIRCRAFT STRUCTURAL MATERIALS AND PARTS, by Waloddi Weibull, 1957. 24 p. FFA 73.
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A PROTOTYPE VISUAL AIRSPEED ACCELERATION INDICATOR, by J. H. Towle, 11 Jan 1955. 20 p. NAES ASL AD-250.7.
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RESUME OF FEASIBILITY BENCH TEST HELICOPTER TRANSMISSIONS SIMULATING FLIGHT LOADS, by E. K. Liberatore, 6 Jan 1956. 142 p. Contr. DA 44-177-TC-329. AD-109214.
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RESISTANCE THERMOMETER FOR HEAT TRANSFER MEASUREMENT IN A SHOCK TUBE, by J. Rabinowicz and M. E. Jessey, 2 July 1956. 33 p. CIT GAL/M 33; Contr. DA-04-495-ORD-19.
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Appendix B and its four drawings are included in a separate package.

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IMPROVEMENT OF THE LATERAL CONTROL SYSTEM OF THE Q-2 TARGET DRONE PROVIDING AUTOMATIC TRIM CORRECTION, by Joachim Gengelbach, June 1957. 21 p. HADC TR 57-4. AD-113040.
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A QUICK METHOD OF ESTIMATING ROCKET-SLED PERFORMANCE, by James P. Judin, 4 Apr 1957. 14 p. NOTS 1705 NAVORD 5437.
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BUILDING "FEEL" INTO CONTROLS: THE EFFECT ON MOTOR PERFORMANCE OF DIFFERENT KINDS AND AMOUNTS OF FEEDBACK, by B. Weiss, 14 Oct 1953. 22 p. Contr. N6onr-241, T.O.6.
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E. O. No. R452-495.

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Section IV. Fused and Melted Elements.

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QUARTERLY SCIENTIFIC REPORT NO. 18, COVERING PERIOD OCT 1, 1957-JAN 1, 1958, by S. Seshadri and T. T. Wu, et al, 1 Jan 1958, 4 p. AFCRC-TN-58-109. Contr. AF 19(604) 786. AD-146808.
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DISTANCE-MEASURING EQUIPMENT. FINAL ENGINEERING REPORT, Feb 1956. 262 p. Contr. AF 18 (600)-705. AD-95579.
Order from LC mi $11.10, ph $41.10. PB 130009

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INVESTIGATION AND STUDY OF PRACTICAL UTILIZATION OF MOLECULAR ABSORPTION PHENOMENA FOR FREQUENCY CONTROL, by L. E. Norton, May 1, 1952 to Feb 28, 1955. 147 p. Contr. DA36-039-SC-15525.
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David Talyor Model Basin, Washington, D. C.
TIME CONSTANTS AND FREQUENCY RESPONSE OF COATED HOT WIRES USED AS TURBULENCE-SENSING ELEMENTS, by A. Borden, June 1957, 55 p. R 952.
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Detroit Arsenal, Center Line, Mich.
AIR FLOW CHARACTERISTICS OF 300 AMPERE GENERATOR, (CODE M-15) ORDNANCE NO. 7358630, by John F. Scarpelli, 2 July 1956. 23 p. R 3641. AD-102729. Final Report.
Order from LC mi $2.70, ph $4.80. PB 129957

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ON ANTENNAS FOR ATMOSPHERIC ELECTRICAL MEASUREMENTS, by H. Dolezalek, Oct 1956, 93 p. AFCRC TN 57-2. Contr. AF 61(514)-640. AD-133687.
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BIREFRINGENCE OF FERRITES IN CIRCULAR WAVEGUIDE, by N. Karayianis and J. C. Cacheris, 23 April 1956. 25 p. TR-347.
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THE BROADBANDING OF MICROWAVE NON-RECIPROCAL FERRITE PHASE SHIFTERS, by R. Van Wolfe & J. C. Cacheris, 23 April 1956. 18 p. DOFL TR-348.
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ELECTRON TUBE GAS, by S. J. Stoll, 1 April 1955. 12 p. DOFL TR-152.
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FERRO RADIATOR SYSTEMS, by F. Reggia, and E. G. Spencer, 15 June 1956. 44 p. DOFL TR-357.
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Diamond Ordnance Fuze Labs., Washington, D. C.
THE GAIN-BANDWIDTH RELATIONS IN TRANSISTOR VIDEO AMPLIFIERS, by T. A. Prugh, 18 Oct 1956. 16 p. DOFL TR 399.
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HIGH-SPEED, HIGH-REPETITION-RATE FERRITE MICROWAVE SWITCH, by H. B. Burns & R. C. LeCraw, June 28, 1956. 11 p. DOFL TR 361.
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MAGNETIC TUNING OF RESONANT CAVITIES AND WIDEBAND FREQUENCY MODULATION OF KLYSTRONS, by G. Jones and J. C. Cacheris, 26 April 1956. 27 p. DOFL TR-349.
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MICROWAVE SEMICONDUCTER SWITCH, by Mary A. Armistead & E. G. Spencer, Sept 25, 1956. 9 p. DOFL TR-390.
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A RADAR VIDEO SIMULATOR FOR RANGE AND ANGLE, by K. J. Young, 10 June 1957. 7 p. DOFL TM 57-3.
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Diamond Ordnance Fuze Labs., Washington, D. C.
A SIMPLE SHORT PULSE RADAR REFLECTOMETER, by Harold A. Conklin, Jr. and Henry B. Burns, 15 Nov. 1956. 26 p. DOFL TR-398.
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VHF FERRITE ANTENNA RADIATION MEASUREMENTS, by H. A. Dropkin & E. Metzger, July 10, 1957. 24 p. DOFL TR-484.
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WAVE PROPAGATION IN THE FERROD RADIATOR, by John E. Tomkins and Marie D. Prytulak, 15 Mar 1957. 12 p. DOFL TR 432.
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Dumont, Allen B., Labs., Inc., Passaic, N. J.
DIRECT-VIEWING STORAGE TUBES. INDUSTRIAL PREPAREDNESS STUDY COVERING THE PERIOD 1-1-57 TO 3-31-57, by M. P. Wilder. 7 p. Contr. DA-36-039-SC-72717.
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DIRECT VIEWING STORAGE TUBES INDUSTRIAL PREPAREDNESS STUDY, by M. P. Wilder & R. E. Rutherford, April 20, 1957. 4 p. Contr. DA-36-039-SC-72717.
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DuMont, Allen B., Labs., Inc., Clifton, N. J.
DIRECT VIEWING STORAGE TUBES, INDUSTRIAL PREPAREDNESS STUDY by M. P. Wilder, April 1 to June 30, 1957. 18 p. Contr. DA-36-039-SC-72717.
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DuMont, Allen B., Labs., Inc., Passaic, N. J.
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DIRECT-VIEWING STORAGE TUBES, by M. P. Wilder. June 30 to July 31, 1957. 15 p. Contr. DA-36-039-SC-72717.
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Eaton Electronics, Research Labs., McGill U. (Canada).
STUDIES IN MICROWAVE OPTICS, G. Bekefi, March 1957. 322 p. E.E.R.L. Technical Report No. 38. AF CRC TR-56-179; Contr. AF 19(122)-81. AD-110152.
Order from LC mi $11.10, ph $50.10 PB 128813

Electrical Engineering Research Lab., U. of Illinois, Urbana.
BEARING COMPUTERS FOR USE WITH SPINNING GONIOMETERS RADIO DIRECTION FINDERS, by

R. R. Sydnor, 30 Sept. 1956. 31 p. Contr. NONR 1834(02).
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Tech. Report No. 3.

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DIRECTION OF ARRIVAL OF RADIO WAVES, by H. D. Webb & A. D. Bailey, 31 Jan 1956. 16 p. Contr. N6ORI-07115.
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A PANORAMIC RDF AND BEARING AVERAGING COMPUTER, USING LINEAR CONVERSION OF RDF BEARINGS, by H. D. Webb and D. L. Bitzer, 20 Dec 1956. 61 p. Contr. Nonr 1834 (02).
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SYNTHESIS OF VOLTAGE TRANSFER FUNCTIONS WITH RIGHT HALF PLANE ZEROS BY RC FEEDBACK NETWORKS, by James J. Mikulski, 15 Mar 1957. 20 p. AF OSR TN 57-168. Contr. AF 49(638)-63. AD-126461.
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TRANSFER FUNCTION SYNTHESIS WITH ACTIVE ELEMENTS, by Franklin F. Kuo, April 15, 1957. 22 p. AF OSR TN 57-200. Contr. AF 49(638)-63. AD-126503.
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DYNAMIC OPERATION OF MAGNETIC AMPLIFIERS FOR FEEDBACK CONTROL SYSTEMS, by H. C. Bourne, Jr. and T. T. Kadota, May 31, 1957. 28 p. Scientific Report No. 4. IER-60-181; AFCRC TN-57-398; Contr. AF 19(604)-1813. AD-117116.
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QUARTERLY PROGRESS REPORT, SERIES 60, REPORT NO. 13. 22 p. N. D. Contr. N7-onr-29529.
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REALIZATION TECHNIQUES FOR LOSSLESS LADDER INTERSTAGE NETWORKS, by D. O. Pederson, Oct 1956. 32 p. IER Series 60, Issue 163. Contr. N7onr-29529, Report No. 55.
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TRANSISTOR BLOCKING OSCILLATOR ANALYSIS, by D. O. Pederson, 10 Sept 1956. 18 p. Contr. N7ONR-299529.
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PROJECT LION SIMULATION STUDY, 1 Nov 1956. 65 p. Progress Report P-8/133 CU-8-56-AF-1572-EE. Contract AF 19 (604) 1572. AFCRC-TN-57-174. Project Lion. AD-117128.
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USE OF HEWLETT-PACKARD MODEL 522B ELECTRONIC COUNTER AS A "SPINNING DISC" RANDOM NUMBER SELECTOR, by R. R. McPherson, July 10, 1956. 12 p. TM 29. Contr. DA-36-039-SC-63203. AD-109266.
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Executone, Inc., N. Y.
U. S. NAVY INTERCOMMUNICATING UNITS TYPE 1A-TW (EXECUTION MODEL NV-15), n.d. 52 p. NAVSHIPS IC IB 940. NAVSHIPS 365-0126. Contr. NObs-12232.
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COMPLEX AMPLITUDE DISTRIBUTION ON THE AXIS OF A SPHERICAL MIRROR USED FOR RAPID SCANNING, by L. Abbozzo Ronchi and V. Russo, 10 June 1956. 20 p. Technical Note 4. AF CRC TN 56-783. Contr. AF 61 (514)-903. AD-110119.
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FUNDEMENTAL RESEARCH ON ELECTROMAGNETIC THEORY AND MICROWAVE SPECTROSCOPY. TECHNICAL NOTE NO. 7, 15 Dec 1956. 27 p. AF CRC TN-57-191. Contract AF61 (514)-903. AD-117108.
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ON A MACROSCOPIC MEASUREMENT OF THE SPIN OF ELECTROMAGNETIC RADIATION, by Giuliano Toraldo Di Francia, April 1957. 23 p. Technical note No. 11; AF Contr. 61(514) 903; AFCRC TN 57-580. AD-133630.
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General Dry Batteries, Inc., Cleveland, Ohio.
LOW TEMPERATURE BATTERIES, INDUSTRIAL PREPAREDNESS STUDY: FINAL & SIXTEENTH QUARTERLY, PROGRESS REPORT PREPARED by J. R. Pischel Feb 1 to June 19, 1957. 26 p. Contract DA-36-039-SC-30279.
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SYNCHRONOUS COMMUNICATIONS SYSTEM, 31 May 1956. 111 p. RADC TR-56-96; Contr. AF 30 (602)-584. AD-97750.
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Final Report.

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TERMINAL REPORT ON MICROWAVE RESEARCH, by S. E. Webber et al. N. D. 681 p. Contr. NObsr-42463.
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ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES, by H-Severin, 31 July 1956. 49 p. RADC TR-56-167; Contr. AF 61(514)-876. AD-97962.
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Phase B: Diffraction of Electromagnetic Waves at a Rectangular Aperture in a Completely Conducting Plane Screen.

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Phase C: Absorption of Microwaves by Magnetic Resonance Absorbers.

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Phase D: Absortion of Electromagnetic cm-Waves in Anisotropic Media.

Hughes Aircraft Co., Culver City, Calif.
DOUBLE SLAB ARBITRARY POLARIZATION SURFACE—WAVE STRUCTURE, by R. E. Plummer and R. C. Hansen, 26 June 1956. 52 p. Scientific report no. 10; AF CRC TN-56-768; Contr. AF 19(604)-1317.
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THE KERR CELL AS A MICROWAVE FREQUENCY OPTICAL SHUTTER 2, EXPERIMENTAL INVESTIGATION, by G. L. Clark and D. F. Holshouser, Mar 1957. 178 p. AFOSR-TN-57-114; Contr. AF 18(600)-1018. AD-120467.
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Ingeniors Vetenskaps Akademien (Sweden).
THE DEVELOPMENT AND DECAY OF THE MAGNETIC FLUX IN A NON-DELAYED TELEPHONE RELAY, by Stig Ekelof, 1957. 54 p. A Study of Telephone Relays (3); Acta Polytechnica 240 (1957).
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GENERAL PHYSICAL LOWS FOR THE ELECTRICAL FILTER LADDER, by Torbern Laurent, 1957. 23 p. Electrical Engineering Series Vol. 8 No. 5; Acta Polytechnica 231 (1957).
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Institute for The Study of Rate Processes, U. of Utah, Salt Lake City.
STRAIN ELECTROMETRY, by Albert G. Funk and Henry Eyring, 30 Nov 1956. 79 p. Technical report. 19 on Contr. N7onr-45101 and N7onr-45103.
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BOUNDS ON SCATTERING PHASE SHIFTS, by Larry Spruch, May 1957. 29 p. AFCRC-TN-57-483; CX-30; Contr. AF 19(604)1705. AD 117247.
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Institute of Mathematical Sciences, New York U., N. Y.
PROPAGATION OF ELECTROMAGNETIC PULSES AROUND THE EARTH, by B. R. Levy and J. B. Keller, Feb 1957. 21 graphs. AFCRC TN 57-383, EM-102; Contr. AF 19(604)1717. AD 117082.
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THEORY OF ELECTROMAGNETIC RESEARCH—ON SOLUTIONS OF NONLINEAR WAVE EQUATIONS, by J. B. Keller, Apr 1957. 13 p. MME-3; Contr. DA 49-170-sc-2253.
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International Resistance Co., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY FOR PRECISION, HIGH STABILITY RESISTORS: QUARTERLY PROGRESS REPORT, JAN 1, 1957 to MAR 31, 1957, by William F. Stark. 21 p. Contr. DA 36-039 sc 72726.
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Quarterly Progress Report.

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RESISTORS, FIXED, HIGH STABILITY, INSULATED, by Sidney J. Stein, John J. Bohrer, et al, 15 July 1955. 52 p. Contr. DA-36-039-SC-64665.
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RESISTORS, FIXED, HIGH STABILITY, INSULATED, by Sidney J. Stein and John L. Bohrer, 15 April 1955 to 15 April 1956, 62 p. Contr. DA-36-039-SC-64665.
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Johns Hopkins U., Baltimore, Md.
A STUDY OF OSCILLATING CIRCUITS FOR TELEMETERING SYSTEMS, by J. W. Gibson et al, Sept 1954. 143 p. WADC TR-54-408; Contr. AF 33(616)153.
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Kansas U., Lawrence.
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Kansas U., Lawrence.
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Kansas U., Lawrence.
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Keystone Electronics Co., Newark, N. J.
TIGHTER TOLERANCE CR-18/U CRYSTAL UNITS. 28 Feb 1957. 3 p. Quarterly Report. Contr. DA 36-039-SC-72691.
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Kuthe Labs., Inc., Newark, N. J.
INDUSTRIAL PREPAREDNESS STUDY ON HYDROGEN THYRATRON TUBES TYPE VC 1257, by A. E. Gordon, April 1-30, 1957. 2 p. Report No. 10. Contr. DA 36-039-SC-70288.
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Kuthe Labs, Inc., Newark, N. J.
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Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
ELECTRIC BREAKDOWN AND CONDUCTION THROUGH MYLAR FILMS, by Y. Inuishi and D. A. Powers, Dec 1956. 21 p. TR 112. Contr. Nonr-1841 (10). Contr. DA-1-49-186-502-ORD (P)-334.
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RECTIFIED A. C. GENERATING SYSTEM, by William Herridge, Mar 1956. 14 p. Contr. DA 20-089-ORD-37210. AD 99176.
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Levinthal Electronic Products, Inc., Redwood City, Calif.
ENERGY DISSIPATION AND ELECTRODE EROSION IN ARCS. TECHNICAL REPORT NO. 1, by Harry G. Heard, Oct 6, 1956. 100 p. AFCRC TN-57-188. Contr. AF 19 (604)-1856. AD 117031.
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INDUSTRIAL PREPAREDNESS STUDY. LOW-NOISE TRAVELING WAVE AMPLIFIER, by M. Nowogrodzki, Quarterly Progress Report No. 4, 1 Apr 1951 to 1 June 1957. 24 p. Contr. DA 36-039-SC-72733.
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LOW TEMPERATURE TYPE, DRY BATTERIES BA-2000 SERIES INDUSTRIAL PREPAREDNESS STUDY. FINAL REPORT, by Harold H. Spengler, 30 Dec 1955. 74 p. Contr. DA 36-039-SC-30280.
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Rayovac Co., Madison, Wis.
PAPER-LINED BATTERIES TYPE BA-270/U-XPL. INDUSTRIAL PREPAREDNESS STUDY. FINAL TECHNICAL REPORT, by R. F. Udell, 31 Dec 1955. 36 p. Contr. DA-36-039-SC-30269.
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TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE. INDUSTRIAL PREPAREDNESS STUDY. QUARTERLY REPORT NO. 6, 28 June to 28 Sept 1956. 94 p. Contr. DA 36-039-SC-66038.
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Raytheon Mfg. Co., Newton, Mass.
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FINAL ENGINEERING REPORT CONTRACT AF 19 (604)-1376, Feb 1957. 90 p. AFCRC TR 56-191; Contr. 19 (604)-1376. AD 110194.
Order from LC mi $4.80, ph $13.80 PB 128330

Report on extending the frequency range of magnetic, transistor and transistor core amplifiers.

Remington Rand Univac Div., Sperry Rand Corp., Philadelphia, Pa.
INVESTIGATION OF TRANSISTOR AND TRANSISTOR/MAGNETIC-CORE CIRCUITRY FOR HIGH SPEED DIGITAL COMPUTER APPLICATIONS, by H. J. Gray and D. M. Lipkin, 30 Apr 1956. 64 p. AFCRC-TN-56-184; Contr. AF 19 (604)-1376.
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Remington Rand Univac Div., Sperry Rand Corp., Philadelphia, Pa.
SERIES PULSE MAGNETIC AMPLIFIERS, by R. D. Tarrey and A. L. Krell, 1 Feb 1951. 63 p. AFCRC TN 56-186; AF 19(604)-1376. AD 110190.
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Scientific Report No. 3.

Research, Inc., Hopkins, Minn.
COMPARISON OF RADIOSONDE AND MICROWAVE REFRACTOMETER IN RADIO PROPAGATION STUDY, by M. M. Mitchell. 45 p. WADC TR 55 81; Contr. AF 33(616)85. AD 76797.
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Research, Inc., Minneapolis, Minn.
DEVELOPMENT OF A UNITIZED STATISTICAL ACCELEROMETER AND RECORD ASSEMBLY, by H. C. Johnson, Aug 1954. 55 p. WADC TR 55-14; Contr. AF 33(600)-26175. AD 65354.
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A STUDY OF HEAT REQUIREMENTS FOR ANTI-ICING RADOME SHAPES WITH DRY AND WET SURFACES, by W. L. Torgeson and A. E. Abramson, Sept 1953. 135 p. AF WADC TR 53-284; Contr. AF 33(616)-85. AD 25909.
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NOISE IN ELECTRON BEAMS, by Charles Fried, 2 May 1955. 46 p. TR 294.
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QUARTERLY PROGRESS REPORT, by G. G. Harvey, et al, 15 Jan 1956. 169 p. Contr. DA 36-039-SC-42607.
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QUARTERLY PROGRESS REPORT, by J. A. Stratton and A. G. Hill, 15 Jan 1947. 101 p. Contr. W-36-039-SC-32037.
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Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
QUARTERLY PROGRESS REPORT, by J. A. Stratton and A. G. Hill, 15 Jan 1948. 71 p. Contr. W-36-039-SC-32037.
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Roger White Electron Devices, Inc. Haskell, N. J.
ELECTRONIC PHASE SHIFTER EMPLOYING HIGH FREQUENCY GAS DISCHARGE TECHNIQUES, by R. H. Geiger and P. Parzen, 30 Oct 1956. 48 p. Scientific Report No. 1. AF CRC TN-56-969; Contr. AF 19 (604)-1592. AD 110162.
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DETERMINATION OF THE ENERGY OUT PUT OF THE XD SERIES COLD-CATHODE TUBE, Leonard Fogel, Sept 1956. 15 p. PATR-2343.
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School of Aviation Medicine, Randolph Air Force Base, Tex.
ANOXIA WARNING DEVICE, by J. W. Prost and W. K. Noell, Mar 1949. 11 p. Proj. No. 21-02-050 Report No. 1.
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School of Aviation Medicine, Randolph Air Force Base, Tex.
BRIGHTNESS AND BRIGHTNESS CONTRAST ON THE INTENSITY MODULATED RADAR SCOPE, by Siegfried Gerathewohl, June 1957. 39 p. AF SAM 56-68.
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A SPECIAL AMPLIFIER FOR PHOTOELECTRIC ANALYSIS OF OXYGEN SATURATION OF BLOOD, by H. Maier-Leibnitz and E. O. Richey, July 1948. 7 p. Proj. No. 21-02-080, Report No. 1.
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Report 3 A proposed Runway Indentification Lighting System.

Signal Corps Engineering Labs., Fort Monmouth, N. J.
BENDS IN SURFACE WAVE TRANSMISSION LINES, by Georg Gorbau, Aug 1956. SCEL TM M-1597.
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South Carolina U., Columbia.
NON-WAVEGUIDE TRANSMISSION OF MILLIMETER WAVES, by R. G. Fellers and W. E. Propst, 15 Apr 1957. 15 p. AF OSR TN-57-188; Contr. AF 18 (603)-43. AD 126483.
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TECHNICAL REPORT FOR THE PERIOD JANUARY 1, 1955-JULY 1, 1956, by D. H. Rank and H. E. Bennett, 1 July 1956. 167 p. Contr. Nonr-656 (12).
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Sperry Gyroscope Co., Great Neck, N. Y.
FINAL REPORT ON DEVELOPMENT OF BROADBAND WAVEGUIDE COMPONENTS. 311 p. Contr. DA 36 039 SC 166.
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A GUN AND FOCUSING SYSTEM FOR CROSSED-FIELD TRAVELING-WAVE TUBES, by O. L. Hoch, 28 June 1957. 85 p. Technical Report No. 383-1. Contr. AF 33 (600)-27784.
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MICROWAVE NOISE FLUCTUATIONS IN THE POTENTIAL-MINIMUM REGION OF AN ELECTRON BEAM, by A. E. Siegman, 22 Apr 1957. 266 p. TR 401-1; Contr. Nonr 225(25); Contr. Nonr 225(24).
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NEON LAMPS AS CIRCUIT ELEMENTS, by W. R. Kincheloe, Jr., 26 May 1957. 37 p. TR 10; Contr. N6onr-25132.
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Stanford Electronics Labs., Stanford U., Calif.
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Stanford Electronics Labs., Stanford U., Calif.
SOME PROPERTIES OF A SHEATH HELIX WITH A CENTER CONDUCTOR OR EXTERNAL SHIELD, by G. W. C. Mathers and G. S. Kino, 17 June 1953. 37 p. TR-65; Contr. N6onr-251(07).
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Stanford Electronics Labs., Stanford U., Calif.
THEORY OF THE SERRODYNE AT LOW TRANSLATION FREQUENCIES, by R. C. Cumming, 1 May 1956. 48 p. RADC TN-56-313; TR262-2; Contr. AF 19(604)-1065. AD 97771.
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THE PROLATE SPHERODIAL MONOPOLE ANTENNA, by Carson Flammer, June 1957. 48 p. AFCRC TN 57-581; Contr. AF 19 (604)-1296. AD 133621.
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Stanford Research Inst., Menlo Park, Calif.
SHUNT-FED AND NOTCH-FED H-F AIRCRAFT ANTENNAS, by R. L. Tanner, July 1957. 64 p. AF CRC TN 57-582; Contr. AF 19(604)-1296. AD 133622.
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Stanford Research Inst., Menlo Park, Calif.
A STUDY OF PRECIPITATION-STATIC NOISE GENERATION IN AIRCRAFT CANOPY ANTENNAS, by Joseph E. Nanevicz, Dec 1957. 35 p. AF CRC TN 57-583; Contr. AF 19(604)-1296. AD 133623.
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VARIATIONAL FORMULAE FOR DOMAIN FUNCTIONALS IN ELECTROMAGNETIC THEORY. Carson Flammer, Jan 1957. 30 p. AF CRC TN-57-152; Contr. AF 19 (604) 1296. AD 110284.
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Stanford U., Calif.
THEORETICAL AND EXPERIMENTAL CHARACTERISTICS OF CONNECTED-RING STRUCTURES FOR USE IN HIGH-POWER TRAVELING-WAVE TUBES, W. R. Ayers and P. T. Kirstein, Jan. 1957. 111 p. AFCRC TN 57 178; Contr. 19(604) 1494. AD 117017.
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Stromberg-Carlson Co., Rochester, N. Y.
U. S. NAVY PORTABLE ANNOUNCING EQUIPMENT TYPE PAM-1, n.d. 68 p. NAVSHIPS 365-0199; NAVSHIPS IC IB 105; Contr. NObs-20002.
Order from LC mi $3.90, ph $10.80 PB 130329

Sylvania Electric Products, Inc., Bayside, N. Y.
HEATER-CATHODE LEAKAGE INVESTIGATION, by Julius Cohen, 1 Feb 1957. 29 p. Report No. YF57 (B7-3028-4P); AFCRC TN-57-187; Contr. AF19(604)-1734. AD 117030.
Order from LC mi $2.70, ph $4.80 PB 128046

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THE DEVELOPMENT OF A LOW HEATER POWER CATHODE RAY TUBE, by George Poletti, Dec 1957. 94 p. Final report for 1 July 1956 to 30 Sept 1957. Contr. DA 36-039-SC-73077.
Order from LC mi $5.40, ph $15.30 PB 133758

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INDUSTRIAL PREPAREDNESS STUDY, TRANSISTOR MANUFACTURING, ENGINEERING DEVELOPMENT, FINAL REPORT, by C. Huang, 3 May 1957. 245 p. Contr. DA36-039-SC-54661.
Order from LC mi $11.10, ph $37.80 PB 128159

Syracuse U. Research Inst., New York.
INTERIM REPORT ON THE LEXINGTON-SYRACUSE TROPOSPHERIC SCATTER PROPAGATION LINK, by Joseph Dienst, et al, Nov 1956. 68 p. AFCRC TN-57-163; Contr. AF 19(604)-1179.
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Technical Research Group, N. Y.
MICROWAVE FILTERS PART I: THE EFFECT OF SMALL LOSS IN THE COUPLING VISES ON THE SHUNT-COUPLED CAVITY. PART II: NARROW PASS BAND LOW INSERTION LOSS FILTERS EMPLOYING RESONANT OBSTACLE COUPLING ELEMENTS, by Rosalind Oppenheim, 15 Jan 1957. 47 p. AF CRC TN-56-777; AF 19(604)-1307.
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SOME CONSIDERATIONS OF FAR FIELD MEASUREMENTS IN THE FRESNEL ZONE, by A. F. Kay, 7 Oct 1956. 17 p. AF CRC TN 775; Contr. AF 19(604)-1307.
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A TRAVELING WAVE GAS CELL, by M. Newstein and R. T. Daly, 27 Feb 1957. 31 p. AF OSR TN-57-111; Contract AF 18 (600)-1313. AD 120464.
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Teletype Corp., Chicago, Ill.
DESIGN AND DEVELOPMENT OF TEST SET, TELETYPEWRITER, TS-799 ()/UGM-1 FINAL REPORT, by Joseph Gardberg, 19 May 1954-15 Apr 1956. 38 p. Contr. DA-36-039-SC-63215.
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Transitron Electronic Corp., Melrose, Mass.
INDUSTRIAL PREPAREDNESS STUDY SILICON HIGH POWER RECTIFIERS, by Robert House, Joseph McDermott, etc., 31 Jan 1957. 144 p. Final Progress Report; Contr. DA-36-039-SC-66036.
Order from LC mi $7.20, ph $22.80 PB 128151

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INDUSTRIAL PREPAREDNESS STUDY, SILICON POWER RECTIFIERS, 30 June 1956. 26 p. Contr. DA-36-039-SC-46638.
Order from LC mi $2.70, ph $4.80 PB 129952

Tufts U., Medford, Mass.
SURFACE WAVES IN YAGI ANTENNAS AND DIELECTRIC WAVEGUIDES, by Albert D. Frost, Nov 1957. 31 p. AF CRC TR 57-368; Contr. AF 19(604)-2154. AD 133788.
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University of Southern California, Los Angeles.
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Order from LC mi $3.30, ph $7.80 PB 133585

Utah U., Salt Lake City.
LADDER AND SIMILAR NETWORKS USED FOR PROJECTILE ACCELERATION BY ELECTROMAGNETIC METHODS, by L. D. Harris and D. S. Humpherys. May 1957. 79 p. AF OSR TN-57-301; Contr. AF 18 (600) 1217. AD 132372.
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A MULTI-STAGE ELECTROMAGNETIC ACCELERATOR MODEL, by Allen S. Jones and L. Dale Harris, Sept 1957. 32 p. AF OSR TN 57-551. Contr. AF 18(600)-1217. AD 136535.
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A VECTOR ANALYSIS OF A SOLENOID-TYPE ELECTROMAGNETIC ACCELERATOR, by Blair E. Bona and L. Dale Harris, May 1957. 40 p. AF OSR TN-57-292; Contract AF 18 (600) 1217. AD 132363.
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LAMINAR BOUNDARY LAYER ON A SPINNING CIRCULAR CONE IN SUPERSONIC FLOW AT A SMALL ANGLE OF ATTACK, by M. Fiebig, June 1956. 63 p. AFOSR TN-56-532; Contr. AF 18(600)-1523. AD-110351.
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A HIGH-STAGNATION TEMPERATURE INTERMITTENT-FLOW SUPERSONIC WIND TUNNEL, by John L. Harkness, 11 Mar 1957. 55 p. DRL 406; AFOSR TN-57-222; Contr. AF 18(600)-589. AD-126520.
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Technical Report.

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THE UNSTEADY PRESSURE FIELD NEAR A SHIP PROPELLER AND THE NATURE OF THE VIBRATORY FORCES PRODUCED ON AN ADJACENT SURFACE, by John P. Breslin, June 1956. 88 p. ETT 609; Contr. Nobs-47790. AD-112951.
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DEFLECTION AND DISTRIBUTION OF STRESSES IN THE FACINGS OF A CENTRALLY LOADED TRANSPARENT SANDWICH BEAM, by Wilhelm S. Erickson, Dec 1953. 22 p. WADC TR 52-185, Supplement 1; Contr. AF 18(600)-70. AD-30551.
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Order from LC mi $8.40, ph $28.80 PB 128766

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AN EXPERIMENTAL INVESTIGATION OF THE FLOW OVER BLUNT-NOSED CONES AT A MACH NUMBER OF 5.8, by Reginald M. Machell and William T. O'Bryant. 15 June 1956. 63 p. Hypersonic Research Project Memo No. 32. Contr. DA-04-495-Ord-19.
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ON THE UNSTEADY VISCOUS FLOW PAST A FINITE FLAT PLATE, by R. C. DiPrima, June 1956. 15 p. Contr. N5-Ori-07666.
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FURTHER INVESTIGATIONS OF THE LAMINAR-TURBULENT TRANSITION IN A FREE JET (ANNULAR NOZZLE), by O. Wehrman and H. Fabiah, Dec 1956. 46 p. AFOSR TR 57-31; Contr. AF 61(514)-915. AD-126494.
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CHARTS OF FLOW PROPERTIES BEHIND PLANE AND CONICAL SHOCK WAVES AT OUTER EDGE OF BOUNDARY LAYER, by Reinhard Krause and John L. Gordon, May 1957. 27 p. HADC TN-57-5. AD-113035.
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Illinois U., Urbana.
SERIES SOLUTION OF LAMINAR INCOMPRESSIBLE MIXING OF TWO STREAMS WITH DIFFERENT VELOCITIES, by L. G. Eldrenkamp and J. Xerikos, May 1954. 34 p. WADC TR 54-275; Contr. AF 33 (038)-21251. AD-63504.
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CHARACTERISTICS OF THE TECHNIQUE OF AERODYNAMIC INVESTIGATION BY MEANS OF SERIES OF ELECTRIC SPARKS, by J. Herzog and J. R. Weske, July 1957. 70 p. Tech. note BN-105. AF OSR TN-57-359; Contr. AF 18(603)-92. AD-132432.
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Institute for the Study of Rate Processes, U. of Utah, Salt Lake City.
MECHANISM OF CRATERING IN ULTRA-HIGH VELOCITY IMPACT, by Melvin A. Cook, 10 July 1957. 30 p. AFOSR TN-57-486; Contr. AF 18(603)-100. AD-136479.
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FLEXIBLE-PLATE NOZZLE DESIGN FOR TWO-DIMENSIONAL SUPERSONIC WIND TUNNELS, by Harold N. Riise, 9 June 1954. 45 p. JPLR 20-74; Contr. DA-04-495-ord-18.
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ON THE ENERGY TRANSFER TO SMALL DISTURBANCES IN A VISCOUS COMPRESSIBLE HEAT CONDUCTIVE MEDIUM, by Boa-Teh Chu, 25 July 1956. 40 p. AF OSR TN-56-377; Contr. AF 18(000)-1121.
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Order from LC mi $3.00, ph $6.30 PB 130215

Martin, Glenn L., Co., Baltimore, Md.
COMBINED AIRLOAD AND THERMAL SHOCK TEST PROGRAM FINAL REPORT, 15 Oct 1953 to 15 Aug 1955. Engineering report 7630. 80 p. Contr. AF 18(600)-792; Contr. AF 18(600)-682. AD-70746.
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INVESTIGATION OF FACTORS AFFECTING THE CONTROL AND STABILITY OF HIGH SPEED AIRCRAFT AND MISSILES, by Phrios Theodorides, Apr 1958. 15 p. AFOSR TR 58-52; Contr. AF 18(600)-428. AD-154215.
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ANALYTICAL DESIGN OF A FAMILY OF SUPERSONIC NOZZLES BY THE FRIEDRICKS METHOD, by J. R. Baron, June 1954. 419 p. WADC TR 54-279; Contr. AF 33(616)-2132. AD-55902.
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FIN TECHNOLOGY AND ITS MODIFICATIONS IN THE DESIGN OF SECTIONALIZED HEAT EXCHANGERS WITH EXTENDED SURFACE FOR COOLING AIRBORNE ELECTRONIC EQUIPMENT. 14 Feb 1956. 50 p. WADC EL-41002.
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EFFECT OF YAW ON BOUNDARY LAYERS AT HIGH SPEEDS, by H. G. Lew and J. B. Fanucci, Nov 1956. 58 p. Tech. Report No. 9. AF OSR TN-57-221; Contr. AF 18(600)-575. AD-126519.
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A STUDY OF A CASCADE SYSTEM FOR SUPERSONIC FLOW DIFFUSION, by E. Beder and R. D. Buhler, May 1954. 75 p. WADC TR-54-261; Contr. AF 33(616)-100. AD-48905.
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THEORETICAL AND EXPERIMENTAL NORMAL FORCE DISTRIBUTION ON A CONE-FRUSTUM BODY AT SUPERSONIC SPEEDS, by Wm. D. Murphree, 15 Sep 1956. 49 p. TR-2R19F.
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ON A STATISTICAL THEORY FOR ONE-DIMENSIONAL REAL GAS FLOWS, by Paul Lieber and Koon-Sang Wan, Sep 1957. 25 p. AFOSR TN 57-478; Contr. AF 18(600)-1704. AD-136470.
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A PRINCIPLE OF MINIMAL DISSIPATION FOR REAL FLUIDS, by Paul Lieber and Koon-Sang Wan, Aug 1957. 54 p. AF OSR TN 57-477; Contr. AF 18 (600)-1704. AD-136469.
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AN EXACT SOLUTION FOR FREE RECTANGULAR PLATES LATERALLY LOADED, by Luigi Broglio, Aug 1956. 113 p. Scuola Di Ingegneria Aeronautica Tech. Note No. 2. AF OSR TN-57-288; Contr. AF 61(514)-888. AD-132359.
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ON THE INFLUENCE OF THE GEOMETRY OF SLENDER BODIES OF REVOLUTION AND DELTA WINGS ON THEIR DRAG AND PRESSURE DISTRIBUTION AT TRANSONIC SPEEDS, by F. Keune and K. Oswatitsch, 15 Apr 1955. 34 p. KTH AERO TN-42; Contr. AF 61(514)-811.
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Order from LC mi $2.40, ph $3.30 PB 128627

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FURTHER RESEARCH ON THE PHYSICS OF AIR VISCOSITY, by Markus Reiner, 15 July 1956 to 14 Feb 1957. 11 p. AF OSR TN-57-189; Contr. AF 61 (514)-964. AD-126484.
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METALLURGY

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Zapffe, Carl A., Baltimore, Md.
GAS-METAL SYSTEMS by C. A. Zapffe and M. M. Eckstein, 30 Sep 1953. 17 p. Contr. N6onr-25802. AD-28908.
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ELECTROREFINING TITANIUM METAL, by J. R. Nettle, and D. H. Baker, Jr. and others. Feb 1957. 46 p. RI 5315.
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Period 1 July 1955-30 June 1956.

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ROLLING OF HIGH-ALUMINUM IRON ALLOYS, by K. Foster and D. Pavlovic, Dec 1955. 24 p. WADC TN 56-29; Contr. AF 33(616)-309.
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EFFECT OF STRAIN RATE ON THE STRENGTH PROPERTIES OF SINGLE AND MULTIPLE RIVETED LAP AND BUTT JOINTS, by Richard F. Klinger, Feb 1955. 13 p. WADC TR-54-122. AD-67338.
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Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
RESEARCH AND DEVELOPMENT ON THE ELECTRON DENSITY DISTRIBUTION IN SEMI-CONDUCTORS, by G. A. Jeffrey and G. E. Pringle, 1 Feb thru Dec 31, 1955. 42 p. Contr. DA 36-061-ORD 463.
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TABLES OF THERMODYNAMIC PROPERTIES OF AIR FROM 3000 K to 10,000 K., C. E. Treanor and J. G. Logan, Jr., June 1956. 33 p. Report No. AD-1052-A-2. AF OSR TN-56-343; Contr. AF 40 (600)-6; AF 18 (603)-10; Contr. AF 18 (603)-10. AD 95219.
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Contribution No. 90.
Contents: 1. Theory of heats of adsorption on a uniform surface. 2. Effects of lateral interaction and grain boundaries.

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Order from LC mi $2.70, ph $4.80 PB 128970

Contribution No 88.
Contents: The heats of adsorption of helium and neon on graphitized carbon black.

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Contribution No. 91.
Contents: An approximate site distribution function from adsorption data; Application to adsorbed helium.

Curtiss-Wright Corp., Caldwell, N. J.
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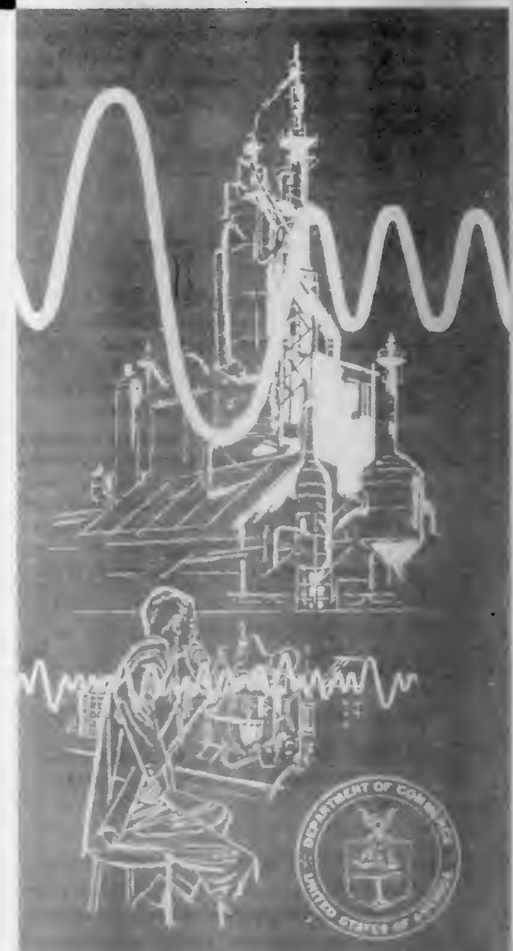

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Army Chemical Warfare Labs., Army Chemical Center, Md.
JOURNAL ARTICLES FISCAL YEAR 1958.
Oct 58, 27p. 77 refs. CWL Special pub. 4-6.
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BASIC RESEARCH RESUMES: A SURVEY OF BASIC RESEARCH ACTIVITIES IN THE AIR RESEARCH AND DEVELOPMENT COMMAND. Rept. on Contract AF 49(638)652. Dec 59, 341p. AFOSR-TR-59-204.
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ASTRONOMY

Radio Astronomy Lab., U. of Alabama, University.
A RADIO STUDY OF THE SUN AND MOON AT MILLIMETER WAVELENGTHS, by F. H. Mitchell and Robert N. Whitehurst. Final technical rept. on Contract DA 01-009-ORD-456. 21 May 58, 13p. 5 refs. AD-161 317.
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Solar and lunar temperatures and atmospheric attenuation were measured at selected millimeter wavelengths. The solar temperature is 4500°K at 6 mm, 5700°K at 7.5 mm, and 6500°K at 8.5 mm. No fluctuations were observed. The lunar temperature varies with phase angle in a rather complex manner from 125°K near new moon to 175°K about 4 days after full moon. The values of atmospheric attenuation are consistent with the Van Vleck theory, but absorption in some types of clouds is smaller than anticipated, particularly between 6 and 7 mm. A small effort was devoted to the analysis, design, and construction of a crystal-audio radiometer for the 3-4 mm wavelength region. (Portions of this report will not reproduce well)

Astrophysics

Harvard Coll. Observatory, Cambridge, Mass.
CLASSIFICATION OF SOLAR PROMINENCES - VIII - 1947, by Donald H. Menzel and F. Shirley Jones. Scientific rept. no. 3 on Contract AF 19(604)4962. Dec 59, 54p. AFCRC-TN-59-639.
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SOLAR RADIO INTERFERENCE AT 125, 200, 425, 550 Mc/s, by A. Maxwell, W. E. Howard, III and G. Garmire. Scientific rept. no. 14 on Contract AF 19(604)1394. July 59, 84p. 48 refs. AFCRC-TN-59-459.
Order from LC mi$4.80, ph$13.80 PB 144 925

This report comprises a detailed analysis of the occurrence and intensity of solar radio bursts at four frequencies in the meter band. The report also includes a brief description of the sweep-frequency equipment and calibration procedures at the Fort Davis Station, a discussion of the characteristics and origin of the four spectral types of solar radio bursts, and a brief account of the association of the bursts with solar optical phenomena. The interfering effects of solar radio activity on radar and radio equipment are discussed at the end of the report.

National Bureau of Standards, Washington, D. C.
A MULTIPLET TABLE OF ASTROPHYSICAL INTEREST, REVISED EDITION. PART I. TABLE OF MULTIPLETS. PART II. FINDING LIST OF ALL LINES IN THE TABLE OF MULTIPLETS, by Charlotte E. Moore. Nov 59, 252p. 410 refs. Technical note 36.
Order from OTS $4.00 PB 151 395

Pending the completion of a current edition, the 1945 Multiplet Table is being reprinted here to meet continuing demands. The leading lines in 196 atomic spectra of 85 chemical elements are listed in related groups called multiplets. Estimated intensities, excitation potentials and multiplet designations are given for the individual lines, and each multiplet is assigned a number. An extensive bibliography covers the source material used for the compilation. The Table is presented in two parts: Part I includes the multiplets, with the spectra of each element being given in order of increasing ionization, and the elements in order of increasing atomic number. Part II is a Finding List in which all the lines in Part I are entered in order of increasing wavelength, with their multiplet numbers. The range of the Table is from 2951 A to 13164 A. A supplementary table of "Forbidden Lines" extends from 2972 A to 12645 A. (Author)

Oslo U. (Norway).
STUDIES IN THE GENERAL FIELD OF THE INTERRELATION OF SOLAR RADIATION IN THE OPTICAL AND METER-WAVE REGIONS WITH OTHER SOLAR PHENOMENA AND PHENOMENA TAKING PLACE IN THE TERRESTRIAL ATMOSPHERE, by Svein Rossland. Technical (Final) rept. for 1 July 54 - 31 Dec 56 on Contract AF 61(514)651-C. 21 Jan 57, 38p. 5 refs. AFCRC-TR-57-267; AD-117 172.
Order from LC mi$3.00, ph$6.30 PB 137 682

Researches in the field of solar radio noise: radiometric observations on 200 mc; general remarks on the registrations on 200 mc; analysis of registrations of solar radiation on 200 mc; a burst analysis receiver; construction of a triple-element interferometer for 200 mc; observations on 55 mc and 500 mc; and analysis of solar eclipse data of June 30, 1954. On sunspot magnetism: the magnetic buoyancy effect; the hypothesis of a toroidal magnetic field on the sun; the magnetic field of sunspots and the Evershed effect; and on short period variations in sunspot magnetic fields. Geometric structure of sunspots: structure of regular single sunspots; structure of double or multiple sunspots; variation of spot structure across the solar disk; and remarks on solar activity indices. Researches on prominences; and flares: theoretical considerations on prominences; and filter observations of prominences and flares. Solar origin of cosmic rays: Solar-terrestrial relationships. Notes on trial projects abandoned or postponed: investigations on the orientation of the axes of sunspots; proper motions of sunspots; the nature of spicules and their dependence on solar magnetic fields; and deformation of a fluid conducting sphere in a magnetic field.

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TARGET RECOGNITION ON COMPLEX DISPLAYS, by Charles A. Baker, Dominic F. Morris, and William C. Steedman. Rept. on Criteria for the Design and Arrangement of Displays. Aug 59, 28p. 4 refs. WADC Technical rept. 59-418; AD-228 809.
Order from OTS $0.75 PB 161 310

A study was conducted to determine the speed and accuracy of form recognition as a function of: (1) the amount of distortion between the reference form and the target form, (2) the number of irrelevant forms in the target display, and (3) the stimulus properties of the forms involved. The stimulus forms were generated by filling in, on a statistical basis, some of the cells of a 90,000-cell matrix. The subjects were shown a reference photograph of a target and instructed to locate that target on a display containing numerous other forms. Both criterion measures, viz., search time and errors, increased as a function of: (1) an increase in the number of irrelevant forms on the target display, and (2) an increase in the difference between the resolution of the reference form and that of the target display. A quantitative description of the targets, which can be used to predict relative target difficulty, was developed. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
UTILIZATION OF MULTIPLE CUES IN PAIRED COMPARISONS, by James V. Bradley. Rept. on research at Antioch Coll. on Contract AF 33(616)6095. Sep 59, 44p. 13 refs. WADC Technical rept. 59-548.
Order from OTS $1.25 PB 161 419

Subjects were given one, two, or three cues with which to make an either—or decision. Certain hypotheses were formulated to describe the subject's thought process in utilizing the multiple cues, and mathematical models were constructed to simulate them. The models were then used upon data for the single-cue case to predict performance in the multiple-cue case. Predicted performance "data" were then compared with actually observed data for the same multiple-cue case, thus testing the predictive validity of the mathematical model and the tenability of the corresponding hypothesis. (Author)

Institute for Cooperative Research, Johns Hopkins U., Baltimore, Md.
APPARENT AND REAL RESOLUTION IN RADAR VISIBILITY, by Harold W. Hake and Emanuel Averbach. Rept. on Human Engineering Analysis of Weapon Systems, Contract AF 33(038)22642. Sep 55, 15p. 9 refs. WADC Technical rept. 55-459; AD-94 316.
Order from LC mi$2.40, ph$3.30 PB 145 334

Differential sensitivity for luminance differences existing in two spatially separated homogeneous fields was measured under three conditions of viewing. In the first the comparison fields, presented on a cathode ray tube face, were separated by darkness; in the second the fields were joined by a transition area in which luminance increased linearly from the value presented in the darker field to that presented in the lighter field. A third condition controlled for the decrease in size of the fields which occurred with increasing separation of them.

Naval Training Device Center, Port Washington, N. Y.
SENSORY INTERACTION AND RESPONSE CAPACITY, by Alexander Goldman. June 59, 60p. 21 refs. Technical rept. NAVTRADEVCEN 789-11-1; AD-225 517.
Order from LC mi$3.60, ph$9.30 PB 144 948

An attempt was made to determine whether the operator in a man-machine system with very high input rates can perform more efficiently when the sensory inputs are through one sense modality or divided between 2 sense modalities. A research tool was developed which permits the display of a target to be tracked so that the movement in either the horizontal or vertical axis may be displayed on the video component while the other is displayed on the audio component; or the movement in both planes may be shown on the video alone; or the movement in both planes may be shown on the video while one of them is also presented in the audio display. Provision was made for a second audio display, so that movement in both horizontal and vertical planes may be presented as audio signals. Any standard control may be used to track the target. Thirty-two Army enlisted men were used as subjects. Results indicated that compensatory tracking was more proficient when the display was entirely video than when it was partly presented by the video component and partly by the audio. When the display was entirely visual, single control (joystick) was superior to two-handed (linear) control. When the display was mixed audio and video, the two-handed control was superior.

Naval Training Device Center, Port Washington, N. Y.
TRACKING PERFORMANCE RELATED TO DISPLAY CONTROL CONFIGURATIONS, by James J. Regan. 23 Jan 59, 37p. 35 refs. Technical rept. NAVTRADEVCEN 322-1-2.
Order from LC mi$3.00, ph$6.30 PB 144 966

The form in which information is presented to and in which control is exercised by operators in instructor's stations and other training equipments can have important effects on the tracking performance of these operators. Questions frequently arise concerning the way in which these display-control configurations should be designed. This research was designed to supplement the information in this area especially as these decisions are affected by a variety of related variables including practice.

Personnel and Training

Adjutant's General's Office, Washington, D. C.
ABSTRACTS OF PRB RESEARCH PUBLICATIONS FY 1959, by A. J. Drucker and Emma E. Brown. Oct 59, 35p. PRB Technical Research Note 105.
Order from LC mi$3.00, ph$6.30 PB 145 110

This volume identifies both by publication serial number and by Research and Development Research Task all research publications prepared and released by the Personnel Research Branch of The Adjutant General's Office in FY 1959. The listing includes 5 Technical Research Reports, 9 Technical Research Notes, 9 Research Studies, and 14 Research Memorandums. Where a publication has been abstracted, the principal research findings have been described in non-technical language as much as possible.

Adjutant General's Office, Washington, D. C.
DEVELOPMENT OF THE ARMY QUALIFICATION BATTERY, AQB-1, by A. G. Bayroff, Leonard C. Seeley, and Alan A. Anderson. Oct 59, 18p. 2 refs. PRB Technical research rept. 1117.
Order from LC mi$2.40, ph$3.30 PB 145 075

The operational requirement that an enlisted man have at least two aptitude area scores of 90 or above to qualify for Army service necessitated more intensive screening of applicants for enlistment and SS

registrants, particularly of men in the Category IV aptitude level. In 1958 the ACB was introduced at all Armed Forces Examining Stations (AFES) as a screening measure. Development and standardization of the Army Qualification Battery composed of tests which are shorter and more appropriate to a limited ability range than the ACB tests is described. The eight AQB tests (four AFQT subtests and four additional short tests parallel to ACB tests) were found to yield satisfactory measures of scores on individual ACB tests. The AQB composites were found to be closely related to corresponding ACB aptitude area scores. As differential measures of the aptitudes of Category IV personnel, the AQB composites can be expected to function as effectively as ACB aptitude areas in identifying the least useful potential soldiers and in appropriately classifying those accepted. (Author)

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AN EVALUATION OF THE EFFECTIVENESS OF A SELF-TUTORING APPROACH APPLIED TO PILOT TRAINING, by Richard S. Hatch. Rept. on Human Factors in the Design of Training Equipment. July 59, 26p. 4 refs. WADC Technical rept. 59-320.
Order from OTS $0.75 PB 161 440

This study concerns the problem of insuring ready recall of a large body of in-flight job information for Air Force pilots. The effectiveness of a voluntary self-tutoring approach utilizing one type of "game appeal" device was examined. Two matched groups of Air Force pilots were pretested on their knowledge of instrument flying information. The device was then installed in the crew lounge of one of the groups. No device was available to the other group. After a 2-month period both groups were post-tested. Despite the fact that minimal exposure to the machine occurred, players improved significantly on the criterion tests while non-players did not improve. Factors pertinent to the interpretation of the results and implications for further research were discussed. (Author)

Applied Psychological Services, Wayne, Pa.
POST-TRAINING PERFORMANCE CRITERION DEVELOPMENT AND APPLICATION: THE SESR PROGRAM: COMMISSIONED AND PETTY OFFICER OPINIONS, by Arthur I. Siegel, Philip Federman and Milton Richlin. Rept. on Contract Nonr-2279(00). Feb 59, 28p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 144 791

A series of interviews was held with a small sample of supervisory fleet personnel in order to determine reactions to the Selective Emergency Service Rates program. Problems in assigning the specialized man in accordance with his specialty were evident, especially in understaffed squadrons. Opinion was generally divided regarding the technical superiority of the SESR program trained individual as compared with the graduate of the previous training program. It was generally thought that the SESR program graduate reaches competency earlier but many supervisors preferred the graduate of the previous program because of his more general usefulness. The supervisors thought the SESR program graduate to be accepted by squadron personnel and maintained that few morale differences were evidenced between the products of the two training programs. Ongoing, longitudinal study of the SESR program was suggested for more definitive conclusions. (Author)

Aviation Psychology Lab., U. of Illinois, Urbana.
TRANSFER OF TRAINING IN FLIGHT PROCEDURES FROM SELECTED GROUND TRAINING DEVICES TO THE AIRCRAFT, by Dora J. Dougherty, Robert C. Houston, and Douglass R. Nicklas. Rept. on Contract N6ori-71-16. 1 Sep 57, 97p. 17 refs. NAVTRADEVCEN Technical rept. 71-16-16; AD-149 547.
Order from LC mi$5.40, ph$15.30 PB 138 224

Four configurations of ground training devices were evaluated for training pilots to perform in-flight procedures. These were a photographic mockup of the cockpit, a partly activated trainer, an aircraft flight simulator, and the combination of a part task (procedures trainer) and time-shared tracking task. All 4 methods provided good learning situations. The groups trained on procedures trainers and the flight simulator showed the highest degree of transfer to the first air trial. Neither method was superior in this respect. Training on an operational flight trainer or a procedures trainer did not significantly differ from the same amount of training in the aircraft itself. The photo mockup provided the best learning situation as measured by performance in the ground situation. By the third air trial, no differences could be observed as a result of training with the different methods. The group that learned procedures while practicing the tracking task had the most difficulty in learning. Transfer to the aircraft was not quite as high as practice in the procedures trainer alone. Time sharing while learning procedures did not facilitate the in-flight performance of procedures and flight skills.

Electric Boat Div., General Dynamics Corp., Groton, Conn.
TRAINING EFFECTIVENESS AS A FUNCTION OF SIMULATOR COMPLEXITY, by John M. Newton. Rept. on Contract N61339-458. Sep 59, 94p. 10 refs. Technical rept. NAVTRADEVCEN 458-1.
Order from LC mi$5.40, ph$15.30 PB 145 165

Although generally, there were no significant differences among the proficiency scores obtained under the five conditions, the general trend is for the mean scores to be ranked in order of simulator complexity. Thus, scores of the subjects trained on the same simulator on which they were tested were consistently higher; subjects trained on the PACE computer were second, followed by those trained with the 20-amplifier Donner computer, 18-amplifier Donner computer with motion in tilt-table and the 18-amplifier Donner computer with no motion in the tilt-table. (Author)

Family Relations Center, San Francisco, Calif.
THE REHABILITATION OF NAVAL DISCIPLINARY OFFENDERS, by Harry N. Coffin and C. E. Keeler. Status rept. no. 7 (Annual technical rept. no. 3) on

Contract Nonr-1535(00). 13 Jan 58, 15p. AD-159 624.
Order from LC mi$2.40, ph$3.30 PB 138 287

The following studies, conducted at the US Naval Retraining Command, were abstracted: (1) revision and refinement of a theory of interpersonal maturity, and the development of techniques for the measurement of maturity levels; (2) the prediction of military delinquency, (3) the prediction of success on restoration to military duty; (4) program effectiveness in Naval retraining; (5) living group study; (6) sociometric analysis-interpersonal maturity and role perception; (7) implicit personality theories of living group study supervisors and consultants; (8) inverse factor analysis of living group study supervisors' and consultants' personality characteristics; (9) interpersonal variables related to recidivism in military delinquency; (10) personality test factors in a civilian delinquent population; (11) living group controls; (12) factors related to ability to predict restoration success; and (13) personality test factors in a population of confined military delinquents.

Family Relations Center, San Francisco, Calif.
THE REHABILITATION OF NAVAL DISCIPLINARY OFFENDERS, by J. Douglas Grant. Annual technical rept. no. 4 on Rehabilitation Research, Contract Nonr-1535(00). 28 Feb 59, 31p. 69 refs.
Order from LC mi$2.70, ph$4.80 PB 144 820

Abstracts of the various panels of the research conducted at the U. S. Naval Retraining Command, Camp Elliott, San Diego, California. This research program is concerned with the rehabilitation of Naval disciplinary offenders.

Georgetown U. Medical Center, Washington, D. C.
A TEST PROGRAM FOR TWO ANTARCTIC EXPEDITIONS: 1956-1959, by Herbert Zimmer. Final rept. for 1 June 57-15 Dec 58 on Contract Nonr-1530(06). 15 Dec 58, 97p.
Order from LC mi$5.40, ph$15.30 PB 145 091

This report consists of the tests, checklists, rating forms, instructions, schedules, etc., used in Operation Deepfreeze III, in order to make them available to future investigators, since they are not published elsewhere.

Harvard Graduate School of Education, Cambridge, Mass.
ON IDENTITY AND LEVEL OF OCCUPATIONAL ASPIRATION, by David V. Tiedeman and Jiwan Lal Pandit. Rept. no. 9 on Harvard Studies in Career Development, Technical rept. no. 5 on Contract Nonr-1866(31). Dec 58, 35p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 088

This investigation considers only the reports an individual makes about himself. No comparison with the opinion of any other person is yet attempted. In this regard, this study falls short of considering an important aspect of Erikson's explanation of identity, namely the actual evaluations others hold of the one whose identity is investigated. Two schools were used to provide some indication of the stability of the results. Pupils expressed their opinions with regard to themselves and members of the following social system.

Human Resources Research Office, George Washington U., Washington, D. C.
AN IMPROVED ADVANCED INDIVIDUAL TRAINING PROGRAM FOR ARMOR, by Eugene F. MacCaslin, Arnold B. Woodruff, and Robert A. Baker (Army Armor Human Research Unit). Rept. on Contract DA 49-106-qm-1. Dec 59, 82p. 15 refs. Technical rept. 59.
Order from LC mi$4.80, ph$13.80 PB 145 134

As the final phase in research on tank crew proficiency, an experimental Armor AIT program was developed to improve training for the jobs of tank driver, loader, and gunner. Performance of a company trained by the six-week experimental program was compared with performance of a control company just completing the standard eight-week AIT program. The experimental company performed better than the control company in 11 of 21 skill areas tested, including the more complex gunnery skills essential in combat, and scored comparably in seven skill areas. Adoption of the experimental program was recommended as requiring less time and training cost, without lessening proficiency in essential armor crew skills. The principles and techniques used in the training program for improving instruction were recommended for use, where appropriate, in other Army training programs. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE USE OF AN OPERATIONAL GAME AS A METHOD OF TASK FAMILIARIZATION, by R. G. Kinkade and J. S. Kidd. Rept. on Contract AF 33(616)3612. July 59, 22p. 8 refs. WADC Technical rept. 59-204.
Order from OTS $0.75 PB 161 439

An evaluation of the usefulness of an "operational game" as a system task-familiarization device was attempted. A sample of 20 Ss was divided into two groups after completion of component skill training. One group was given 5 hr. of practice on an operational game derived from a radar air traffic control task. The other group went directly into system training on the end task provided by an electronic ATC simulator. Comparison of the two groups' proficiency during system training on the end task indicates a consistent superiority for the group having had preliminary practice with the operational game. It was hypothesized that the positive transfer effects observed were due to the similarity between the decision-making requirements of the two situations. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
THE DEVELOPMENT OF A NON-COGNITIVE BATTERY: PREDICTION OF RADIOMAN PERFORMANCE, by David Kipnis and Albert S. Glickman. June 59, 28p. 9 refs. BuPers Technical Bulletin 59-14; AD-225 616.
Order from LC mi$2.70, ph$4.80 PB 144 674

In this third in a series of reports on the development of tests of temperament and personality for predicting the performance of enlisted personnel, a number of experimental tests of temperament and personality were administered to entering students at Class A Radioman School. Final grades and marks in code-receiving were obtained from school records. Evaluations of duty performance were obtained from each Radioman's most immediate supervisor about one year after testing. It was found that some of the experimental tests were reasonably effective in predicting both the school grades and the level of performance of duty of the enlisted man. Because of the promise indicated in this study, the research with tests of temperament and personality is being continued and expanded to include different ratings. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
RELATIVE WEIGHTS OF OFFICER CANDIDATE COURSE GRADES, by Byron Groesbeck. June 59, 16p. 1 ref. BuPers Technical Bulletin 59-7; AD-227 795.
Order from LC mi$2.40, ph$3.30 PB 144 539

A comparison was made between (1) the weights prescribed by BuPers for OCS course grades, (2) the weight actually received by each course grade when multiplied by the prescribed weight and summed to form the final grade, and (3) the weight that would be received by each course grade if the final grade were a simple sum of the original course grades. The results obtained from OCS classes 34 and 35 were almost identical. If the final grade were a simple sum of course grades, the engineering, navigation, operations, and naval weapons grades would tend to have greater weight in determining the final grade than would the orientation, seamanship, and military aptitude grades. When the course grades are multiplied by the prescribed weights and summed to form the final grade, the weights of the course grades correspond fairly well to the prescribed weights. Exceptions are the navigation grade, which receives relatively more weight than desired, and the military aptitude grade, which receives relatively less weight than desired. (Author)

Personnel Lab., Lackland AFB, Tex.
PREDICTION OF AIR FORCE TRAINING AND PROFICIENCY CRITERIA FROM AIRMAN CLASSIFICATION BATTERY AC-2A, by Leland D. Brokaw. Oct 59, 20p. 2 refs. WADC-TN-59-196; AD-228 445.
Order from LC mi$2.40, ph$3.30 PB 144 792

The validity of the Airman Classification Battery AC-2A during the first 14 months of its administration was determined. Data are presented for 46 specialties for which both technical training and job proficiency criteria were available, in the form of Final School Grades and Airman Proficiency Test Scores. Technical training validities are given for an additional 20 technical schools. The expectation of some reduction of general validity as a function of maximizing differentiating power was realized. Slightly greater drops in general validity than had been anticipated were found in the mechanical and administrative aptitude clusters, while the remainder of the battery showed validity comparing favorably with the preceding Battery AC-1B. The AC-2A Battery demonstrated itself to be an effective instrument for differential classification; interpretation of its validities are made in this frame of reference. Current Air Force policies require a different kind of instrument for most effective recruitment and placement of new airmen. (Author)

Psychology

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A DEVICE FOR MEASURING CROSS MOTOR BEHAVIOR IN PRIMATES, by Donald W. Ormiston, Frederick H. Rohles, Jr. and Marvin E. Grunzke. Rept. on Behavioral Effects of Unusual Environmental Conditions. Oct 59, 9p. WADC Technical note 59-353.
Order from OTS $0.50 PB 161 410

To meet the need for a method of measuring gross motor behavior as affected by various gravitational forces, a jumping device for primates was developed consisting of a large box with a stand at each end and a well in the middle. The well carried a constant electrical charge. Shock, preceded by a tone, was used to make the animal jump over the well to the opposite side. Motion pictures of the jump, as viewed through the plexiglas side and top, allowed measurement of the height and distance of the jump. Other possible uses of the device are discussed. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
JUDGMENTS OF THE RELATIVE FREQUENCY OF SEQUENTIAL BINARY EVENTS: EFFECTS OF FREQUENCY DIFFERENCES, by Dwight E. Erlick. Rept. on research done at Antioch Coll. on Contract AF 33(616)6095. Oct 59, 22p. 3 refs. WADC Technical rept. no. 59-580.
Order from OTS $0.75 PB 161 426

This study concerns accuracy of discriminating which of two events occurred more frequently when both are presented in a random sequential order, at a constant rate, too fast to permit counting. Subjects were required to indicate on a 10-cm. scale the proportion of the total time occupied by the more frequent event. Each judgment was based on a total of 100 events, with the overall per cent differences between the occurrence of the two elements being 0, 4, 10, and 14. The mean proportion of correct judgments increased as the per cent difference between the frequency of the events increased, with an 8.3 per cent difference being discriminated correctly 75 per cent of the time. The actual proportion of the trial occupied by the more frequent event was over estimated at the higher per cent differences. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
ALTERED ENVIRONMENTS FOR BIOLOGICAL SPECIMENS. I. RESTRAINT CONDITIONING OF LARGE BIOLOGICAL SPECIMENS, by William E. Ward. Oct 59, 20p. 2 refs. AFMDC-TN-59-36.
Order from LC mi$2.40, ph$3.30 PB 144 795

A report describing the initial phase of a study of the psychobiology of restrained immature chimpanzees under conditions of isolation and aircraft flight is presented. Restraint was accomplished by securing the subjects in small nylon vests and buckling the latter to chairs developed for this purpose. The subjects adapted rapidly to restraint and at the end of four months were sitting restrained on the ground for six hours each day under isolated conditions, as well as flying restrained for four hours each week. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
MARKOV LEARNING MODELS FOR MULTIPERSON SITUATIONS, I. THE THEORY, by Patrick Suppes and Richard C. Atkinson. Technical rept. no. 21 on Contract Nonr-225(17). 20 Feb 59, 79p. 26 refs.
Order from LC mi$4.50, ph$12.30 PB 144 957

Army Medical Research Lab., Fort Knox, Ky.
DIFFERENTIAL SATIATION EFFECTS UNDER FIXED-RATIO AND REGULAR REINFORCEMENT SCHEDULES, by P. L. Carlton. Rept. on Psychophysiological Problems. 28 May 58, 8p. 3 refs. Rept. no. 318.
Order from LC mi$1.80, ph$1.80 PB 144 786

Two water deprived rats were extensively trained on concurrent fixed-ratio and regular reinforcement schedules. After their performance had stabilized, the effects of satiation on the behavior generated by these two schedules were observed. It was noted that satiation served to increase the duration of periods of no responding under the fixed-ratio schedule without altering the response rate. On the other hand, responding under the regular reinforcement schedule was unchanged. (Author)

City Coll. of the City of New York.
PERSONAL NEEDS AND THE ACCEPTANCE OF A NEW GROUP AS A REFERENCE GROUP, by Ruth E. Hartley. Technical rept. no. 6 on Acceptance of a New Reference Groups, Contract Nonr-1597(01). 15 Feb 58, 16p. 16 refs. AD-154 874.
Order from LC mi$2.40, ph$3.30 PB 138 286

The relationship between the perceived satisfaction of a complex of needs and the acceptance of a new membership group as a reference group was examined. The following hypotheses were formulated and tested: (1) the more successful a new group is perceived to be in meeting the personal needs of an individual, the more likely he is to accept it as a reference group; (2) the more successful a new group is perceived to be in meeting the personal needs of an individual, in comparison with his established groups, the more likely he is to accept it as a reference group; and (3) the effectiveness of the new group in meeting the needs of the individual, as shown by the individual's acceptance of the group as a reference group, is defined by the importance assigned by the individual to the needs that the group meets, as well as by the individual's perception of the degree to which given needs have been met by the group. Subjects were 146 male freshmen at a municipal college, and data were obtained by means of questionnaires. All the hypotheses were supported by the data. The data indicated that the absolute level of the ability of a given group to fulfill the needs of its members is more significant than its comparative standing in this respect in relation to other membership groups. The data also suggested the operation of a general personality tendency, evidenced by the comparative importance assigned to one's needs, in association with a tendency to the ready acceptance of a new group as a reference group.

Connecticut Coll., New London.
PSYCHOLOGICAL STRESS AND RELATED CONCEPTS: INDICES TO A BIBLIOGRAPHY, by Mortimer H. Applezweig. Supplement to Technical rept. no. 7 on Motivation Research Project, Contract Nonr-996(02). Jan 58, 37p. AD-158 086.
Order from LC mi$3.00, ph$6.30 PB 138 257

(See also PB 138 221)

Connecticut U., Storrs.
VERBAL GENERALIZATION: A THEORETICAL RATIONALE AND AN EXPERIMENTAL TECHNIQUE, by W. A. Bousfield, B. H. Cohen, and G. A. Whitmarsh. Technical rept. no. 23 on Contract Nonr-631(00). Jan 58, 10p. 3 refs.
Order from LC mi$1.80, ph$1.80 PB 138 336

The study describes a purely verbal method for studying verbal generalization. A pilot study making use of this method yielded results interpreted as giving some support for the proposed rationale.

Dunlap and Associates, Inc., Stamford, Conn.
MOTOR HABIT INTERFERENCE: A RESUME OF THE LITERATURE AND THE DEVELOPMENT OF PRINCIPLES FOR ITS MINIMIZATION IN TRAINING, by Alfred F. Smode, Jerome C. Beam, and Jack W. Dunlap. Rept. on Contract Nonr-2515(00). Jan 59, 109p. 148 refs.
Order from LC mi$5.70, ph$16.80 PB 144 750

This report presents a detailed discussion of habit interference in motor performance. It is expressly written for operating personnel responsible for the conduct of training in the military, and for psychologists engaged in the area of training research. Three major sections are developed. Chapter I presents a technical review of the literature on what currently is known on habit interference. A brief non-technical summary of the empirical findings on habit interference is presented at the end of the chapter for those individuals more interested in the

essence of the empirical data. Chapters II and III are devoted to the development of techniques and procedures for minimizing the effects of interference in perceptual-motor learning. Chapter III is devoted to the development of categories of behavior which embrace the variety of motor-manipulative jobs for which military personnel are trained. Within this framework principles and hypotheses are developed for minimizing habit interference for the categories or types of motor behaviors identified.

Educational Testing Service, Princeton, N. J.
LEVEL OF ASPIRATION MEASURES AND SELF-ESTIMATES OF PERSONALITY IN RELATION TO ACHIEVEMENT MOTIVATION, by Henry N. Ricciuti and Douglas G. Schults. Rept. on Contract Nonr-694(00). Jan 58, 25p. 12 refs. AD-154 568.
Order from LC mi$2.70, ph$4.80 PB 138 338

The primary purpose of this research was to investigate the relationship between level of aspiration measures derived from two cognitive tasks and achievement motivation scores obtained by means of the thematic apperception method. A secondary purpose was to compare the achievement motivation scores with several indices of reported self-perceptions with respect to various personality traits. The subjects were 61 male and 34 female college students. For measuring achievement motivation, the general technique developed by McClelland and his co-workers was used. A small and generally negative relationship was found between achievement motivation and self-criticalness, regardless of the perceived status, on the Check List traits. The pattern of correlations indicated a sex difference similar to that obtained with the aspiration measures. There was also a suggestion of a low, negative correlation between achievement motivation and favorable self-appraisal on the Check List traits.

Michigan U. Research Inst., Ann Arbor.
LABORATORY FACILITIES EMPLOYED IN PSYCHO-MEMORY EXPERIMENTS, by Robert C. Bilger. Rept. on Contract AF 49(638)369. Sep 59, 20p. 2 refs. Technical memo. no. 72; 2803-2-T; AFOSR-TN-59-923.
Order from LC mi$2.40, ph$3.30 PB 144 793

Equipment and operating procedures used in psychophysical memory experiments at Electronic Defense Group are described and illustrated. This equipment gives precise control of signal parameters and enables one to efficiently collect the large quantities of data required for specification of the parameters of the human hearing mechanism. (Author)

New Mexico U., Albuquerque.
RELATIONSHIPS AMONG THE TRAITS OF THE PERCEIVER AND THOSE OF THE PERCEIVED IN IMPRESSION FORMATION, by David T. Benedetti, Robert M. Morgan, and David W. Bessemer. Final rept. on Contract AF 49(638)33, Phase 4. Sep 59, 51p. 14 refs. AFOSR-TR-59-187.
Order from LC mi$3.60, ph$9.30 PB 144 787

Two questions were experimentally investigated: To what extent are the impressions one forms of other persons contingent upon the extent to which one possesses the traits one perceives in the others? When one perceives another person, is the resulting impression an integrated or a piecemeal cognition? College students were given controlled information about a series of hypothetical persons. The impressions they formed were measured in a variety of ways. The major conclusions were: (1) In general, one's personality traits are not potent, overall determiners of the impressions one forms of others, although there are certain selective relationships here; (2) Impressions formed of other people clearly tend to be integrated cognitions, in the sense that judgemental responses based upon them are typically intercorrelated. This study is predicated upon the assumption that since interpersonal behavior is in part a function of personality impressions, the prediction and control of such behavior in military or other practical situations calls for grounding in knowledge gained by basic research.

New York U., N. Y.
CONCEPT FORMATION AS A FUNCTION OF COMPETITION BETWEEN RESPONSE PRODUCED CUES, by Howard H. Kendler and Alan D. Karasik. Technical rept. no. 1 on Studies on the Experimental Analysis of Problem Solving Behavior, Contract Nonr-285(30). 15 Nov 57, 15p. 10 refs. AD-147 130.
Order from LC mi$2.40, ph$3.30 PB 137 859

A mediational S-R formulation was applied to verbal concept formation behavior. It was hypothesized that concept formation depended not only on S responding to words that belong to a concept (relevant words) with a common implicit response, but also S responding to the words that do not belong (irrelevant words) with different implicit responses. It was predicted, therefore, that different sets of irrelevant words should influence the manner in which a set of relevant words are combined into a common concept. This prediction was confirmed. The results suggested that the speed of concept formation varied directly with the ability of the irrelevant words to evoke implicit responses that are distinctively different from those required for the relevant words. (Author)

Ohio State U. Research Foundation, Columbus.
ORIGINALITY IN GROUP PRODUCTIVITY, by Pauline N. Pepinsky and Harold Pepinsky. Technical rept. no. 4 (Annual) 1 Jan-15 Nov 58, on Contract Nonr-495(15). 15 Nov 58, 20p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 144 851

This report is a resume of the work accomplished and in progress and is directed toward these general objectives: (1) the identification and measurement of behaviors that are independent and original, but contribute to group productivity; and (2) the determination of conditions leading to such behaviors, and the experimental testing of such effects.

Ohio State U. Research Foundation, Columbus.
THE RELATIONSHIP OF PHONETIC STRUCTURE TO THE INTELLIGIBILITY OF WORDS SIMULTANEOUSLY RECORDED AT EAR AND LIPS, by Henry M. Moser, Herbert J. Oyer and Susan M. Wolfe. Technical rept. no. 47 on Contract AF 19(604)1577. Apr 58, 28p. 15 refs. AFCRC-TN-58-54; AD-152 646.
Order from LC mi$2.70, ph$4.80 PB 137 943

Previous study has shown that when speech signals were recorded at lips and left ears of speakers, and fed to headsets of trained listeners at specified S/N ratios, signals, origin ear, were significantly more intelligible than signals, origin lips. A comparative analysis is made of phonetic elements of listener response to speech signals, origins ear and lips, elicited in the earlier study. Listener responses totaled 72,000. Listeners highly trained on fifty words tend to restrict substitute responses to words within the list for signals of both origins. Fewer substitutions of words from outside the original list occur as noise in the listening condition becomes more destructive. Substitutions remain relatively constant between origins through ratios. Omissions for stimuli, origin lips, increase more rapidly. Number of sounds in the test stimuli had no differential effect on intelligibility when related to origin. The frequency of occurrence of two, three, four, and five sound word substitutes is in almost complete agreement with frequency of occurrence of two, three, four, and five sound words in the test list. Analysis of intelligibility errors relative to vowels and diphthongs in the test list revealed that words containing [æ, ʌ, ɑ, ɔ, ɑʊ, and ɔɪ] were less intelligible from origin ear, than origin lips through S/N ratios. (Author)

Psychological Labs., Carnegie Inst. of Tech., Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS. V. CONSIDERATION OF SOME VARIABLES RELATIVE TO LEADERSHIP, by E. P. Hollander. Technical rept. on Contract Nonr-1849(00). Mar 59, 16p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 145 214

This is a report of findings from an investigation of sources of leadership status within eight training sections of naval officer candidates numbering thirty each. Variables of accuracy of estimate of other's values, academic performance, personal desire for social approval, and motivation to maintain affiliation with the section, were of particular concern. Except for academic performance, which quite usually reveals a positive relationship to leadership status in such groups, none of the other variables yielded significant relationships beyond trends. It is suggested that classes of this sort may not behave as functional groups because of the emphasis on intragroup competition, the absence of manifestly significant common goals, and the non-volitional aspects of membership. (See also PB 143 460)

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES IN SELECTION LEARNING. I. THE EFFECT OF SELECTION PROCESSES ON ACQUISITION AND RETENTION, by Eugene Burnstein. Technical rept. no. 1 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. Sep 59, 25p. 17 refs. AFOSR-TN-60-11.
Order from LC mi$2.70, ph$4.80 PB 145 101

The purpose of this study was to examine a type of learning called selection learning. It was hypothesized that there exist two factors in selection learning which cancel each other in acquisition, thus preventing differences in performance from appearing. One factor, facilitation of learning, was hypothesized to be a direct function of the informativeness of the selection cue. The other, interference with recall of international items was hypothesized to be a direct function of the informativeness of the selection cue. It was further hypothesized that the effects of interferences dissipate more rapidly than the effects of facilitation.

Research Center for Human Relations, New York U., N. Y.
STUDIES IN PRODUCTIVITY AND COHESIVENESS OF CULTURALLY MIXED GROUPS. II. EFFECTS OF VARIATIONS IN REWARD STRUCTURE, AUTHORITARIANISM, AND GROUP PRESTIGE, by Irwin Katz. Technical rept. no. 2 on Contract Nonr-285(24). Feb 59, 45p. 11 refs.
Order from LC mi$3.30, ph$7.80 PB 145 208

An experiment was performed in which bi-racial groups, consisting of two Negro college students and two white college students, were given a series of varied tasks to perform. Members of every group were matched on intelligence, informed of this fact, and caused to perform equally well on some cognitive tasks. As in a previous experiment, two types of Reward structure were created, Group Reward and Individual Reward, and also two conditions of Prestige, High Group Prestige and No Group Prestige. In addition, a new variable of Authoritarianism of white Ss was introduced by using high F-Scale scorers and low F-Scale scorers. Each experimental group was subjected to the same experimental treatment throughout its employment. Racial differences for all treatments combined indicated that Negroes oriented compliantly toward whites, felt intellectually inadequate, rejected whites as future work companions, and experienced less total satisfaction. Both the Reward variable and the Prestige variable had opposite effects on Negroes and whites. Negroes responded more favorably to Ind R and No P than to Grp R and Hi P, while whites responded more favorably to the latter conditions than to the former. Negroes were more ascendant with Hi F whites than with Lo F whites, and Hi F whites tended to be compliant in bi-racial situations but mutually antagonistic when paired alone. Numerous interactions of the F-Score variable with Reward and with Prestige revealed highly consistent patterns in which Hi F whites and Lo F whites responded in opposite ways to the experimental conditions.

Syracuse U., N. Y.
THE EFFECT OF NEED-ORIENTED COMMUNICATIONS ON ATTITUDE STRUCTURE AND CHANGE, by Francis J. Di Vesta and Jack C. Merwin. Rept. on Contract AF 41(657)73. June 58, 58p. 20 refs. WADC-TR-58-93; AD-151 044.
Order from LC mi$3.60, ph$9.30 PB 137 881

Several hypotheses, concerning attitude change and derived from a cognitive theory of attitude structure, were tested experimentally. The change procedure consisted of three tape recorded communications in which the positions were, respectively, that the attitude object facilitated, hindered, or had no effect on the satisfaction of the need for achievement. Scales of need strength, beliefs about the attitude object, and attitudes toward the attitude object were administered four months before, immediately before and/or immediately after the change procedure. Each of the two experimental groups and the control group was comprised of approximately 70 subjects. Changes in beliefs about the potentiality of the attitude object for satisfying the need for achievement corresponded to the position asserted by the respective communications. Corresponding changes in attitude were similarly demonstrated. An index based upon need strength and position of beliefs was found not to be related to change in attitude for the experimental groups but was significantly related to change in attitude occurring over a four months period. Significant relationships were found between initial position of attitudes and beliefs and the respective shifts in position. The findings were interpreted as supporting the cognitive theory of attitude structure. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
THE USE OF GROUP DECISION TO RESOLVE A PROBLEM OF FAIRNESS, by L. R. Hoffman and N. R. F. Maier. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 59, 15p. 2 refs. 2144-351-T; AD-210 919.
Order from LC mi$2.40, ph$3.30 PB 144 697

An experiment is reported on the problem of fairly distributing a reward among group members. An empirical investigation was conducted of the use of the method of group decision in making such a distribution. Thirty groups, varying in size from 2 to 5, in an undergraduate psychology course were each assigned a number of points toward the final grade to be divided among their members, with a net loss to the group for failure to agree. In almost three-fourths of the groups, points were awarded to the members with the lower class standings. Variance of points awarded was positively correlated with variance of grade points in a group, and the number of points received was negatively correlated with grade points accumulated by an individual. Satisfaction with the decisions, which was high, was positively related to an individual's felt freedom to participate and to his satisfaction with influence over the decision. People who gave and received many points were also satisfied. Appointed leaders failed to function as leaders but participated more than other group members. Implications of the results for a practical industrial problem involving differential needs are discussed. (Author)

BIOLOGICAL SCIENCES

Anatomy and Physiology

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A PRELIMINARY REPORT OF HUMAN RESPONSE TO REARWARD-FACING RE-ENTRY ACCELERATIONS, by Neville P. Clarke, Alvin S. Hyde and others. Rept. on Acceleration in Flight. July 59, 19p. 6 refs. WADC Technical note 59-109.
Order from OTS $0.50 PB 161 438

Tidal volume, electrocardiographic changes, tracking performance ability, and subjective response were evaluated during an acceleration profile designed to encompass several possible rearward-facing re-entry patterns. A maximum acceleration of 16.5 g and a total time of 170 seconds were employed. Subjects faced the center of rotation with the trunk and head inclined 12° in the direction of the centrifuge axis. The subjects were supported with a contoured net system. Two of seven subjects repeated the experiments wearing the MC-2 full pressure suit, both pressurized and unpressurized. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
VENTILATORY RESPONSE TO FORWARD ACCELERATION, by Fred W. Zechman, Neil S. Cherniack and Alvin S. Hyde. Rept. on Biophysics of Acceleration. Sep 59, 21p. 16 refs. WADC Technical rept. 59-584.
Order from OTS $0.75 PB 161 427

This report presents the findings to two series of experiments dealing with the effect of forward acceleration on respiration in man. In the first, the effect of 5, 8, and 12 g on respiratory frequency, tidal volume, minute volume, and nitrogen elimination were determined. Frequency increased reaching an average of 39.2 cycles per minute and tidal volumes decreased to an average of 318 cc at 12 g. The volume of nitrogen eliminated during a 30 second period, breathing oxygen at 12 g, was essentially unchanged suggesting that gross alveolar ventilation did not decrease. In the second series, 0_2 consumptions were measured before, during, and after accelerations of 5, 8, 10, and 12 g. Oxygen consumptions increased with acceleration and it is presumed that the extra work of breathing may be an important contributing factor. In both series of studies the trunk was inclined 12° in the direction of acceleration and a rate of onset of 1 g per second was used. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. IV. ASSOCIATED EFFECTS OF DIET, ENVIRONMENTAL TEMPERATURE, AND DURATION OF EXPOSURE ON THE MAJOR CONSTITUENTS OF THE LIVERS OF RATS, by David A. Vaughan, John P. Hannon and Lucile N. Vaughan. Sep 59, 16p. 14 refs. Technical rept. 59-5.
Order from LC mi$2.40, ph$3.30 PB 144 850

The effects of feeding pemmican, and of exposure to an environment of 5° C. for periods of 1 month or 5 months, on the percentages of glycogen, total fat, phospholipid, protein, and water in the livers of rats were studied concomitantly. Cold exposure had the following significant effects: (1) a reduction in percentage of glycogen of both dietary groups, (2) a reduction in percentage of total fat of the pemmican group, (3) an increase in phospholipid (percentage of total fat) of both dietary groups, (4) an increase in percentage of water of both dietary groups. The ingestion of pemmican had the following significant effects: (1) a reduction in percentage of glycogen, (2) an increase in percentage of total fat, (3) an increase in phospholipid (percentage of total fat) at 27° C., (4) a decrease in percentage of water. A statistical analysis revealed that the effects of cold exposure and diet were to a certain extent interdependent, and that the duration of exposure modified the effects of both of these experimental treatments in several cases. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. VI: THE PHYSIOLOGICAL EFFECTS OF RESTRICTED DIETS DURING SUCCESSIVE WINTER FIELD TRIALS, by David A. Vaughan, Horace F. Drury and others. Aug 59, 27p. 12 refs. Technical rept. 58-8.
Order from LC mi$2.70, ph$4.80 PB 144 834

Two out of three different 1000 calorie combinations of pemmican and sugar were fed to each of 12 subjects during a two-phase, winter field study. All of the diets tested consisted primarily of pemmican, with the sugar contribution ranging from 0 to not more than 32% of the calories. The 5-day experimental phases were separated by a 7-day "recovery period." In the second period, the magnitude of all the above responses was strikingly reduced. The data suggest that the adaptation to caloric restriction which developed during the first period, as evidenced by sequential changes in blood sugar levels, nitrogen balance and ketone body excretion, persisted throughout the recovery period, permitting the subjects to respond more favorably to the second dietary stress.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
BLOOD CHEMISTRY OF THE COLD-ACCLIMATIZED RAT. I: PLASMA ELECTROLYTES, by John P. Hannon, Anna M. Larson, and David W. Young. Nov 59, 11p. 14 refs. Technical rept. 57-60.
Order from LC mi$2.40, ph$3.30 PB 144 843

Plasma from normal and cold-acclimatized (1 month at 5 ± 1° C.) rats were assayed for sodium, potassium, calcium, magnesium, chloride and phosphate. Acclimatization led to significant increases in sodium and magnesium levels but no changes in the other electrolyte studies. The physiological mechanisms behind these changes are discussed. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
EFFECT OF A LOW ENVIRONMENTAL TEMPERATURE ON WEIGHT AND FOOD CONSUMPTION OF THIAMINE-DEFICIENT RATS, by David A. Vaughan and Lucile N. Vaughan. June 58, 14p. 6 refs. Technical rept. 58-7; AD-227 508.
Order from LC mi$2.40, ph$3.30 PB 144 836

Fifty young adult rats (220-300 gm.) were divided into two groups. Twenty-five were subjected to moderately severe cold (5° C.); 25 were maintained at 25°C. Each group was divided into 5 subgroups, which received a thiamine-deficient diet for 18 days supplemented with the following levels of thiamine: 0.3 mcg./gm. diet, 0.4 mcg./gm., 0.5 mcg./gm., 0.6 mcg./gm., and 2.0 mcg./gm. Respective mean weight changes at these levels were: -69 gm., -55 gm., -51 gm., -18 gm., and +26 gm. for the cold rats; -89 gm., -71 gm., -49 gm., -37 gm., and +55 gm. for the rats held at 25° C. Corresponding mean voluntary food intakes for the 18-day period were 253, 299, 304, 351, and 436 gm. for the rats at 5° C. and 97, 100, 123, 143, and 284 gm. for the rats at 25° C. A statistical analysis indicated that there was no significant difference in weight response between the warm and cold rats at deficient levels of thiamine intake. The relation of weight changes to food intakes suggested that the cold rats used an approximately constant increment of food for their extra energy requirements in the cold. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE EFFECT OF TEMPERATURE ON THE HEART RATE, ELECTROCARDIOGRAM, AND CERTAIN MYOCARDIAL OXIDATIONS OF THE RAT, by John P. Hannon. Mar 58, 21p. 14 refs. Technical rept. 58-3; AD-220 761.
Order from LC mi$2.70, ph$4.80 PB 144 847

Deep hypothermia in the rat was characterized according to the sequential changes in body temperature, heart rate, and electrocardiogram. In vitro assays of myocardial metabolic activity were made at temperatures ranging from 5°C. to 35°C. These assays strongly suggested that the in vivo cardiac dysfunctions observed at low temperatures were attributable to shifts in temperature kinetics of enzyme systems at 20-21°C. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
GROSS LIVER COMPOSITION OF THE RAT FOLLOWING ONE-MONTH COLD EXPOSURE, by John P. Hannon and Lucile N. Vaughan. Sep 59, 13p. 17 refs. Technical rept. 58-26.
Order from LC mi$2.40, ph$3.30 PB 144 844

The total body weight, the liver weight, and the levels of water, protein, lipid, phospholipid, glycogen, and ash were assayed in male Sprague-Dawley rats exposed to either control conditions (26 ± 1° C.) or to cold (5 ± 1° C.) for 1 month. A statistically significant suppression of total body growth, but an augmentation of relative liver growth, was observed in the cold-exposed group. Cold also led to significant increases in the level of liver lipid and phospholipid, and a decrease in glycogen. No differences were observed in the protein, water, or ash content of the two groups. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
INFRARED EMISSIVITIES OF SOME ARCTIC

FAUNA, by H. T. Hammel. (Pennsulvania U. School of Medicine). May 57, 9p. 7 refs. Technical rept. 57-25; AD-220 677.
Order from LC mi$1.80, ph$1.80 PB 144 848

The infrared emissivities of the surfaces of ten arctic species were measured and found to be 1.0 for every species. The furs measured were winter pelts of the pine marten (Martes americana), sea otter (Enhydra lutris), beaver (Castor canadensis), red fox (Vulpes fulva), gray wolf (Canis lupus), lynx (Lynx canadensis), bobcat (Lynx rufus), snowshoe hare (Lepus americanus), barrenground caribou (Rangifer arcticus) and the winter plumage of the willow ptarmigan (Lagopus lagopus). The color of the surface for visible light, which may range from white to black, is no guide to the color in the far infrared at which wave lengths the surface is radiating energy to its environment. It seems likely that no arctic species has adapted to its radiation environment by acquiring a surface of low emissivity in the far infrared in order to reduce radiant heat loss to the cold sky. The same end would be achieved, however, if the animal were to shield itself from the sky. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE RESPIRATION OF RAT LIVER HOMOGENATES FOLLOWING PROLONGED COLD EXPOSURE, by John P. Hannon. Sep 59, 13p. 6 refs. Technical rept. 57-59; AD-228 411.
Order from LC mi$2.40, ph$3.30 PB 144 841

The respiration of liver homogenates derived from adult male rats exposed to cold for about 1 month was studied. Cold exposure led to increased rates when citrate, isocitrate, α-ketoglutarate, succinate, fumarate, malate, glutamate, and β-hydroxybutyrate were present as substrates. An increased endogenous metabolism was also found but no change in rate was observed when lactate was present as substrate. Differences were also found in both the magnitude and pattern of in vitro oxidations following cold exposure. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ROLE OF THE SYMPATHETIC NERVOUS SYSTEM IN THE CONTROL OF CHEMICAL REGULATION OF HEAT PRODUCTION, by A. C. L. Hsieh, L. D. Carlson, and G. Gray, (U. of Washington School of Medicine). Nov 59, 12p. 5 refs. Technical rept. 57-30; AD-228 548.
Order from LC mi$2.40, ph$3.30 PB 144 839

The ganglionic blocking agent hexamethonium chloride and the adrenolytic agent piperoxane hydrochloride prevented the increase in oxygen consumption otherwise observed in curarized, cold-adapted rats exposed to cold. Atropine sulfate had no effect. The sympathetic nervous system, including the adrenal medulla, appears to be important in the mediation of chemical regulation of heat production in these animals. L-noradrenaline was more effective than adrenaline in preventing the fall in oxygen consumption caused by hexamethonium. This finding suggests that noradrenaline may also play an important part in chemical regulation. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SEASONAL AND RACIAL VARIATIONS IN HUMAN BLOOD ADENINE NUCLEOTIDE LEVELS, by John P. Hannon. Oct 59, 10p. 7 refs. Technical rept. 57-57.
Order from LC mi$1.80, ph$1.80 PB 144 838

This report presents the results of an observation of highly suggestive seasonal differences in blood chemistry.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THIAMINE LOAD TEST STUDIES IN HUMANS, by David A. Vaughan and Lucile N. Vaughan. Oct 59, 15p. 27 refs. Technical rept. 57-58.
Order from LC mi$2.40, ph$3.30 PB 144 837

The experiments reported here were of an exploratory nature. The first objective was to devise and test a liquid diet which was deficient in thiamine and in which the fat content could be varied isocalorically. Secondly, the diet was then used to determine whether a load dose return was affected by an extreme change in the fat content of the diet. Thirdly, the urinary excretion of thiamine during the oral ingestion of large amounts of thiamine was followed for an extended period.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
TRACKING PROFICIENCY AS A FUNCTION OF THERMAL BALANCE, by Robert B. Payne. May 59, 12p. 12 refs. Technical rept. 58-14; AD-220 763.
Order from LC mi$2.40, ph$3.30 PB 144 845

An experiment was conducted for the purpose of learning (a) whether performance decrement in monitoring and controlling a complex visual display is related to body heat loss, and (b) whether such an impairment can be forestalled by glycine administration. Following extensive training on the experimental task, 72 subjects were independently and randomly assigned to the nine combinations of three ambient temperature conditions (70°, 55°, and 40°F.) and three glycine treatments (0, 20, and 40 gms), then required to execute a performance sequence lasting three hours and twenty minutes. Statistical analyses established that the mathematical function relating performance to temperature was a parabola having a maximum near 55°. No significant glycine effects were observed. (Author)

Armed Forces-NRC Committee on Hearing and Bio-Acoustics, St. Louis, Mo.
CHABA ANNUAL REPORT NO. 4, by Hallowell Davis, Donald H. Eldredge, and J. Richardson Usher. Technical rept. no. 10, 1 June 56-31 May 57, on Contract Nonr-1151(01). June 57, 47p. 9 refs; AD-148 380.
Order from LC mi$3.30, ph$7.80 PB 138 235

The activities of the several Working Groups are summarized in the body of this report

Army Medical Research Lab., Fort Knox, Ky.
ANALYSIS OF COOLING UNDER CONDITIONS OF CHANGING AIR TEMPERATURE, by E. H. Wissler and G. W. Molnar. Rept. on Environmental Physiology. 4 Apr 58, 21p. 5 refs. Rept. no. 295; AD-160 329.
Order from LC mi$2.70, ph$4.80 PB 144 953

By means of Duhamel's theorem and a Hankel transform an equation was derived for the cooling of an infinite cylinder under conditions of changing air temperature. The usefulness of the equation is restricted to specified conditions. It enables the utilization of data obtained under still air conditions. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
ACCELERATION PROBLEMS IN SPACE FLIGHT, by James D. Hardy, Carl C. Clark, and R. Flanagan Gray. Rept. no. 4 on Proj. [NM] 005.12-0005.6; Proj. TED ADC AE 1412. 1 Oct 59, 38p. 30 refs. NADC-MA-5909.
Order from LC mi$3.00, ph$6.30 PB 145 036

This paper describes the major problems associated with the effects of acceleration upon man and details the work which has already been done in this field on centrifuges, rocket sleds and other simulators. The problem of weightlessness is discussed with special reference to Gerathewohl's investigation of human tolerance to the weightless state produced during ballistic trajectory aircraft flights. A detailed account is given of advances in high G protection including the use of the contour couch and water immersion. Water immersion as a means of G protection is described with special emphasis on the recent investigations by Gray and Webb with the G capsule. In this total immersion capsule and with chest pressurization Gray in a record centrifuge run, recently withstood 31 G for 5 seconds with no lasting ill effects. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE ROLE OF SKIN IN HEAT TRANSFER, by Alice M. Stoll. Rept. no. 20 on Proj. NM 19 01 12.1, 16 Nov 59, 12p. 13 refs. NADC-MA-5918.
Order from LC mi$2.40, ph$3.30 PB 145 164

The dimensions and properties of human skin with respect to its role in heat transfer are summarized and discussed. (Author)

Biological Research Labs., Boston U., Mass.
VASOMOTOR ADJUSTMENTS IN THE MICROCIRCULATION DURING CHANGES IN BLOOD DISTRIBUTION, by George P. Fulton and Robert F. Slechta. Rept. for Jan 57-July 59 on Contract AF 49(638)44. [1959] 28p. 23 refs. AFOSR-TR-59-191.
Order from LC mi$2.70, ph$4.80 PB 144 789

This report describes the progress made on a research program in peripheral vascular responses to such blood-redistributing conditions as body orientation changes, corticosteroids and other substances produced during stress, temperature changes, hemorrhage, anoxia, etc.

Buffalo U., N. Y.
SOME PERCEPTUAL AND PHYSIOLOGICAL ASPECTS OF UNIFORM VISUAL STIMULATION, by Walter Cohen. Rept. for 31 Jan 58-31 Jan 59 on Contract DA 49-007-MD-866. [1959] 20p. 8 refs. AD-211 273.
Order from LC mi$2.40, ph$3.30 PB 144 807

The studies described in this report are concerned with the perception of objects in a uniform visual field. Three major problems were investigated. (A) The extent to which the accuracy of form recognition is dependent upon the structure of the visual field, the structure of the target, and prolonged exposure (90 sec.) to a uniform field. (B) The dependence of spatial orientation on field structure, characteristics of the target, and the subject's set. (C) The effects of prolonged exposure to the uniform field (20 min.) upon the "blank-out" (or "white-out") phenomenon, which involves a temporary cessation of vision. The chief findings were as follows: (a) Both uniformity of the field and prolonged exposure reduced the accuracy of recognition. However, their influence was found to vary with the complexity of the target. (b) Sensitivity to change in tilt was shown to be dependent upon the three variables listed above. An interaction effect among the three variables was found. (c) More frequent and more intensive "blank-outs" were reported with longer stimulation. Form recognition was seriously interfered with when "blank-out" occurred.

Chicago U., Ill.
A MATHEMATICAL INTERPRETATION OF MOTOR REACTIONS TO FIXED AND MOVING STIMULATION OF THE EYE, by M. Valentinuzzi. Rept. on Application of Information Theory to the Nervous System, Contract AF 18(600)1454. 25 Aug 58, 31p. 22 refs. AFOSR-TN-58-697; AD-162 231.
Order from LC mi$3.00, ph$6.30 PB 137 896

The results of experiments performed by L. S. Stone and by R. W. Sperry, on vision in salamanders are analyzed. A summary of Reichardt's theory, which originated in the researches of B. Hassenstein on insects, is given, and an application to salamanders is carried out. Introducing a simpler mathematical development based on the one-factor theory of excitation, the same formal results are obtained. A complete model, which includes those results and tries to fit the salamander behavior described by Stone, is elaborated and translated into boolean terms. As a complementary consideration it is pointed out that the functional rigidity of the visuomotor system, deriving from a biological molecular hysteresis, could be framed in the neuro-affinity principle, the spatial expression of which would turn out to be a biological field. (Author)

Gaustad Mental Hospital, Oslo (Norway).
AIRBORNE EEG RECORDING IN HIGH PERFORMANCE AIRCRAFT, by C. W. Sem-Jacobsen, O. Nilseng and others. Technical final rept. on Contract AF 61(514)1201. 28 Jan 59, 7p. 3 refs. AFOSR-TR-59-35; AD-213 038.
Order from LC mi$1.80, ph$1.80 PB 145 074

Thirty pilots performed 10 commonly flown maneu-

vers during which EEG recordings were made to determine whether the EEG was a suitable device for measuring physiological and psychological responses to flight stresses. The pilots were divided into 3 groups on the basis of the EEG records. Group A showed only minimal changes in response to the test flight. Group B showed marked high voltage changes of short duration in response to the same maneuvers. In the EEG's of the pilots belonging to group C gross changes of probably more pathological nature were seen. Out of the 30 pilots, 19 were in group A; 8 were in group B, and 3 in group C. After the test the pilots in group A appeared unaffected by the flight, kept good radio contact, were in good spirits, and reported no blackouts. The pilots of the B-group, on returning to the ground, perspired and appeared fatigued. They revealed blackouts and made mistakes in recollecting the flight. The pilots of group C were pale, perspired heavily, and had gone through episodes of loss of consciousness.

Pennsylvania U., University Park.
REGULATION OF FOOD INTAKE AND PHYSICAL ACTIVITY AND THE CONTROL OF OBESITY, by Albert Stunkard. Rept. for 1 Dec 57-30 Nov 58 on Contract DA 49-007-MD-925. [1958] 9p. 10 refs.
Order from LC mi$1.80, ph$1.80 PB 144 806

The present program represents a long-range combined psychological and physiological study of human obesity. During the past year the program has successfully negotiated the transfer to the University of Pennsylvania, a new research team has been recruited, new projects have been initiated and old ones continued, and the program is currently at its highest point of effectiveness and productivity. The underlying point of view of the program is that obesity results from a disordered energy regulation, a disorder which has its analogues in the disorders of energy regulation of the lower animals, but to which significant contribution is made by specifically human disturbances in communication and behavior. During the past year a variety of different points in the cycles of regulation have been studied, and further information has been accumulated as to where disorders may occur and where they definitely do not occur. The nature of the problems have, thus, been more clearly specified and beginnings have been made at their solution. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
NEUROPHYSIOLOGICAL REPRESENTATION OF COMPLEX AUDITORY STIMULI, by Moise H. Goldstein, Jr. Rept. on Contract DA 36-039-sc-64637. 19 Feb 57, 77p. 83 refs. Technical rept. 323; AD-156 530.
Order from LC mi$4.50, ph$12.30 PB 145 131

Neurophysiological representation of complex acoustic signals at the cochlea and cortex of the cat's auditory pathways was investigated. The signals were presented monoaurally and included repetitive bursts of noise, clicks, and bursts of tone; these are signals which human listeners judge to be of low pitch, although the concentration of energy is not in the low audio frequency range. Thresholds of cortical response were found to be independent of repetition rate. The tonotypic organization of the auditory cortex is related, primarily, to the distribution of stimulus energy in the spectrum. The temporal representation of envelope repetition rate was studied for stimuli at low and moderate intensity levels. The synchrony of cortical potentials is difficult to study by visual inspection, since the ongoing activity tends to observe small evoked responses. A synchrony to stimuli, with repetition rates up to 200/sec, in the cortical potentials from unanesthetized cats was detected by using an electronic processing device that averages a large number of responses. Evoked responses to stimuli with repetition rates up to 100/sec were detected in barbiturate-anesthetized cats. Psychophysical data on the discrimination of envelope repetition rate of modulated stimuli are also presented. A mathematical representation of signals as a function of variables related to spectral frequency and envelope periodicity is included.

University of Southern California. School of Medicine, Los Angeles.
PHYSIOLOGIC PRODUCTION OF CATECHOL AMINES IN RESPONSE TO SEVERAL PHYSICAL STRESSES, by John P. Meehan and Edith Jacobs. Rept. on Biophysics of the Cardiovascular System, Contract AF 33(616)5591. Sep 59, 24p. 17 refs. WADC Technical rept. 59-534.
Order from OTS $0.75 PB 161 441

Measurements of the physiologic production of adrenaline and noradrenaline in response to four standardized physical stresses were undertaken on young adult male subjects. Plasma levels of noradrenaline were found to increase significantly in exercise and the increase appears to bear a positive relationship to the physiologic severity of the exercise. Plasma levels of noradrenaline did not change as the result of the cold pressor test or as the result of exposure to positive accelerations of 3 g for 5 minutes. Renal plasma flow was not altered as the result of similar exposure to acceleration lasting for 10 minutes. (Author)

Vision Research Labs., U. of Michigan, Ann Arbor.
THE EFFECT OF FIXATION CONDITIONS ON DEPTH-DISCRIMINATION THRESHOLDS AT SCOTOPIC AND PHOTOPIC ILLUMINANCE LEVELS, by Alfred Lit. Rept. on Project Michigan, Contract [DA 36-039-sc-52654]. Nov 58, 16p. 8 refs. 2144-323-T; AD-206 347.
Order from LC mi$2.40, ph$3.30 PB 145 095

The precision of depth discrimination has been measured in a two-rod test apparatus involving real-depth cues. Effects due to different methods of fixating the rods have been assessed at each of a number of levels of equal illuminance presented to the two eyes. It was found that, for all three methods of fixation, the precision of depth discrimination increased by about 20:1 as the level of illuminance was increased over a range of some five log units. One method of fixation involved steady fixation on the movable comparison rod. A second method of fixation involved steady fixation on the immovable standard rod. In the third method of fixation, the observers were allowed to fixate on either of the rods at will. The precision of depth discrimination was clearly greatest with the

first method, at all but the very highest illuminance levels at which all three methods gave essentially equivalent results. The second method produced generally the lowest precision, whereas the third produced levels of precision generally intermediate between the other two. These results have a significance for photochemical theories of vision and for the current controversy concerning the role of convergence cues in stereoscopic acuity. (Author)

Visual Research Lab., Wellesley Coll., Mass.
SOME RELATIONSHIPS OF GLARE AND TARGET PERCEPTION, by Ernst Wolf and Michael J. Zigler. Rept. on Visual Presentation of Information, Contract AF 33(616)3305. Sep 59, 37p. 18 refs. WADC Technical rept. 59-394.
Order from OTS $1.00 PB 161 367

This study was carried out to describe quantitatively the relationship between the luminance of a glare source and threshold luminance of a test target when both are varied in angular subtense and distance from each other. The threshold visibility of a test target in the vicinity of a glare source was determined for various sizes and luminances of the glare source, various angular separations between glare source and target, and various exposure times and retinal locations. Thresholds for target perception become lower as glare luminance is decreased, area of glare source is decreased, distance between glare source and test target is increased, and size of test target is increased. When exposure time of the test target is increased, thresholds become lower until an exposure time of approximately one second is reached; longer exposure times have little effect on thresholds. When Landolt rings, letters, and dials are shown at various distances from a glare source, threshold luminance for readability similarly depends upon glare luminance and angular separation between glare source and target. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
LUMINOSITY FUNCTIONS OBTAINED WITH DIFFERENT METHODS AND DIFFERENT VIEWING CONDITIONS, by H. R. Blackwell and O. M. Blackwell. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Jan 59, 24p. 3 refs. Rept. no. 2144-344-T; AD-211 453.
Order from LC mi$2.70, ph$4.80 PB 144 733

A series of measurements of the human luminosity function made with a variety of methods, and under a variety of viewing conditions, is summarized. The luminosity function defines the effectiveness of various wavelengths of visible radiation in eliciting the brightness response. Methodological variants which were studied include: (a) the method used to arrive at the brightness equation; (b) the number and spectral composition of the standard radiances used; (c) the configuration of the field of the photometric comparator; and (d) the use of direct heterochromatic comparison versus the use of flicker photometry. Luminosity functions were measured by a standard procedure for 1^{o} and 3^{o} comparison fields, and at 4 levels of retinal illuminance from 0.0894 to 304 trolands. The luminosity data obtained were found to agree exceptionally well with the 1931 and 1951 CIE photopic luminosity functions from 520 to 700 mμ. However, at wavelengths below 520 mμ, the luminosity coefficients obtained are considerably higher than even the 1951 CIE values, which are themselves considerably higher than the 1931 CIE values.

Biochemistry

Army Medical Research Lab., Fort Knox, Ky.
THE ROLE OF PLASMA ACCELERATOR-GLOBULIN AND ITS THROMBIN ACTIVATED FORM, SERUM ACCELERATOR-GLOBULIN, IN THE CONVERSION OF PROTHROMBIN, by Betty R. Johnston and H. Jensen. 3 Mar 58, 22p. 27 refs. Rept. no. 329; AD-153 646.
Order from LC mi$2.70, ph$4.80 PB 138 334

Either plasma accelerator-globulin or serum accelerator-globulin must be present in order to obtain complete conversion of prothrombin in the presence of serum-eluate factor (s) [proconvertin or plasma thromboplastin component or both], antihemophilic factor, platelet factor 3, and calcium ions. If plasma accelerator-globulin is present, it must be converted to serum accelerator-globulin by the action of thrombin before the maximum rate of prothrombin conversion is reached. Serum accelerator-globulin does neither affect the degree nor the rate of interaction of serum-eluate factor(s), antihemophilic factor, platelet factor 3, and calcium ions forming a prothrombin-conversion factor but affects thrombin formation at a point just prior to or during the conversion of prothrombin.

Nutritional Research Lab., St. Luke's Hospital, New York.
AMINO ACID METABOLISM OF MAN IN HEALTH AND DISEASE, by Anthony A. Albanese. Annual progress rept. for 1 Jan-31 Dec 57 on Contract Nonr-1167(00). 15 Dec 57, 12p. 15 refs. AD-150 041.
Order from LC mi$2.40, ph$3.30 PB 138 204

In metabolically normal older convalescents, the consumption of at least 1.5 g of protein per kilo per day, with 30% in the form of meat, speeded tissue regeneration. Consecutive week-long N balance studies with placebo, a supplement containing methionine, threonine, valine and isoleucine (MTVI), a supplement containing MTVI and lysine (MTVIL), and again MTVI, were conducted on 26 adult females (31 to 92 yr). The balance N of 8 subjects was improved during the administration of MTVIL. Increases in N balance were also obtained with steroids. A technique was developed for detecting functional defects in peptic digestion. Observations suggested that greater protein utilization was achieved as the calorie distribution of the supplement approached the ideal ratio (protein 15%, carbohydrates 50% and fats 35%). Plasma amino N levels appeared to constitute a valuable adjunct to differentiate between maximal and submaximal positive N balance states in depleted individuals. Study of enzymatic techniques was initiated to measure the nutritive value of proteins as they occur in common foods.

Washington State Coll. [Pullman].
ENZYMATIC STUDIES ON THERMOPHILIC BACTERIA, by L. Leon Campbell, Jr. Final rept. for 1 Feb 56-31 Jan 59 on Contract Nonr-1856(00). [1959] 12p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 144 745

Results are summarized on: Studies on alpha-emylase of Bacillus stearothermophilus: amylase yields by different cultural methods, preparation of crystalline enzyme; optimum pH and temperature for dextrinogenic activity of alpha-amylase; effect of enzyme and substrate concentration on activity; effect of calcium on enzyme activity; effect of urea, guanidine, N-ethylmaleimide and p-hydroxymercuribenzoate on enzyme activity; determination of free sulfhydryl groups in the enzyme; thermal stability of the enzyme; ultraviolet absorption spectrum of crystalline amylase; amino acid analysis of the enzyme; dye binding capacity of the enzyme and titration data; optical rotatory properties of the enzyme; physical constants of the enzyme; effect of performic acid oxidation on enzyme activity; Proteinase of Bacillus stearothermophilus; Amino acid deaminases and amino acid amide deamidases of bacillus coagulans and Bacillus stearothermophilus; Glucose and pyruvate metabolism of Bacillus coagulans.

General Biology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SIMPLIFIED APPARATUS AND METHODS FOR THE WET ASHING OF LARGE NUMBERS OF BIOLOGICAL SAMPLES, by John P. Hannon. Aug 59, 14p. 1 ref. Technical rept. 57-56.
Order from LC mi$2.40, ph$3.30 PB 144 835

Apparatus and techniques described in this report were developed. These include: construction of a simple 14-unit digestion apparatus that takes up approximately the same space that 6-unit commercial models occupy and yet costs only a fraction as much; racks for holding and segregating the large numbers of kjeldahl digestion flasks finally, a technique for the calibration of kjeldahl flasks so that the digestions and dilutions preparatory to making the desired assay can be carried out in the same flask. Thus, where space is limited, the large capacity of this digestion apparatus, the sulfuric acid-hydrogen peroxide digestion procedure which is described, and the conventional nesslerization method for determining nitrogen will greatly increase the capacity of the laboratory to carry out tissue digestions.

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 1. MEDICAL BIOLOGICAL, SOCIAL AND BEHAVIORAL SCIENCES. 366p.
Order from OTS $3.75 PB 161 133

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Medical Sciences:
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(See also PB 151 494)

Pacific Science Board, National Research Council, Washington, D. C.
ATOLL RESEARCH BULLETIN NOS. 59-60. Rept. on Contract N7onr-29154. 31 Oct 57, 279p. 47 refs. AD-152 999.
Order from LC mi$11.10, ph$42.60 PB 137 948

Contents:
Bull. 59. The Gilbert Islands; Some Aspects of Human Ecology, by René L. A. Catala.
Bull. 60. Climate and Meteorology of the Gilbert Islands, by Marie-Hélène Sachet.
(See also PB 128 595)

Microbiology

[Bureau of Labs.] Florida State Board of Health, Jacksonville.
THE RELATIVE EFFICACY OF CULTURE MEDIA FOR THE ISOLATION OF MYCOBACTERIUM TUBERCULOSIS FROM CLINICAL MATERIAL, by Mildred B. Jefferies, Albert V. Hardy, and Nathan J. Schneider. Sep 59, 9 refs. AFSAM rept. 59-94.
Order from LC mi$1.80, ph$1.80 PB 145 103

The relative efficacy of Lowenstein-Jensen medium, penicillin blood agar, American Trudeau Society medium, Difco Peizer TB medium, Middlebrook 7H9 agar A, and a semi-synthetic autoclavable medium for the isolation of Myco. tuberculosis from specimens submitted to a public health laboratory has been compared. Lowenstein-Jensen was the most sensitive of the media tested though the difference in positive isolations on this and on the American Trudeau Society medium was not statistically significant. In our hands, the others were less effective and in some respects more difficult to use. A third slant increased only slightly the proportion of positive findings. The use of two slants with large areas for inoculation appears to be an acceptable technic and this is practicable for laboratories handling large numbers of specimens. (Author)

Bureau of Labs., Florida State Board of Health, Jacksonville.
A STUDY OF THE NEUTRAL RED TEST FOR THE DETERMINATION OF THE VIRULENCE OF MYCOBACTERIA, by Mildred B. Jefferies, N. J. Schneider, and A. V. Hardy. Sep 59, 4p. 6 refs. AFSAM rept. no. 59-54.
Order from LC mi$1.80, ph$1.80 PB 145 098

Two hundred fifty-three acid-fast strains of mycobacteria were tested for virulence by inoculating guinea pigs and comparing the results with those obtained in the neutral red test. In 80.9 percent of the strains tested, test results showed agreement. In 19.0 percent of the strains tested the results were not in agreement. Some of the factors which may have influenced the results are discussed.

Pathology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
DEVELOPMENT OF MICROSTRUCTURE OF ALASKAN ESKIMO TOOTH SAMPLES, by Gisle Bang. 15 May 58, 13p. 15 refs. Technical rept. 58-20.
Order from LC mi$2.40, ph$3.30 PB 144 833

The present study deals with the microstructure of teeth from contemporary Alaskan Eskimos, which do not appear to have been studied histologically before. In addition to teeth from contemporary individuals with and without caries, the study includes teeth obtained from skulls of Alaskan Eskimos prior to their contact with western civilization.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE GROWTH OF HUMAN TUMORS IN THE HIBERNATING HAMSTER, by W. Bradford Patterson, Charles P. Layman, and Helen P. Patterson (Harvard Medical School). Oct 59, 9p. 13 refs. Technical rept. 57-18.
Order from LC mi$1.80, ph$1.80 PB 144 840

Four human transplantable tumors have been grown in hibernating hamsters. One human tumor strain failed to grow. During hibernation, tumor growth was markedly inhibited, but resumed its normal rate when animals were returned to warm room temperatures. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
PRODUCTION OF PAIN AND THERMAL BURNS IN SKIN AREAS PREVIOUSLY EXPOSED TO ULTRAVIOLET RADIATION, by Alice M. Stoll, Leon C. Greene, and James D. Hardy. Rept. no. 19 on Proj. NM 10 01 12.1. 21 Sep 59, 13p. 14 refs. NADC-MA-5915; AD-226 918.
Order from LC mi$2.40, ph$3.30 PB 144 676

In order to evaluate the relationship of tissue damage to pain sensation in areas of hyperalgesia, the skin of three subjects was irradiated with erythemal doses of ultraviolet radiation and then exposed to thermal radiation. Measurements were made of the pain threshold lowering effect of the ultraviolet radiation and, following the development of the hyperalgesia, of the lowering of the blister threshold to thermal radiation. Lowering of the pain threshold of 4-7°C was observed, while the lowering of the blister threshold (i.e., the temperature at which blistering was produced) was of the order of 0.5°C. The ultraviolet-irradiated hyperalgesic skin is therefore not more fragile as regards moderately high temperature (50°C) and high temperature burns than is normal undamaged skin. This finding is in keeping with the previously proposed theory that the intensity of pain is a function of the relative reaction rates at the thermal threshold and at skin temperatures above this threshold. Theory predicts, however, that ultraviolet irradiated skin heated to, and maintained at, relatively low temperatures (40-45°C) will be more easily blistered than will undamaged skin. This possibility has not been investigated as yet. The promising possibility of testing the analgetic action of the weak analgesics, such as the salycilates by experimental procedures in areas of induced hyperalgesia is noted. (Author)

Psychological Research Associates, Inc., Arlington, Va.
ANALYSIS OF DATA ON THE SURVEY OF THE DENTAL HEALTH OF THE NAVAL RECRUIT, by Ray C. Hackman and John A. Lesser, Jr. Rept. on Contract Nonr-2362(00). Jan 58, 22p. 1 ref. PRA Rept. 58-5.
Order from LC mi$2.70, ph$4.80 PB 138 335

This report summarizes analyses made of the relationships between measures of dental health and/or state and certain personal, demographic, and attitudinal variables that characterize the naval recruit. Some fifteen measures of dental health or state were examined.

Wisconsin U. School of Medicine, Madison.
PREVENTION AND TREATMENT OF VENTRICULAR FIBRILLATION IN HYPOTHERMIA, by John E. Steinhaus and Karl L. Siebecker. Apr 58, 12p. 8 refs. Arctic Aeromedical Lab. technical rept. no. 58-5; AD-227 657.
Order from LC mi$2.40, ph$3.30 PB 145 092

The treatment of heart failure produced by body cooling was studied. The role of CO_2 in onset of ventricular fibrillation was studied, and the results suggest that this physiological variable may be a less important factor than has been previously indicated. Increased CO_2 levels made resuscitation less difficult. An investigation of various anesthetic agents at 27°C. hypothermia revealed an absence of ventricular fibrillation, despite the long periods of hypercarbia and hypoxia. (Author)

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECT OF EA 1476 ON SWIMMING TIME

IN GUINEA PIGS, by Charles G. Wilber and Roy E. Crawford. Sep 59, 7p. 3 refs. CWLR-2308.
Order from LC mi$1.80, ph$1.80 PB 145 137

The effect of EA 1476 on swimming time in guinea pigs was ascertained. The swimming time of guinea pigs in a bath at 28°C was decreased to approximately 74 per cent of controls after treatment with EA 1476 in a dose of 1 mg/kg. Guinea pigs which had been accustomized to swimming, by repeated training sessions, swam longer and showed less variability than untrained animals. (Author)

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
THE INHALATION TOXICITY OF SESQUI-MUSTARD (Q) AEROSOL IN MICE, RATS, GUINEA PIGS, HAMSTERS, PIGEONS, AND DOGS, by F. J. Vocci, C. L. Punte, Jr., and others. Sep 55, declassified 18 Sep 58, 45p. 24 refs. Medical Labs. Research rept. no. 403.
Order from LC mi$3.30, ph$7.80 PB 144 679

The inhalation toxicity of Q aerosol in mice, rats, guinea pigs, hamsters, pigeons and dogs exposed for a period of 2 or 10 minutes based on a 14 day observation period is summarized in the following table:

Species	LCt50(t = 2 min.) mg. min. /m. 3	LCt50 (t = 10 min.) mg. min. /m. 3
Mice	72 (53 - 85)	63 (40-82)
Rats	133 (114-154)	109 (74-183)
Guinea Pigs	220 (140-470)	83 (63-117)
Hamsters	274 (262-282)	220
Pigeons	---	---
Dogs	180	

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
THE MEDIAN DETECTABLE CONCENTRATION OF DIBORANE, PENTABORANE AND DECABORANE BY ODOR FOR MAN, by Charles C. Comstock and Fred W. Oberst. Aug 53, 9p. 4 refs. Research rept. no. 206; AD-16 993.
Order from LC mi$1.80, ph$1.80 PB 144 667

The median detectable concentrations (MDC's) of 3 boron hydrides were determined with a Fair-Wells osmoscope. Each compound was tested 2 to 4 times on 10 to 15 subjects. The MDC's of diborane (B_2H_6), pentaborane (B_5H_9), and decaborane ($B_{10}H_{14}$) were 3.7, 2.5, and 0.35 mg/cu m, respectively. The prescribed chamber concentration of B_2H_6 was determined by an analytical procedure, whereas the concentrations of B_5H_9 and $B_{10}H_{14}$ were determined by nominal methods. The B_2H_6 was described as having an odor of rotton eggs; B_5H_9, as either garlic, acetylene-like, or slightly sweet; and $B_{10}H_{14}$, either unpleasant, foul, or chocolate-like. No aftereffects occurred from any of the vapors in concentrations of 0.2 to 6 mg/cu m.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE PROPHYLACTIC AND THERAPEUTIC EFFECTIVENESS OF DAM (2, 3-BUTANEDIONE 2-OXIME) IN RATS POISONED BY GB VAPOR, by Fred W. Oberst, Carl W. Umland, Jr. and others. Sep 59, 22p. 11 refs. CWLR-2305.
Order from LC mi$2.40, ph$3.30 PB 144 711

The work reported was designed to determine some of the factors limiting the prophylactic and therapeutic effectiveness of 2, 3-butanedione 2-oxime (DAM) in protecting rats against the toxic action of inhaled GB vapor. It was concluded that DAM administered intraperitoneally 5 min to 4 hr prior to GB vapor exposure by inhalation is an effective prophylactic agent for rats. Its effectiveness depends on the dose of DAM, the time of its administration before exposure to GB vapor, the concentration of GB vapor, and the length of time of a GB exposure. In contrast with its prophylactic effectiveness, DAM is less effective as a therapeutic agent when administered intraperitoneally to rats immediately after a 30-sec lethal exposure. (Author)

CHEMISTRY

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 2. CHEMISTRY. 365p.
Order from OTS $3.75 PB 161 134

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Physical chemistry, colloids
Physical chemistry, general and nuclear
(See also PB 151 495)

North Carolina U., Chapel Hill.
THE CHELON APPROACH TO ANALYSIS, by Charles N. Reilley, R. W. Schmid and Fawzy S. Sadek. UNC-Chem. no. 1 on Contract AF 49(638)333. 29 Aug 59, 56p. 41 refs. AFOSR-TN-59-[896].
Order from LC mi$3.60, ph$9.30 PB 144 879

The introduction of chelons such as EDTA has virtually revolutionized the analytical approach to the metal ion analysis. This approach commenced with the classical work of Schwarzenbach on the volumetric determination of calcium and magnesium—a procedure which was rapidly and universally adopted for estimation of water hardness. Since then the applicability of the EDTA methods has been extended to the determination of over 50 elements and its scope will undoubtedly be broadened even further. Because of the present wide applicability of the chelon approach and because of its unusual future possibilities, this brief and introductory status report is given to acquaint chemists with this approach and to present some material suitable in inorganic research and in analytical courses in summary form. (Author)

Pennsalt Chemicals Corp., Wyndmoor, Pa.
RESEARCH IN THE BROAD FIELD OF SYNTHESIS AND CHARACTERIZATION OF INORGANIC COMPOUNDS AND MATERIALS, by A. Kowalski, F. D. Loomis and others. Technical rept. no. 1, 15 Sep 58-15 Mar 59, on Contract Nonr-2687(00). [1959] 78p. 80 refs.
Order from LC mi$4.50, ph$12.30 PB 145 349

A large number of coordination compounds of chromium, cobalt, platinum and zinc were prepared as potential monomers. In many instances, synthesis procedures reported in the literature could not be duplicated. Polymerization of these monomers is now under investigation. Polymeric $[Zn(NH_3)Cl_2]_x$, which softens at 100°C., was discovered to be capable of being drawn into flexible fibers that retain plasticity under anhydrous conditions. This polymer, which shows excellent bonding strength to glass, will withstand temperatures up to 425°C. for 1.5 hours. Attempts to link 1, 3, 5-triazine rings by means of polyfunctional catenating agents were initiated. A series of novel triazine polymers incorporating sulfamide has been synthesized, some of which could be pressed to transparent films. New methods for synthesizing unusual linking agents such as sulfuryl and thionyl isocyanates and some related phosphorus derivatives were investigated. Experiments were initiated on modification of a number of silicates by interstitial cation substitution, anion replacement and isostructural substitution. Analogous work on fluoaluminates was initially limited to cation substitution.

Washington U., Seattle.
THE REACTION OF BROMINE TRIFLUORIDE AND FLUORINE TO BROMINE PENTAFLUORIDE, by Harris E. Kluksdahl and George H. Cady. Technical rept. no. 21 on Contract Nonr-477(16). 1959, 14p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 144 898

The kinetics of the gas phase reaction of bromine trifluoride and fluorine to form bromine pentafluoride have been studied from 68 to 121° C in a nickel reactor and with the initial pressures varying from 30 to 300 mm. The reaction was found to be bimolecular, homogeneous, and to have an activation energy of 16.4 kcal. The observed frequency factor of 2.6 x 10" cc. mole sec. corresponded to a probability factor of 10^{-3}, thus indicating that every bimolecular collision was not effective in producing bromine pentafluoride. The loss of three rotational and two vibrational degrees of freedom indicates that energy transformations have to be made in several degrees of freedom in formation of the activated complex, and this very likely accounts for the slowness of the reaction. Evidence was found suggesting that bromine trifluoride is partially associated in the vapor phase. (Author)

Birkbeck Coll. (Gt. Brit.)
ALKYL AND ARYL DERIVATIVES OF THE PHOSPHONITRILIC HALIDES, by R. A. Shaw. Annual technical status rept. no. 1, 1 Oct 58-30 Sep 59, on Contract DA 91-508-EUC-363. 10 Nov 59, 71p. 13 refs.
Order from LC mi$4.50, ph$12.30 PB 145 348

This report covers the first year's work on alkyl and aryl derivatives of the phosphonitrilic halides. The most striking progress was made in the work on the phenylation of the trimeric chloride, $P_3N_3Cl_6$, under FRIEDEL-CRAFT'S conditions. Different catalysts have been examined and so far aluminium chloride has been found to be the most successful. Many compounds and polymers are described and discussed.

Chemical Lab., U. of Kansas, Lawrence.
REDUCTION OF ORGANIC COMPOUNDS BY LOWER VALENT SPECIES OF ACTIVE METALS, by William E. McEwen and Jacob Kleinberg. Technical rept. no. 10, 1 Aug 58-1 Jan 59, on Contract DA 23-072-ORD-1048. [1959] 15p. 23 refs. OOR rept. 873.10-C.
Order from LC mi$2.40, ph$3.30 PB 145 173

The anodic oxidation of aluminum in pyridine solutions of sodium iodide or lithium chloride in the presence of benzophenone gives initial mean valence numbers significantly lower than 3. Reduction products, namely benzhydrol and benzopinacol, are isolated from the anolyte hydrolysate in amounts corresponding to oxidation of aluminum from its measured initial mean valence state to the familiar tripositive state. The ratio of the two reduction products shows a dependence on the nature of the cation of the electrolyte. The same reduction products are obtained from the catholyte hydrolysate when lithium chloride is used as electrolyte and aluminum as cathode. Mechanisms are proposed to account for both anolyte and catholyte products. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
THE HEAT OF POLYMERIZATION OF PHENYL GLYCIDYL ETHER AND OF AN EPOXY RESIN. PART II. EFFECT OF ALCOHOL ON THE POLYMERIZATION, by C. H. Klute and B. W. Shellenbarger. 9 Nov 59, 7p. 3 refs. Technical rept. TR-791.
Order from LC mi$1.80, ph$1.80 PB 144 758

In a previous report the heats of polymerization of phenyl glycidyl ether were compared with those of an epoxy resin for a variety of polymerization catalysis. In those experiments 20 parts by weight of ethylene glycol per 100 parts of phenyl glycidyl ether were added to the ether to serve as a cocatalyst. In the present report it is demonstrated that, when lesser amounts of alcohol are used, the measured heats of polymerization are not significantly different from the values obtained earlier. (Author)

Iowa State [U. of Science and Tech.] Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH-TEMPERATURE LUBRICANTS AND RELATED MATERIALS, by Henry Gilman and Richard D. Gorsich. Rept. on Rubber, Plastic, and Composite Materials, Contract AF 33(616)3510. May 57, 63p. 26 refs. WADC Technical rept. 53-426, Pt. 4; AD-118 307.
Order from OTS $1.75 PB 131 176

This project is concerned primarily with the synthesis of new compounds to be examined as potential hydraulic fluids and lubricants. The synthesis and preliminary screening of organo-metallic and organo metalloidal compounds has been extended. New cyclic compounds continue to be promising. It has also been found that the meta-biphenylyl group can be added to those groups which impart desirable physical characteristics. The methyl-dibenzylsilylmethyl group is also of significant promise. In the experimental part, there is included a table which outlines the preliminary screening of thirty-six compounds. (Author).
(See also PB 111 889)

Istituto di Chimica Industriale, Universitá Bologna (Italy).
EXPERIMENTAL AND THEORETICAL STUDY OF THE CONJUGATION IN AROMATIC COMPOUNDS WITH PARTICULAR EMPHASIS ON: 1. SUBSTITUTED DIARYL SELENIDES. 2. DISUBSTITUTED THIOPHENE DERIVATIVES. 3. THEORETICAL CORRELATION OF THE EXPERIMENTAL RESULTS, by Angelo Mangini. Final technical rept. for 1 Oct 58-Oct 59 on Contract DA 91-591-EUC-883. Oct 59, 151p. 40 refs. AD-228 535.
Order from LC mi$7.50, ph$24.30 PB 144 912

Seleno-derivatives: Seleno-derivatives, many not yet described in the chemical literature, were prepared; the preparation and purification of these compounds are very difficult because of their low yield and the separation of metallic selenium. A comparison of the electronic spectra of some suitable seleno compounds indicated that the selenium of selenides, like the sulphur of sulphides, does not expand its valence shell, neither as electron-acceptor nor as electron-acceptor-donor. Thiophene derivatives: Thiophene derivatives, phenyl-thiophenes, diphenyl-thiophenes, and thienyl-ketones, with some benzyl-thiophenes, were prepared through a series of intermediates. Many of these derivatives are new compounds. The electronic spectra were recorded in aprotic solvents. Results indicated (1) a stronger resonance effect of the substituent in the α position than in the β position; (2) the α-phenyl-thiophene is quite comparable to diphenyl; (3) a noticeable steric effect in 3, 4-diphenyl-thiophenes, contrary to the 2-thienyl-ortho substituted phenyl-ketones (ortho substituent being the methyl group or bromine); and (4) the electron donor power of the sulphur of thiophene is greater than the oxygen of furan. A study of the UV spectra of thiophene derivatives indicated that expansion of the valence shell of the sulphur of thiophene appears improbable.

Massachusetts U., Amherst.
O-ACYLHYDROXYLAMINES. II. O-MESITYLENESULFONYL, O-p-TOLUENESULFONYL- AND O-MESITOYLHYDROXYLAMINE, by Louis A. Carpino. Rept. on Contract AF 18(603)114. Oct 59, 12p. 8 refs. AFOSR-TN-59-1242.
Order from LC mi$2.40, ph$3.30 PB 144 962

O-Mesitylenesulfonyl- and O-p-toluenesulfonylhydroxylamine have been prepared by the hydrofluoric acid and perchloric acid cleavages of the corresponding t-butyl N-arenesulfonoxycarbamates. The structures of the O-arenesulfonylhydroxylamines were established by (a) iodometric analysis, (b) reaction with acetone which gave the corresponding O-sulfonylacetoximes and (c) infrared examination. O-Mesitoylhydroxylamine was prepared similarly from t-butyl N-mesitoyloxycarbamate. Reaction of O-mesitoylhydroxylamine with dibenzylamine gave 1, 1-dibenzylhydrazine. (Author)

Mellon Inst. [of Industrial Research, U. of Pittsburgh] Pa.
STEREOSPECIFICITY IN THE FREE RADICAL POLYMERIZATION OF VINYL ACETATE (PART I). SYNTHESIS OF MODEL BRANCHED POLYMERS (PART II). THERMALLY STABLE POLYMERS CONTAINING THE TRIAZINE RING (PART III). MODELS OF STEREOREGULAR POLYMERS (PART IV) by Barbara Botelen, T. G. Fox and others. Technical rept. no. 1 on Contract Nonr-2693(00). 28 Feb 59, 85p. 12 refs.
Order from LC mi$4.80, ph$13.80 PB 144 900

Rochester U., N. Y.
PHOTOISOMERISATION PROCESSES IN CYCLIC KETONES I. CYCLOPENTANONE AND CYCLOPENTANONE ($2,2,5,5,-D_4$), by R. Srinivasan. Rept. on Contract AF 18(600)1528. 25 Nov 58, 14 refs. AFOSR-TN-58-998; AD-206 141.
Order from LC mi$2.40, ph$3.30 PB 138 145

4-pentenal has been identified as one of the products of the vapor phase photolysis of cyclopentanone at 3130A. Quantum yields for the formation of 4-pentenal have been obtained at various temperatures and in the presence of added oxygen and carbon dioxide. The photolysis of cyclopentanone ($2,2,5,5\text{-}D_4$) has been found to give tetradeutero 4-pentenal the structure of which is most probably $CD_2 = CHCH_2CD_2CHO$. On the basis of these results, it is deduced that the photoisomerization of cyclopentanone to 4-pentenal involves a direct transfer of a hydrogen atom from a β-carbon to the carbonyl group in an excited state of the ketone molecule. (Author)

Technical Operations, Inc., Burlington, Mass.
THE CHEMISTRY OF QUINONE, by James E. LuValle, Gershon M. Goldberg and others. Technical note on Contract AF 18(600)371. 15 Aug 58, 73p. 53 refs. Rept. no. TOI 58-29; AFOSR-TN-58-774; AD-201 777.
Order from LC mi$4.50, ph$12.30 PB 137 874

The chemistry of p-benzoquinone has been examined in detail. Of particular interest were the transitory colored intermediates observed in the early stages of some of the known reactions of quinone and the monomeric products thought to be formed on alkaline decomposition of quinone. Hydroxyhydroquinone, hydroxyquinone and 2, 5-dihydroxyquinone were synthesized and their reactions were extensively investigated. It appears likely that a path of decomposition of quinone proceeds through the intermediates hydroxyhydroquinone, hydroxyquinone and dihydroxyhydroquinone to dihydroxyquinone. No evidence for the dismutation of quinone or hydroxyquinone was found. Observations on the behavior of quinone in acid and alkaline solutions led to the formulation of two general mechanisms useful for the explanation of the reactions of quinone in solution. A series of ionic and free radical intermediates formed from quinone are capable of adding ions from solution to form the monomeric reaction products or of adding to other quinone molecules to form the polymeric humic acids. The extreme reactivity of quinone appears to arise as a result of the facile opening of its carbonyl bonds by either acidic or basic reagents. (Author)

Physical Chemistry

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
THE MECHANISM OF POLYTETRAFLUOROETHYLENE PRYOLYSIS, by Henry Friedman. Rept. on Contract AF 04(647)269. 19 June 59, 28p. 26 refs. Technical Information Series R59SD385; Aerophysics Research Memo 37.
Order from LC mi$2.70, ph$4.80 PB 145 182

New kinetic equations for polymer chain degradation were used to examine the polytetrafluoroethylene pyrolysis mechanism. Observations made during polytetrafluoroethylene pyrolysis, which were not readily explained by previously postulated mechanisms, were accounted for by the present mechanism.

Bureau of Mines, Bartlesville, Okla.
THERMOCHEMISTRY AND VAPOR PRESSURE OF ALIPHATIC FLUOROCARBONS. A COMPARISON OF THE C-F AND C-H THERMOCHEMICAL BOND ENERGIES, by W. D. Good, D. R. Douslin and others. Technical note on Contract CSO 680-57-4. 3 Nov 58, 28p. 15 refs. AFOSR-TN-58-976; AD-205 856.
Order from LC mi$2.70, ph$4.80 PB 137 848

The heat of formation of four organic fluorine compounds, including three completely fluorinated aliphatic compounds, was determined by a rotating-bomb method of combustion calorimetry. An earlier technique that used sealed, fused-quartz ampoules for containing samples of volatile fluorine compounds was replaced by an improved technique that used sealed bags of a polyester film.

California U., Berkeley.
THE INFRARED DETECTION OF THE FORMYL RADICAL, HCO, by George E. Ewing, Warren E. Thompson, and George C. Pimentel. Rept. on Contract AF 49(638)1. 9 Nov 59, 18p. 22 refs. AFOSR-TN-59-1197.
Order from LC mi$2.40, ph$3.30 PB 144 866

The photolysis of HI, DI, HBr, and DBr suspended in solid CO at 20°K is described. The formyl radical, HCO or DCO, is produced, as shown by broad absorptions in the visible spectral region (6695, 6352, 6052, 5789, 5548, 5330, 5102 A) which correspond to absorptions of gaseous HCO. Infrared absorptions of HCO (at 1860 and 1091 cm^{-1}) and of DCO (at 1860 and 856 cm^{-1}) provide a basis for discussing the chemical bonding of this free radical and for calculating its thermodynamic properties. These experiments, the first infrared detection of a triatomic free radical by the matrix isolation method, depend upon reactivity of the matrix, possibly eliminating difficulties of the cage effect. (Author)

Central Inst. for Industrial Research (Norway).
OXIDATION OF NIOBIUM, by Tor Hurlen, Hallstein Kjøllesdal and others. Technical scientific note no. 1 on Contract AF 61(052)90. Apr 59, 126p. 75 refs. AD-225 549.
Order from LC mi$6.30, ph$19.80 PB 145 171

The oxidation of niobium was studied at pressures of 760 to 10^{-2} torr (mm Hg) and at temperatures from 150° to 1000°C by gravimetric and volumetric rate measurements, X-ray and electron diffraction, and electron microscopy. The linear (I) oxidation, in the initial stages of the oxidation up to 550°C, represents a phase boundary-controlled dissolution of O into the metal lattice; no oxides were present on the metal surface. The parabolic (II) oxidation is probably due to the diffusion of O, either through a growing layer of NbO_x or through an O-saturated Nb zone of increasing thickness, becoming rate determinable. NbO_x is formed during this oxidation stage at temperatures below 400°C; above 400°C NbO_x is not readily formed. The transition between II and the linear (III) oxidation is connected to a nucleation of $\gamma\text{-}Nb_2O_5$ on the surface of the sheet and not to a breakdown of a protective oxide film. The extension of the transition stage decreases with increasing temperature. Oxidation III also represents a phase boundary-controlled reaction and shows a square root dependence on O pressure; no transition to pressure independence occurred within 760 to 10^{-2} torr (mm Hg). The parabolic IV and V oxidations show a pressure dependence unusually high for a normal Wagner type of oxide growth. Temperate changes cause only negligible effects on the parabolic rate constants at 500° to 600°C. Deviations from the generalized oxidation behavior were found for the oxidation in O of 1 mm Hg above 600°C. Under these conditions, the oxidation seems near to normal in the beginning of the runs, but later the oxidation successively becomes slower than expected from the generalized behavior and almost stops before the sheets are oxidized throughout.

Chicago U., Ill.
CHEMISTRY OF GALLIUM, by Warren C. Johnson. Progress rept. for 1 June-1 Aug 47 on Contract N6ori-20, T. O. 16. [1947] 7p.
Order from LC mi$1.80, ph$1.80 PB 145 454

Research was conducted on: Sublimation experiments; Reaction with excess Ga_2O_3; Ball-mill for grinding reactants; Apparatus for filtration under vacuum; Results of ether extraction of reaction products; X-ray diffraction studies; Apparatus for reaction between Ga_2O_3 and NH_4Cl at atmospheric pressure; and Study of analytical methods. (See also PB 98 426, PB 98 618, and PB 105 062.

Chicago U., Ill.
THERMODYNAMIC STUDY OF InSb USING A MASS SPECTROMETER, by G. DeMaria, J. Drowart and M. G. Inghram. Technical rept. no. 9, 1 July-30 Sep 58, on Contract DA 11-022-ORD-1993. [1958] 23p. 23 refs. WAL-803/19-3; OOR rept. 1543.11P; AD-210 754.
Order from LC mi$2.70, ph$4.80 PB 144 921

The molecules in thermodynamic equilibrium with solutions of indium and antimony have been determined and their partial pressures measured. The partial molar free energy, heat and entropy of solution of antimony in liquid InSb have been calculated.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
TEMPERATURE DEPENDENCE OF MICELLULAR SOLUBILIZATION, by A. Mankowich. 23 Oct 59, 27p. 9 refs. Rept. CCL-85; AD-228 293.
Order from LC mi$2.70, ph$4.80 PB 145 107

The temperature dependence of micellar solubilization was determined in the 140° - 180° F temperature range using a dye (orange OT) solubilization technique with built and unbuilt solutions of three high cloud point commercial surfactants, one an anionic agent of the alkyl aryl suphonate type (SDBS) and two types of nonionic agents, polyoxyethylene sorbitan monolaurate (PSML) and pentadecaethylene glycol nonyl phenyl ether (PGNPE). It was found that the logarithm of solubilization in both built and unbuilt solutions was directly proportional to temperature (solubilization was an exponential function of temperature), and that the log solubilization - temperature slopes of the built and unbuilt solutions of each surfactant were approximately parallel. The linearity of the log solubilization - log concentration function for built and unbuilt surfactant solutions was confirmed at all temperatures. For 0.58:1 to 1.73:1 mole ratios of builder - SDBS, the enhanced solubilization was independent of builder type (neutral Na_2SO_4 or polyphosphate $Na_5P_3O_{10}$); that is, equimolar amounts of Na_2SO_4 or $Na_5P_3O_{10}$ increased solubilization by sodium dodecyl benzene sulphonate equally. In the temperature range studied, no uniform trend for the effect of builders on micellar solubilization by nonionic surfactants was noted. (Author)

Cornell U. [Ithaca, N. Y.]
THE FORMATION OF A DINUCLEAR Cr (III) SPECIES BY OXIDATION OF CHROMOUS SOLUTIONS, by Michael Ardon and Robert A. Plane. Rept. on Contract AF 49(638)279. 23 Oct 58, 12p. 18 refs. AFOSR-TN-58-936; AD-205 090.
Order from LC mi$2.40, ph$3.30 PB 137 843

The dissolved chromic species formed when chromous perchlorate is oxidized in aqueous solution by molecular oxygen is shown by visible spectrum and behavior toward a cation exchange resin to be the same as the hydrolytic polymer which forms first when chromic solutions are refluxed. Analysis of the solution for chromium, perchlorate, and free acid show the species to have a charge of +2 per Cr atom. Ion exchange experiments indicate that +4 is the most likely charge for the entire species, which is consistant with its being dinuclear Cr(III) species with the two Cr atoms bound by either an O or two OH bridges. This same product can be formed by oxidation of Cr^{++} with Tl^{+3} and in lower yield by ClO_3^-, HClO, $Cr_2O_7^=$ and H_2O_2. It is absent when the oxidation is performed with Fe^{+3}, Cu^{++}, Cl_2, or Br_2. It is believed that the dimer results from reaction of the intermediate Cr(IV) with Cr^{++}. (Author)

Duke U., Durham, N. C.
RESEARCH ON THE MANGANESE DIOXIDE ELECTRODE, by W. C. Vosburgh. Terminal rept. on Contract Nonr-1016(00). 26 Feb 58, 12p. 9 refs. AD-153 969.
Order from LC mi$2.40, ph$3.30 PB 137 803

Discharge of MnO_2 electrodes in acid solution: The electrodes were made by electrodeposition of graphite rods from a bath of $MnSO_4$ and H_2SO_4 between 75° and 90°C. The electrolyte was usually 0.045M H_2SO_4. The potential of the MnO_2 electrode was measured against a calomel electrode. The total Mn^{++} in the solution was found by titration and the oxidation value of the MnO_2 was calculated from the time and the current, assuming 100% current efficiency. The calculated composition of the MnO_2 was variable and the total amount was always less than the 0.2 mmol usually found by chemical analysis for similar electrodes. The Mn was also more variable than it should have been. After an apparently complete discharge some MnO_2 always remained on the electrode. The effect of the NH_4Cl concentration of the electrolyte on the potential of MnO_2 electrode: The change of MnO_2 electrode potential was measured with pH for a sample of precipitated MnO_2 in NH_4Cl electrolyte. The change in potential with pH was close to the theoretical value given by the equation, $E = E_o - 0.059$ pH. The effect of adsorption of Mn^{++} ion on the MnO_2 electrode potential: All detectable Mn^{++} was removed from solutions of NH_4Cl and $MnSO_4$ with NH_3 by adsorption or reaction with MnO_2. The termination of a discharge: The discharge of the MnO_2 electrode was terminated when the discharge curve (potential against time) turned fairly sharply downward and the potential decreased more and more rapidly. The Mn^{++} given to the electrolyte at different stages of these discharges was measured.

Frick Chemical Lab., Princeton U., N. J.
CHEMICALLY INDUCED VIBRATIONAL EXCITATION: A STUDY OF THE HYDROXYL RADICALS FORMED IN THE H + O_3 ATOMIC FLAME, by David Garvin. Technical note no. 4 on Contracts AF 18(600)134 and CSO 680-56-30. 20 Nov 58, 31p. 26 refs. AFOSR-TN-58-1076; AD-207 455.
Order from LC mi$3.00, ph$6.30 PB 144 853

The vibrational-rotational spectrum of the hydroxyl radical in its electronic ground state has been determined in the visible and near infra-red region. Line systems in twenty-seven vibrational bands have been identified. Intensities of lines in eighteen bands are reported.

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, by J. H. Affleck. Scientific rept. no. 6 on Contract AF 19(604)4093. 14 Dec 59, 20p. 27 refs. AFCRC-TN-60-104.
Order from LC mi$2.40, ph$3.30 PB 145 364

The thermionic constants have been determined for a number of refractory substrates in combination with a barium activator. Effects of inadequate coverage of the substrate by the activator are discussed, and evidence is presented showing how this influences the measurements. The barium-tantalum carbide system has a low Richardson work function and is to be examined in more detail. (Author) (See also PB 144 187)

Industrial Research and Development Labs., (Gt. Brit.)
GENERAL MECHANISM OF DRAINAGE FROM SOLID SURFACES, by J. S. Stanley and J. A. Radley. Final technical rept. for 1 Oct 58-1 Oct 59 on Contract DA 91-591-EUC-929. 31 Oct 59, 87p. 17 refs.
Order from LC mi$4.80, ph$13.80 PB 144 911

Drainage of pure liquids from solid surfaces which they wet completely has been found to follow Bikerman's drainage equation which expresses the rate of flow of a Newtonian liquid draining from a smooth vertical surface under gravity. The experiments described in this report, however, give evidence of hitherto unsuspected properties of wetting agents. All types of wetting agents tested, anionic, nonionic and cationic behaved qualitatively in the same way, although the actual concentration at which the maxima and minima occurred were dependent upon the electrolyte concentrations of the solutions and upon the structure of the wetting agents. Simple salts and acid dyestuffs that were not surface active had no effect on the quantity of solution retained at the surface. Possible applications of these results in the study of adhesives and lubrications are described.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
STUDIES ON THE LOWER OXIDES OF TITANIUM, by A. D. Pearson. Doctoral thesis. Rept. on Contracts Nonr-1841(10) and AT(30-1)1937. June 57, 54p. 35 refs. Technical rept. 120; AD-135 252.
Order from LC mi$3.60, ph$9.30 PB 137 818

Pure TiO is face-centered cubic (fcc) above ca. 950°C. The structure of samples annealed below this temperature is complex, consisting of 2 or possibly 3 phases not in equilibrium. Impurities and excess of O stabilize the fcc form at room temperature. The electrical resistivity of TiO (prepared by melting) is 2.81×10^{-4} ohm cm at room temperature, and increases with temperature between -162° and 362°C. The thermoelectric e. m. f. of TiO is of the same order of magnitude as that of metals. The directly measured density is less than that calculated from the lattice constant, indicating that 14.6% of the lattice positions are unoccupied. The properties of the products suggest that the TiO-phase oxides may be considered as solid solutions of O in Ti. X-ray investigations indicate that Ti_3O_4 probably does not exist. The trigonal unit cell of Ti_2O_3 is confirmed between room temperature and 350°C by using an improved technique for developing diffraction photographs; at room temperature $\underline{a}$ = 5.428A; α = 56°39'. The lattice parameters change rapidly between 160° and 200°C, corresponding to the rapid increase in magnetic susceptibility. Ti_2O_3 is antiferromagnetic; $\chi_m = 1.09 \times 10^{-6}$ cgs at 20°C. The thermal activation energy of electric conduction of Ti_2O_3 in the room-temperature region is 0.08 ev, about half of the observed optical activation energy (0.15 ev). The material is a p-type semiconductor at room temperature, but n-type conduction becomes dominant above 240°C.

Laval U. (Canada).
STUDY OF CHEMICAL REACTIONS IN THE ELECTRICAL DISCHARGE, by Paul A. Giguère. Technical rept. no. 50 on Contract AF 18(600)492. 10 Nov 59, 8p. AFOSR-TR-59-183.
Order from LC mi$1.80, ph$1.80 PB 144 905

The work done over the past five years is summed up. The first project, entitled: "Kinetics of the thermal decomposition of hydrogen peroxide vapor" was completed successfully. An incidental result was the discovery of the inhibiting action of hydrogen peroxide on the second explosion limit of the hydrogen-oxygen reaction. The second project "Chemical reactions in the electrical discharge" was aimed mainly at spectroscopic identification of trapped free radicals, in particular HO_2. This could not be achieved for reasons that now appear obvious. However, much useful information was obtained on the products of the reactions in dissociated water and hydrogen peroxide vapors and, lately, on the interaction of atomic hydrogen with solid ozone. (Author)

Missouri U., Columbia.
ELECTROCHEMICAL SYSTEMS FOR USE IN LOW TEMPERATURE BATTERIES, by G. V. Lago, J. P. Karnes and J. B. Jennings. Quarterly progress rept. no. 2, 17 June-16 Sep 58, on Contract DA 36-039-sc-74994. [1958]. 27p.
Order from LC mi$2.70, ph$4.80 PB 144 916

Load tests have been made on a number of cells employing MnO_2 - Shawinigan Black cathodes and Mg

anodes at room temperature and at -45°C. Initial and final "no-load" voltages were also measured. The cells have been made more uniform with respect to tightness of packing and to folding of the separator paper. No gas is evolved in the cells at -45°C. The equivalent conductances at infinite dilution and dissociation constants of KSCN-CH_3CN and KSCN-H_2O-CH_3CN systems have been calculated. Viscosities and dielectric constants have been redetermined. Some preliminary work with the KSCN-H_2O-CH_3CN has been done. (Author) (See also PB 138 837)

Naval Ordnance Test Station, China Lake, Calif.
A GRAVIMETRIC DETERMINATION OF INSOLUBLE IMPURITIES AND ASH IMPURITIES IN PROPELLANT-GRADE CELLULOSE NITRATE, by Aaron N. Fletcher. 8 Jan 59, 15p. 2 refs. NOTS-TP-2152; NAVORD Rept. 6444; AD-211 979.
Order from LC mi$2.40, ph$3.30 PB 144 870

Mixed-solvent alkaline degradation of propellant-grade cellulose nitrate is used to allow gravimetric determinations of insoluble and ash impurities in 10-g samples. The need for such large samples is indicated by the nonhomogeneity of impure cellulose nitrate. The standard deviations of measurements for precision were found to be about 0.01% for both the insoluble and the ash impurities determination. Tests for accuracy showed standard deviations of 0.03% for the insoluble impurities and 0.01% for the ash impurities when evaluated over the range 0.0 - 0.6% impurities. (Author)

Naval Ordnance Test Station, China Lake, Calif.
SOME NOTES ON TRAVEL IN EUROPE. I. SYMPOSIUM AND CONGRESS ON MODERN ELECTROCHEMICAL METHODS OF ANALYSIS. II. ACADEMIC, GOVERNMENT, AND INDUSTRIAL RESEARCH LABORATORY VISITS, by Gerald C. Whitnack. 30 Apr 58, 25p. NOTS rept. 1942; AD-200 539.
Order from LC mi$2.70, ph$4.80 PB 144 757

The primary purpose of the trip reported here was to present an invited paper at a Symposium in conjunction with the XVI International Congress of Pure and Applied Chemistry in Paris, France. In addition, official visits to academic, government, and industrial laboratories in Italy, England, and Scotland and conferences with leading scientists in the fields of electrochemistry, polarography and analytical chemistry were arranged. Although the writer is most proficient in these fields and therefore concentrated the most on them, nevertheless, a great deal of knowledge pertinent to other fields of research was obtained. This included information on high explosives, propellants, detonator compositions, chromatography, plastics, manufacturing techniques, synthesis, continuous flow processes, etc. (Author)

Naval Research Lab., Washington, D. C.
IGNITION STUDIES. PART V. STUDY OF THE PROCESSES OCCURRING DURING THE SPONTANEOUS IGNITION OF THE HEXANE ISOMERS, by W. A. Affens, J. E. Johnson, and H. W. Carhart. Interim rept. 27 Jan 60, 17p. 10 refs. NRL rept. 5437.
Order from OTS $0.50 PB 161 105

Spontaneous ignition properties of the hexane isomers in air were studied using a uniformly heated one-liter spherical Pyrex flask. Particular emphasis was placed on pre-ignition reactions by means of measurements of internal gas temperature and oxygen consumption. Time-temperature recordings of gas temperature were found to be helpful in distinuguishing between ignition and non-ignition, but not between hot- and cool-flame ignition, although in most cases this distinction could be made visually in total darkness. Minimum ignition temperature in air for cool- or hot-flame ignition, minimum reaction temperature, pre-ignition range, maximum temperature rise above base temperature, and oxygen consumption at ignition for the isomeric hexanes, appear to show correlation with ease of oxidation and ignition. The present work suggests that minimum ignition temperature for cool- or hot-flame ignition may well be a more reliable criterion for fire safety than the commonly used SIT (hot-flame ignition only). (Author) (See also PB 111 614)

Notre Dame U., Ind.
SINTERING REACTIONS OF ZINC OXIDE, by V. J. Lee and G. Parravano. Rept. on Contract AF 49(638)103. Dec 58, 26p. 6 refs. AFOSR-TN-58-811; AD-202 356.
Order from LC mi$2.40, ph$3.30 PB 137 837

Sintering has been studied from 700° to 900°C in air, oxygen, helium, and hydrogen. Fresh zinc oxide sinters rapidly in air and oxygen, but it does not sinter appreciably in helium in the same temperature range.

Pennsylvania State [U., University Park.]
SURFACE POLARIZATION AND WETTABILITY OF INORGANIC SUBSTANCES BY WATER, by D. P. Enright, L. R. Sonders and W. A. Weyl. Technical rept. no. 8 on Contract N6onr-269, T. O. 8. [1948] 7p. 6 refs. AD-221 183.
Order from LC mi$1.80, ph$1.80 PB 145 455

Some literature review is presented. An outline is given of some experiments involving anhydrous chromic chloride, cadmium iodide mercuric iodide, some clay products and glass capillaries.

Polytechnic Inst. of Brooklyn, N. Y.
STUDIES IN THE REACTIONS OF HIGH ENERGY ATOMS AND MOLECULES, by R. A. Marcus. Rept. on Contract AF 33(616)3887. Jan 59, 36p. 27 refs. WADC Technical rept. 59-24; AD-209 533.
Order from OTS $1.00 PB 151 875

The results obtained in three individual studies are summarized in this final report. A theory is presented which relates the lifetimes of excited molecules formed by light absorption to the wavelength of the exciting light and to the temperature. Measurements of the reaction products from the flash photolysis of acetone are reported for various acetone pressure temperatures, light intensities, wavelengths,

and varying pressures of added oxygen, biacetyl and some hydrocarbons. The measurement of reaction products in flash systems provides helpful, direct information about the primary species produced by light absorption. Various trends in the data indicate the presence of certain excited molecules and hot radicals as well as the usual thermal radicals. The construction of an apparatus is described for the measurement of the rate of a chemical reaction as a function of the relative velocity of the two reactants. In this apparatus a high energy beam of monoenergetic helium atoms is used to bombard hydrogen molecules at room temperature. Preliminary results indicate the formation of hydrogen atoms by this technique, as evidenced by their blue coloration of molybdenum oxide. Various components to be used to make this study a quantitative one are outlined. (Author)

Princeton U., N. J.
PRELIMINARY STUDY OF THE LIGHT SCATTERING TECHNIQUE FOR DETERMINATION OF SIZE DISTRIBUTIONS IN BURNING SPRAYS, by R. A. Dobbins. Technical rept. on Contract AF 18(600)1527. 15 July 58, 54p. 18 refs. Aeronautical Engineering Lab. rept. no. 430; AFOSR-TN-58-822; AD-202 906.
Order from LC mi$3.60, ph$9.30 PB 138 169

Purdue U., Lafayette, Ind.
STRESS RELAXATION AND EXCHANGE IN PELLETS USED FOR THE INFRA-RED TECHNIQUES, by F. Vratny. Rept. on Contract AF 18(603)45. Aug 58, 11p. 4 refs. AFOSR-TR-58-867; AD-203 668.
Order from LC mi$2.40, ph$3.30 PB 138 165

In the pelleting of lead nitrates for infra-red study, exchange between lead nitrate and potassium chloride proceeds at a logarithmic rate. Water adsorption and stress relaxation also proceed at logarithmic rates. Increasing the rate of water adsorption enhance the rate of exchange and stress relaxation. (Author)

Purdue U., Lafayette, Ind.
THE THERMAL DECOMPOSITION OF PRASEODYMIUM NITRATE, by F. Vratny and J. M. Honig. Rept. on Contract AF 18(603)45. Nov 59, 30p. 15 refs. AFOSR-TN-59-1153.
Order from LC mi$2.70, ph$4.80 PB 144 944

The thermal decomposition of $Pr(NO_3)_3$ has been measured in the temperature range $285 \leq T \leq 485$°C. In conjunction with infrared spectra of the solid decomposition products it is postulated that the reaction proceeds via an intermediate nitrite structure. The composition of the final nonstoichiometric oxide varied with the temperature at which the reaction was allowed to proceed. Various characteristic features of this decomposition reaction are discussed. (Author)

Rochester U., N. Y.
THE FLUORESCENCE AND PHOSPHORESCENCE OF ACETONE VAPOR, by Julian Heicklen. Rept. on Contract AF 18(600)1528. 12 Sep 58, 6p. 4 refs. AFOSR TN-58-847; AD-203 337.
Order from LC mi$1.80, ph$1.80 PB 138 245

Light emission from acetone has been studied with incident radiation from 2800A to 3130A.

Rochester U., N. Y.
PHOTOCHEMICAL STUDIES 54. METHANOL VAPOR, by Raymond P. Porter and W. Albert Noyes, Jr. Rept. on Contract AF 18(600)1528. 12 Sep 58, 24p. 17 refs. AFOSR-TN-58-848; AD-203 338.
Order from LC mi$2.70, ph$4.80 PB 138 149

The principal products of the photochemical decomposition of methanol vapor at wave lengths below 2000 Å are hydrogen, formaldehyde, ethylene glycol together with small amounts of carbon monoxide and methane. By use of scavengers and by study of deuterated methanol, CD_3OH, at least two primary processes must occur: (1) $CH_3OH + h\nu = CH_2O + H_2$; 2) $CH_3OH + h\nu = CH_3O + H$. Other primary processes, including the formation of hot methoxy radicals and hot hydrogen atoms, may occur but conclusive evidence for or against them could not be obtained. Secondary reactions are discussed. Methoxy radicals must, by abstraction, form CH_2OH radicals, and CH_2OH radicals must also be formed by the reaction $H + CH_3OH = CH_2OH + H_2$. (Author)

Syracuse U., N. Y.
SOLUBILITY OF IRON IN LIQUID LITHIUM, by John J. Sand. Rept. on Subcontract to Olin Mathieson Chemical Corp. Contract AF 33(600)33920. 22 Aug 58, 40p. 15 refs. OMCC-HEF-166.
Order from LC mi$3.00, ph$6.30 PB 145 280

The solubility of iron in lithium over the temperature range 200°C to 1200°C is estimated to be

$S_T^o = 0.178T - 17.5$ where: S_T^o = the equilibrium solubility of iron in lithium, PPM Fe/Li (parts by weight of Iron per million parts by weight lithium) and T = temperature in degrees C. The experimental method used was to heat the Iron capsules containing lithium to equilibrium at specific temperatures and then to quench them in a CO_2 - oil bath at -30°C. Each quenched iron-lithium sample was analyzed colorimetrically for iron and then by titration for lithium.

Texas U., Austin.
CHEMICAL KINETICS IN LINEAR FLOW SYSTEMS I, by J. A. Cunningham and F. A. Matsen. Technical note 4 on Contract AF 18(603)142. Oct 58, 9p. 2 refs. AFOSR-TN-58-872; AD-203 916.
Order from LC mi$1.80, ph$1.80 PB 138 148

Equations are developed describing the kinetics in a flow system assuming parabolic flow. While these equations are more complex then the equations for planar flow developed in the preceding technical note, they do not improve the description of the thermal decomposition of butane. (Author)

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
SOLUTIONS FOR COMPLEX SYSTEMS OF CHEMICAL REACTION KINETICS. PART I. AN IRREVERSIBLE UNIMOLECULAR REACTION FOLLOWED BY A SECOND IRREVERSIBLE UNIMOLECULAR REACTION, by David D. Konowalow, James E. Blair and others. Rept. on Theory of Propagation of Flames and Detonations, Contract AF 33(616)3414. Aug 59, 44p. WADC Technical note 59-243, Pt. 1.
Order from OTS $1.25 PB 161 408

The analytical solutions of the rate equations for the system $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ are explored for characteristic features which are useful to the kineticist in determining the rate constants from fragmentary experimental data. Among the most useful features are the maximum which B exhibits and the time at which it occurs from which both rate constants can be determined. A critical examination of the pseudostationary state approximation as applied to this system is made The approximation is found to be accurate when the intermediate B is short lived. (Author)

Trinity Coll., Dublin (Eire).
MAGNETOCHEMICAL BEHAVIOUR OF THE 7-SUBSTITUTED 8-HYDROXYQUINOLATES OF NICKEL, by William J. Davis and Ronald E. Burton. Final technical rept. no. 1, 1 Oct 58-1 Oct 59, on Contract DA 91-591-EUC-96001-1069-59. 1 Oct 59, 13p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 144 889

This work was undertaken to elucidate the structure and behavior of the complexes formed by nickel with certain 8-hydroxyquinolines (oxines) substituted in the 7-position. The main effort has been concentrated on (a) the synthesis of 7-substituted 8-hydroxyquinolines, (b) the examination of the compounds formed between nickel ions and these oxines, (c) the construction of a precision magnetic susceptibility balance, and (d) measurements of magnetic susceptibilities of nickel oxinates.

West Virginia U., Morgantown.
COMPLEXES OF COPPER(II) ION AND 2-AMINO-2(HYDROXYMETHYL)-1, 3-PROPANEDIOL, by James L. Hall and Joe A. Swisher. Technical rept. no. 5, 1 June 58-31 Aug 59, on Metal Ion Complexes of Oxygen-Substituted Amines, Contract DA 36-061-ORD-579. 15 Nov 59, 15p. 12 refs. OOR rept. 1604.11-C.
Order from LC mi$2.40, ph$3.30 PB 144 913

The coordination compounds formed by copper(II) ion and 2-amino-2(hydroxymethyl)-1, 3-propanediol have been studied in solution and by the preparation of crystalline compounds. The amine, $H_2NC(CH_2OH)_3$, is commonly named tris-(hydroxymethyl)-aminomethane and will be abbreviated tris.

Wisconsin U. [Madison].
HYDROGEN BONDING STUDIES. IV. ACIDITY AND BASICITY OF TRIPHENYLHYDROXY COMPOUNDS OF GROUP IV_B ELEMENTS AND THE QUESTION OF PI-BONDING FROM OXYGEN TO METALS, by Robert West and Ronald H. Baney. Rept. on Contract AF 49(638)285. 8 Dec 59, 19p. 26 refs. AFOSR-TN-59-1207.
Order from LC mi$2.40, ph$3.30 PB 144 865

The acidity and basicity as hydrogen bond donors and acceptors has been measured for the compounds Ph_3MOH, where M = C, Si, Ge, Sn and Pb. The trends in acidity and basicity in these compounds indicate that dative pi-bonding from oxygen to M is strong in Ph_3SiOH, weaker in Ph_3GeOH, and negligible in the other three compounds. A linear relationship has been found between νOH and the electronegativity of M, for these and related hydroxyl compounds. (Author) (See also PB 142 157)

Wisconsin U., Madison.
STUDIES OF PERCHLORYL FLUORIDE FLAMES, by R. Maurice Lodwig and John L. Margrave. Technical rept. on Contract DA 11-022-ORD-1818. 31 May 58, 24p. 19 refs. OOR rept. 1428.5-6; AD-137 094.
Order from LC mi$2.70, ph$4.80 PB 145 083

Wisconsin U., Madison.
THE VAPOR PRESSURE OF NICKEL FLUORIDE, by Milton Farber, Richard T. Meyer, and John L. Margrave (Jet Propulsion Lab.). Technical rept. on Contract DA 11-022-ORD-1818. 1 Mar 58, 6p. 9 refs. AD-158 448.
Order from LC mi$1.80, ph$1.80 PB 144 859

The vapor pressure of NiF_2 was measured to see if the objection raised about the possibility that NiF_2 might be sufficiently volatile at high temperatures to complicate the interpretation of the data was checked for its validity for experiments carried out in Ni containers. Vapor pressure was measured by the Knudsen effusion method over the range 1026 to 1104°K and the flow method with N_2 as the flow gas over the range 1233° to 1349°K. Results indicated that the vapor pressure of NiF_2 is a negligible part of the F pressure deviation observed by Doescher (J. Chem. Phys. 19:1070, 1951; 20: 330, 1952), and $NiF_2(g)$ was not present in high enough concentrations to change the interpretation of the effusion data of Wise (J. Chem. Phys. 20:927, 1952).

EARTH SCIENCES

Willow Run Labs., U. of Michigan, Ann Arbor.
OBSERVATIONS OF HIGH-FREQUENCY SEISMIC ENERGY, by D. E. Willis, R. C. Fitzpatrick, and J. T. Wilson. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Jan 59, 17p. Rept. no. 2144-305-T.
Order from LC mi$2.40, ph$3.30 PB 145 119

Observations of seismic waves generated by nuclear and high-explosive blasts and earthquakes were made with standard refraction-type geophones. The output of the geophones was recorded on magnetic tape and seismic level recorders. A comparison and analysis of seismic data from various sources is shown. . High-frequency seismic waves appear to have been transmitted over large distances from the three types of sources. (Author)

Climatology and Meteorology

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
HIGH ALTITUDE CLOUD PHOTOGRAPHY FROM BALLISTIC MISSILES, by D. N. Vachon and J. I. F. King. Rept. on Contract AF 04(647)269. 1 Dec 59, 17p. Technical Information Series R59SD471.
Order from LC mi$2.40, ph$3.30 PB 145 181

During the time between separation and re-entry, the nose cones of IRBM's and ICBM's can be utilized for many scientific purposes. Recently during the normal course of flight testing, 16mm films were used to record the separation and stabilization processes. Although the camera system was not designed for cloud photography, we were able to obtain some extremely useful information. A brief analysis of the cloud systems has been made and is summarized with the use of a limited number of prints. The potential of future cloud photography during flight tests is explored.

Air Force Cambridge Research Center, Bedford, Mass.
THE METEOROLOGICAL MEASUREMENTS AND FIELD PROGRAM OF PROJECT JET STREAM FROM 1956 TO 1958, by R. M. Endlich and R. M. Rados. Oct 59, 134p. 23 refs. Geophysical Research Papers no. 64; AFCRC-TR-59-266.
Order from OTS $2.75 PB 161 432

During the course of "Project Jet Stream," a number of meteorological research flights were made at altitudes from 25,000 to 40,000 feet in a B-47 aircraft equipped with special instruments for measuring winds, temperatures, pressure, turbulence, etc. The measurements from 36 flights conducted from Wright-Patterson Air Force Base, Dayton, Ohio, during 1956-1957 have been processed for use in research efforts. These data pertain to several operational problems of aircraft and missiles and to many fundamental meteorological questions; therefore, they are being made generally available for study. To use the data intelligently, some familiarity with the measuring instruments and with the conduct of the field program is required. This paper is intended to supply this background. Methods of data reduction and the final forms in which the data are presented are also described. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
A NOTE COMPARING 1-KM VERTICAL WIND SHEARS DERIVED FROM SIMULTANEOUS AN/GMD-1A AND AN/GMD-2 WINDS-ALOFT OBSERVATIONS, by H. A. Salmela and N. Sissenwine. Nov 59, 15p. GRD Research Notes no. 22; AFCRC-TN-59-496.
Order from OTS $0.50 PB 161 429

Winds-aloft observations that were taken simultaneously by the AN/GMD-1A and AN/GMD-2 rawin sets during field trials of the new AN/GMD-2 at Andrews AFB, Maryland are analyzed and compared. For wind-speed differences for approximately one kilometer of ascent (actually three minutes) equal to and greater than 20 mps as observed by the GMD-2, the distribution of the differences as observed by the GMD-1A is presented. The maximum wind differences for the positive shear (wind increasing with height) and the negative shear (wind decreasing with height) as observed by the GMD-1A are compared with the simultaneous differences reported by the GMD-2. These latter differences give the approximate true shears. Comparison of the two sets of vertical wind shears (wind-speed differences) makes it possible to obtain a quantitative estimate of the exaggeration in the vertical wind shears indicated by operational GMD-1A soundings. (Author)

Cloud Physics Lab., U. of Chicago, Ill.
CLOUD REFRACTIVE INDEX STUDIES. PART II: USE OF DISTRIBUTIONS OF ΔN VS. ΔS FOR ESTIMATING MECHANICAL TURBULENCE, by Roscoe R. Braham, Jr. Edward L. Harrington, and Thomas E. Hoffer. Technical note no. 17 on Contract AF 19(604)1931. 2 Sep 58, 36p. 2 refs. AFCRC-TN-58-613; AD-206 771.
Order from LC mi$3.00, ph$6.30 PB 137 910

An analysis was made of fine structure variations of refractive index in and around a group of about 70 cumulus clouds with a view toward relating these variations to mechanical turbulence parameters. Frequency distributions of refractive index gradients were prepared for each level of flight for clear air, cloud core and regions of transition at the cloud boundaries. Similar distributions were prepared for refractive index increments. The latter distributions in the form of tables of N change vs. gradient size (ΔS), are presented as an appendix. From these distributions a parameter analogous to the "mixing" length" of early turbulence theory was computed. This study shows that eddies of the transition regions of cumulus clouds have dimensions of a few tens of meters and are carried for distances of the order of 30-50 meters before losing their identity. Mixing lengths of clear air eddies are much larger than those of cloud eddies, except, possibly, for those eddies in the uppermost parts of the clouds. (Author)

Deutscher Wetterdienst, Frankfurt (West Germany).
TEMPERATURE OF MIDWINTER AND PRECEDING SOLAR ACTIVITY, by E. Dinies. Scientific rept. no. 1 on Contract AF 61(514)954c. Oct 56, 9p. 1 ref. AFCRC-TN-57-279; AD-117 164.
Order from LC mi$1.80, ph$1.80 PB 137 680

Florida State U., Tallahassee.
A NUMERICAL EXPERIMENT IN DEDUCTION OF THE DIVERGENCE ASSOCIATED WITH A MODEL OF A STEADY COLD CYCLONE, by Stanley E. Asplund. Technical rept. no. 14 on Contract Nonr-1600(00). 31 Jan 59, 212p. 62 refs.
Order from LC mi$9.60, ph$33.30 PB 144 555

The tropospheric wind structure in a sub-class of cut-off cold-core cyclones is idealized in a model. This model is a hypothetical case in which velocity divergence is present in exactly the right amount to maintain a zero local rate of change of vorticity. The rotational nondivergent part of the total wind field is prescribed. The divergent irrotational part is obtained by an iterative numerical process based upon evaluation of divergence from the vorticity equation. Beginning with the lower-boundary assumption of vertical velocity, the divergence required to balance all other contributions to vorticity tendency is computed at 100 mb intervals. Successive pressure surfaces are linked by numerical integration of the continuity equation. Computations and results through 500 mb are reported and discussed. The model wind field is prescribed by mathematical expressions for zonal wind superimposed on a vortex at a reference surface of 565 mb.

Massachusetts Inst. of Tech., Cambridge.
THE EVALUATION OF SUBJECTIVE PROBABILITY FORECASTS, by Frederick Sanders. Scientific rept. no. 5 on Contract AF 19(604)1305. June 58, 63p. 6 refs. AFCRC-TN-58-465; AD-160 741.
Order from LC mi$3.90, ph$10.80 PB 137 505

An evaluation is made of a large number of subjective probability forecasts referring to a wide variety of weather elements and conditions and to time periods up to twenty hours in advance. These forecasts are found to be generally quite reliable, if reliability is measured by the correspondance between each forecast probability value and the corresponding percent frequency of occurrence of the forecast weather condition (mean "observed" probability value). The forecast probability values and the corresponding percent frequencies of occurrence are expressed in terms of departures from climatological expectancy. It is then found that the observed departure values are only about three quarters of the forecast departure values. A method is presented of scoring the probability forecasts in terms of a percent reduction over climatology. It is shown that this percent reduction suffers not only because of lack of reliability, as defined above, but also because of lack of resolution. The resolution of a set of forecasts representing a particular forecast probability value is measured by the variance of the individual "observed" probability values about their mean for that set. Lack of resolution is primarily responsible for the rather modest percent reduction yielded by the subjective probability forecasts. A negative percent reduction is found in those forecasts which refer to weather conditions which occur either very infrequently or very frequently. Probabilistic forecasts are discussed in relation to categorical forecasts, and some advantages of the former are elucidated. (Author)

Meteorologic Lab., U. of Illinois, Urbana.
EVALUATION OF THE AN/APQ-39(XA-3) CLOUD DETECTOR RADAR, by K. E. Wilk. Final rept. for 16 Mar 55-31 Mar 58 on Contract AF 19(604)1395. [1958] 42p. 10 refs. AFCRC-TR-58-246; AD-152 596.
Order from LC mi$3.30, ph$7.80 PB 137 693

This report is an evaluation of a ground based AN/APQ-39(XA-3) airborne radar as a cloud indicator during the winter months in the Midwest. Data on clouds, precipitation, and other meteorological parameters were collected by means of a modified AN/APQ-39(XA-3) radar, meteorological instruments, and cloud photography. The observed data and radar characteristics are analyzed to determine the empirical detection capabilities, theoretical detection capabilities, and the synoptic interpretations of the radar echoes. The results indicate the AN/APQ-39(XA-3) radar is capable of detecting 77 percent of the observed clouds. Cloud genera usually can be identified from the configuration of the radar return. The radar also provides limited knowledge of the existence and character of precipitation and of the air mass structure. (Author)

Meteorologic Lab., U. of Illinois, Urbana.
STUDY AS TO MERITS OF VARIOUS RAPID RAINDROP COUNTING AND SORTING TECHNIQUES, by Glenn E. Stout and William C. Ackermann. Final rept. for 15 May 56-13 Mar 58 on Contract AF 19(604)1900. [1958] 30p. 5 refs. AFCRC-TN-58-255; AD-152 632.
Order from LC mi$2.70, ph$4.80 PB 138 093

An extensive literature search has been made to evaluate known instruments, designs, and methods of counting rain and drizzle drops according to their sizes. Emphasis has been placed on the techniques that are adaptable to automatic registration of drop count versus various powers of drop diameter.

Naval Ordnance Test Station, China Lake, Calif.
MODIFIED RADIOSONDE FOR OBTAINING LOWER-LEVEL ATMOSPHERIC DATA, by Paul H. Miller. 1 Oct 59, 19p. 3 refs. NOTS TP-2334; NAVORD Rept. 6600.
Order from LC mi$2.40, ph$3.30 PB 145 124

A standard AMT-4 radiosonde modulator has been modified at the Naval Ordnance Test Station for use in obtaining micro-meteorological temperature data in the lower levels of the atmosphere. The modification consists of reqiring the basic circuit to eliminate the taking of relative humidity data and increase the number of high references made. The sequence of transmitted data consists of alternating low references and temperature data throughout a range of four contacts followed by a high reference. This sequence is repeated until the 105th contact is reached, a point well above the upper limit of the range of interest in a low-level sounding. The modified radiosonde may be used as either a captive instrument or attached to a slow-rising balloon. (Author)

Naval Ordnance Test Station, China Lake, Calif.
A PROPOSED RABAL SYSTEM FOR THE RAPID ACQUISITION OF HIGH-ALTITUDE WIND DATA, by Paul H. Miller. Sep 59, 15p. 4 refs. NAVORD rept. 6593; NOTS TP-2325.
Order from LC mi$2.40, ph$3.30 PB 144 984

A modified radiosonde has been assembled at the Naval Ordnance Test Station with which it is proposed to obtain high-altitude wind data more rapidly and economically than is possible with existing equipment. The unit consists of a battery and an AN/AMT-4 transmitter that emits an unmodulated carrier signal. The unit may be tracked with either one or two GMD-1 tracking antennas depending on whether the desired winds-aloft data is to be obtained by using an assumed ascension rate or by triangulation. Advantages and disadvantages of both methods are outlined. The suggested configuration and methods eliminate many of the steps now involved in the determination of high-altitude winds. (Author)

Naval Ordnance Test Station, China Lake, Calif.
TROPOPAUSES AND RELATED ATMOSPHERIC PHENOMENA AT THE NAVAL ORDNANCE TEST STATION, by P. H. Miller and D. L. Farnham. Nov 59, 158p. 62 refs. NOTS TP-2226; NAVORD rept. 6533.
Order from LC mi$7.50, ph$24.30 PB 145 167

Tropopause data obtained and evaluated at the Naval Ordnance Test Station indicate a very definite correlation between the major tropopauses and their leaves, and such phenomena as the jet steam, clear-air turbulence, mountain waves, and the formation of aircraft condensation trails. A review of the literature on tropopauses and related phenomena is presented. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
YUMA SUMMER MICROCLIMATE, by Arthur V. Dodd and Harry S. McPhilimy. Nov 59, 39p. 8 refs. Technical rept. EP-120.
Order from LC mi$3.00, ph$6.30 PB 145 139

Detailed and continuous temperature, wind, and radiation records for a 2-month summer period under diverse terrain conditions at Yuma Test Station, Arizona, were analyzed. It was found that the temperature regime near and at the earth's surface varies significantly from the regime as found by "standard" observations. Midday temperatures greater than 140F were frequent on both sand and desert pavement surfaces. Temperatures at levels 200 centimeters above these surfaces were seldom more than 110F. The wind regimes at the relatively low sandy plains and desert pavement sites were quite similar, with strongest winds in the afternoon and very light winds at night. Winds measured at the crest of a hill averaged stronger day and night and had important effects on the temperature regime. The total incoming radiation at Yuma Test Station at midday is extremely high, often exceeding 500 Btu/ft^2/hr. Outgoing radiation is also at a maximum at midday when it averages over 300 Btu/ft^2/hr. The net radiation is positive (incoming) for an average of 12 hours each day, and exceeds 150 Btu/ft^2/hr for an average of 6 hours each day. At night there is a small negative radiation balance. (Author)

Washington U., Seattle.
A METHOD OF ANALYSIS OF SURFACE GEOSTROPHIC WINDS IN MOUNTAINOUS REGIONS, by Nolan Patrick Williams. Scientific rept. no. 6 on Contract AF 19(604)3063. Aug 59, 49p. 7 refs. AFCRC-TN-59-413; AD-217 311.
Order from LC mi$3.30, ph$7.80 PB 144 581

A method of representing the air flow over mountainous terrain is derived to serve the same function as an isobaric analysis in flat regions. Constant pressure charts were analyzed at 50-mb intervals between 950 and 750 mb, the height contours being terminated where they intersected solid ground. At these intersections, geostrophic winds were measured, plotted on a base map, and analyzed by means of streamlines and isotachs. These plots gave what may be termed the true surface geostrophic wind field. This field proved very different from the geostrophic wind field corresponding to the sea-level isobars. A large fictitious gradient over the mountains of western Canada and Alaska was analyzed. The tedious process involved in obtaining the true surface geostrophic wind is not suited to practical use. An attempt was made to combine routine analyses in such a way that they yielded an equivalent result. The combination of the surface and 850-mb charts gave a satisfactory representation in most areas, though it was necessary to make use of the 700-mb chart in the vicinity of the St. Elias Range. (Author)

Washington U. [Seattle]
RESULTS OF A SERIES OF DYNAMICAL PREDICTIONS FOR THE ARCTIC: WINTER SEASON, by Richard J. Reed. Scientific rept. no. 8 on Contract AF 19(604)3063. Sep 59, 56p. 14 refs. AFCRC-TN-59-415; AD-217 313.
Order from LC mi$3.60, ph$9.30 PB 144 690

A series of 24-hr forecasts of 1000 and 500-mb height, and 1000 to 500-mb thickness for the area north of 60° are presented for a 20-day period in December 1956 and January 1957. The forecasts are based on graphical integrations of a two-level baroclinic model. An approximate and exact method were used to convert vorticity changes to height changes. The verifications include both types of forecasts. The performance of the daily forecasts, as expressed by space correlations and root-mean-square errors, was slightly better than for an earlier arctic forecast (AD-211 493), and somewhat poorer than for similar forecasts for the US and Canada. The differences in performance can be explained largely on the basis of the degree of synoptic activity and the equality of the map analyses. From the time correlations (or correlations at grid points) and the corresponding root-mean-square errors, results indicate that the method performed best in or near regions where the observed root-mean-square pressure or height changes were largest. The forecast accuracy seemed to be sensitive to the synoptic regime and, other things being equal, to be greater at middle latitudes where weather changes are more active. (Author)

Washington U. [Seattle]
A SYNOPTIC-CLIMATOLOGICAL STUDY OF THE ARCTIC CIRCULATION IN SUMMER, by Bruce Arlen Kunkel. Scientific rept. no. 7 on Contract AF 19(604)3063. Sep 59, 53p. 20 refs. AFCRC-TN-59-414; AD-217 312.
Order from LC mi$3.60, ph$9.30 PB 144 691

Estimates of cyclone and anticyclone frequencies for the area north of 60°N for the summer season were revised using data for the 5 years, 1952-56. In view of the different pictures these recent data give regarding the arctic circulation in summer, mean monthly sea-level pressures for the 5-year period and frequencies of various types of fronts were obtained. Results indicate that the inner arctic is a region of high cyclone frequency in summer. The large frequency and great persistence of the lows makes this region somewhat analogous to the Aleutian and Icelandic regions of semipermanent low pressure. The lows in the Arctic Basin have their origin mainly over Siberia and may be attributed to the strong baroclinic zone that develops along the arctic coast in summer. Greatest frequency of anticyclones is found in the zone about 75°N. Instead of a single polar front displaced far northward from its winter position, 2 belts of high frequency were found, one off Japan and another along the arctic coast. Minimum frequencies occurred in the area formerly believed to be occupied by the polar front. (Author)

Frost Science

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
TABLES OF KELVIN FUNCTIONS AND THEIR DERIVATIVES, by D. E. Nevel. Rept. on Mechanics of Ice Sheets. June 59, 75p. 3 refs. Technical rept. 67.
Order from LC mi$4.50, ph$12.30 PB 145 116

Tables of the basic functions necessary for the solution of problems related to the trafficability of ice sheets are tabulated, including the following functions and their first derivatives: ber (χ), bei (χ), ker (χ), kei (χ), ber_ϕ (χ), and bei_ϕ (χ) for $0 \leq X \leq 1$ ($\Delta X = 0.001$), $1 \leq X \leq 6$, ($\Delta X = 0.01$), and $6 \leq X \leq 10$ ($\Delta X = 0.1$). A differential equation is given which describes the bearing capacity of a floating ice sheet (considered as a plate on an elastic foundation) together with a solution in terms of Kelvin functions. The formulas for these functions and their first derivatives are also presented. The functions were computed with a Bendix G-15D electric computer and are accurate to the last digit (12th), except for 4, which are occasionally in error in the last digit. (Author)

Dartmouth Coll., Hanover, N. H.
ICE STRUCTURES, ANGIUSSAQ LAKE, NORTHWEST GREENLAND, by L. D. Taylor and J. B. Lyons. Scientific rept. no. 1 on Contract AF 19(604)2159. 1 Sep 59, 37p. 27 refs. AFCRC-TN-59-461.
Order from LC mi$3.00, ph$6.30 PB 144 799

A discussion is presented of the structural and textural features of the four major ice types underlying perennially-frozen Angiussaq Lake, Northwest Greenland. Major attention is focused on the lake ice and the major and minor features which contribute to its strength and suitability as an aircraft landing platform. The other ice types - glacial ice, coarse-grained stratified ice, and granular stratified ice - are of minor areal extent, but of significance in unravelling the developmental history of the lake. Strength tests on the lake ice, carried out by Barnes, indicate its ability to support a C-124, even at the height of the thaw season. Surface imperfections in the ice cover, however, make it unsafe for landings at that time of the year. Suggestions are offered for a few simple modifications which could possibly convert the lake ice surface into a suitable all-weather airstrip. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
SQUAW VALLEY WINTER TRIALS, 1958-59, COMPACTED-SNOW PARKING STUDY ON MEADOW LAND by R. C. Coffin, Jr. Final rept. 16 Nov 59, 67p. 5 refs. Technical rept. 051.
Order from LC mi$3.90, ph$10.80 PB 145 156

The results of constructing, trafficking, and maintaining a 15-acre compacted-snow public parking lot on the meadow at Squaw Valley, California, during the winter of 1958-59 are presented. It is concluded that a compacted-snow mat can be built in January and maintained through February provided there is at least 18 in. of snow pack, that night temperatures are usually below freezing, and that the area is adequately protected against runoff water from surrounding areas. (Author) (See also PB 137 880)

Geodesy

Aeronautical Chart and Information Center, St. Louis, Mo.
GEODESY FOR THE LAYMAN, by Richard K. Burkard. Oct 59, 83p.
Order from OTS $2.25 PB 161 372

The use of intermediate and long range rockets and missiles requires that the distance and direction from launch site to target be accurately known. The science of geodesy can help to provide this information. The basic principles of geodesy and geodetic surveying are presented in an elementary form. The formation of geodetic datums is introduced and the necessity of connecting or joining datums is discussed. Methods used to connect independent geodetic systems to a single world reference system are discussed. Particular emphasis is placed on the Air Force role in developing a World Geodetic System. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
RESULTS IN GEODETIC PHOTOGRAMMETRY. I. THE PRECISE DETERMINATION OF THE LOCATION OF BERMUDA FROM PHOTOGRAMMETRIC OBSERVATIONS OF FLARES EJECTED FROM JUNO II, by Duane C. Brown. Rept. on Missile Test Project, Contract AF 08(606)1156. 27 Oct 59, 33p. 4 refs. RCA Data Processing Technical rept. no. 54; AFMTC-TR-59-25.
Order from LC mi$3.00, ph$6.30 PB 144 794

Photogrammetric observations of a pair of flares ejected from a Juno II rocket have led to the determination of the location of Bermuda on the North American Datum. Bermuda's position was altered by 1."2 ±0."54 in latitude and by 6."8 ±0."60 in longitude, the total displacement amounting to 176.5 ±17.5 meters. The success of this venture provides further support to the thesis that advanced photogrammetric techniques are capable of producing geodetic positions to first order accuracy over very long distances. Suggestions on various aspects of a possible global program of geodetic photogrammetry are forwarded. An appendix considers the problem of adjusting a general photogrammetric net when not only the plate coordinates, but also any elements of camera orientation and any coordinates of control are considered to be observed quantities subject to significant errors of known variance and covariance. (Author)

O'Neill, Hugh T., and Associates, Annapolis, Md.
NEW METHODS OF RECONNAISSANCE AND INTELLIGENCE FROM AERIAL PHOTOGRAPHY, ESPECIALLY BY MEANS OF NEW TYPES OF FILMS AND FILTERS. Technical rept. no. 1 on Contract AF 33(616)262. 30 Sep 53, 86p. AD-203 988.
Order from LC mi$4.80, ph$13.80 PB 145 444

Contents:
Part I. A basic study of the factors which influence the recognition of objects in aerial photographs
Part II. Preliminary review and study (of) past and present color systems, processes and techniques to determine their possibilities for inclusion in an improved film for aerial reconnaissance
Part III. A determination of the characteristics such as, the value, contrast and color, which are necessary in aerial photographs in order to extract the maximum amount of information from monochromatic two-color and three-color aerial photographs
Part IV. Preliminary research of the suitability of techniques of exposing black and white films with alternating color filters producing stereo pairs with different tonal renditions for aerial reconnaissance.

Oceanography

Chesapeake Bay Inst., Johns Hopkins U. [Annapolis, Md.]
COMPUTATION OF THE LONGITUDINAL SALINITY DISTRIBUTION IN A DELAWARE ESTUARY FOR VARIOUS DEGREES OF RIVER INFLOW REGULATION, by D. W. Pritchard. Rept. on Contracts 14-16-008-517 and 14-16-008-546. Sep 59, 77p. Technical rept. XVIII; Reference 59-3.
Order from LC mi$4.50, ph$12.30 PB 144 712

This report presents the results of an evaluation of the probable longitudinal distribution of salinity as a function of time under four different seasonal flow patterns: (a) Modal Flow: a typical natural annual variation in river inflow; (b) Modified Case 1: low river flow regulated at 4,000 cfs (at Trenton); (c) Modified Case 2: low river flow regulated at 6,000 cfs (at Trenton); (d) Modified Case 3: low river flow regulated at 8,000 cfs (at Trenton). For each of these flow conditions the seasonal variation in salinity was computed as a function of position along the central axis of the estuary, under the assumption that the particular seasonal flow variation under consideration was repeated year after year. The method of computation is described in later sections of this report.

Narragansett Marine Lab., U. of Rhode Island, Kingston.
BIOLOGICAL PRODUCTIVITY PROJECT, by David M. Pratt. Rept. for 1 Jan-31 Dec 58 on Contract Nonr-396(03). [1958] 6p. Ref. no. 59-1.
Order from LC mi$1.80, ph$1.80 PB 145 209

Growth rates of the quahog, Venus mercenaria L., in Narragansett Bay were studied over a three-year period in relation to various environmental factors. It was shown that growth is not appreciably influenced by existing differences in current speed, dissolved oxygen content, or salinity of the bottom water. Growth is negligible below 10°C and increases with rising mean temperatures at least to 23°C. Temperature appears to impose an upper limit to the potential rate of growth. Comparisons of growth rates with phytoplankton concentrations suggested that small diatoms, either living or as detritus, are an important source of quahog nutrition in these waters. It was repeatedly demonstrated that growth is retarded in sediments with a high silt-clay content. This effect was studied in relation to the concomitant reduction in sediment permeability, the possible accumulation of inhibitory substances in muddy sediments, and the necessity for more frequent clearing of the animals' filtering apparatus.

Scripps Institution of Oceanography, U. of California, La Jolla.
MARINE MICROBIOLOGY, by Leslie Ralph Berger and Claude E. ZoBell. Annual progress rept., no. 11, 1 Jan-31 Dec 57, on Physiological Activities of Marine Bacteria, Contract N6onr-275(18). 1 Jan 58, 15p. 5 refs. SIO Reference 58-1; AD-156 539.
Order from LC mi$2.40, ph$3.30 PB 138 280

The effects of temperature and pressure were investigated on a glycosidase from a Streptomyces species. Glycosidase catalyzes the reaction between phenyl-β-D-2-deoxy-2-acetamidoglucoside and H_2O to yield phenol and N-acetylglucosamine. The rate at which phenol is liberated from the glycoside was measured from 1 to 1000 atm and between 15° and 60°C. At the lower temperatures, pressure decreased the reaction rate. At the higher temperatures, the increased pressure inhibited what appeared to be thermal denaturation of the enzyme system. A thermal gradient incubator block is described for use in bacteria growth studies

at 18 different temperatures simultaneously. Equilibrium constants are being determined of various ionic substances under pressure. Attemps are being made to develop better nutrient media for the enumeration of marine bacteria and to determine the specific growth requirements of pure cultures. The kinetics of bacterial growth is discussed. (See also PB 127 188)

Woods Hole Oceanographic Institution, Mass.
OPTICAL STUDIES OF PARTICULATE MATTER IN THE SEA, by Bostwick H. Ketchum and David H. Shonting. Technical rept. on Contract Nonr-2219(00). Feb 58, 29p. 8 refs. Reference no. 58-15.
Order from LC mi$2.70, ph$4.80 PB 138 326

A study of particulate matter distribution using the light-scattering photometer was made on the Cariaco Trench in the Caribbean Sea. Five successful lowerings of the light-scattering photometer were made; two near the center of the basin, one on the eastern sill, one on the western sill of the trench, and one in St. George's Harbor, Grenada, B. W. I. A discussion of the light-scattering data of the trench waters and its relationship to the dynamics of the water in the general area of the trench is presented. A comparison is made with the light scattering and Secchi disc readings of both the trench and the continental shelf waters. In addition, a theoretical relationship of scattering intensity with extinction coefficient is derived along with a comparison of turbidity measurements with other oceanographic data.

Physics of the Atmosphere

Arizona State Coll., Flagstaff.
THE ABUNDANCE OF ATMOSPHERIC CARBON MONOXIDE AT FLAGSTAFF, ARIZONA, by Arthur Adel. Scientific rept. HB-8 on Infrared Spectroscopy of the Sun, Moon, and Earth, Contract AF 19(604)2177 7 Sep 59, 23p. 3 refs. AFCRC-TN-59-466.
Order from LC mi$2.70, ph$4.80 PB 144 976

Thirty-four recorded measurements of the rotation-vibration line R(2) in the carbon monoxide band at 4.7 microns in the solar-telluric spectrum have been analyzed to ascertain the abundance of the gas above the Atmospheric Research Observatory at Flagstaff, Arizona.

Electrical Engineering Research Lab., U. of Texas, Austin.
A COMPARISON OF OBSERVED AMPLITUDES OF TROPOSPHERIC INDEX OF REFRACTION FLUCTUATIONS WITH THOSE CALCULATED FROM OBSERVED MEDIAN TRANSMISSION LOSSES, by Frank N. Edmonds, Jr. Rept. on Contract AF 19(604)2249. 15 Aug 58, 34p. 14 refs. Rept. no. 6-25; AFCRC-TN-58-378; AD-160 831.
Order from LC mi$3.00, ph$6.30 PB 138 249

In a companion report, a mathematical description of the index of refraction fluctuation field over Camp Carson, Colorado, was obtained from airborne refractometer measurements made on March 8 and 9, 1955. This representation was given in terms of the power spectra of the fluctuations as a function of frequency of the index fluctuations and of altitude. In the present report, a formula derived from scatter propagation theory and based on the measured fluctuation spectra, is given which relates radio transmission loss to the square of the amplitude of the refractive index fluctuations. Using this relationship, a value of the square of the index fluctuations was calculated which would account for the mean radio signal level on each of 14 National Bureau of Standards radio paths originating in the Camp Carson area.

Massachusetts Inst. of Tech., Cambridge.
THE MODES OF RELEASE OF AVAILABLE POTENTIAL ENERGY, by Barry Saltzman and Aaron Fleisher. Scientific rept. no. 1 on Planetary Circulations Project, Contract AF 19(604)4958. Oct 59, 21p. 13 refs. AFCRC-TN-59-629.
Order from LC mi$2.70, ph$4.80 PB 144 926

We have obtained the space spectra of the fields of vertical motion and temperature in the free atmosphere for February, 1959, and have estimated from these the conversions between available potential energy and kinetic energy as a function of wavenumber. (Author)

National Bureau of Standards, Boulder, Colo.
MEAN ELECTRON DENSITY VARIATIONS OF THE QUIET IONOSPHERE. I. MARCH 1959, by J. W. Wright and L. A. Fine. Feb 60, 53p. 5 refs. Technical note no. 40-1.
Order from OTS $1.25 PB 151 399-1

The CRPL has initiated a program for large-scale computation of electron density profiles from ionospheric vertical soundings. Scaling is performed at field stations permitting computation of hourly profiles at the central laboratory. These profiles are combined to form hourly mean quiet profiles for each station and month. The results of this program for one month are illustrated graphically. This report is the first of a series illustrating the electron density variations in the mean quiet ionosphere between latitudes 15°N and 50°N along the 75°W meridian. (Author)

Naval Research Lab., Washington, D. C.
THE RADIOACTIVITY OF THE ATMOSPHERE, by Irving H. Blifford. Interim rept. 15 Apr 53, declassified 28 Oct 57, 40p. 416 refs. NRL rept. 4118; AD-10 322.
Order from LC mi$3.00, ph$6.30 PB 145 154

A historical survey is presented of the radioactivity of the atmosphere. The radioactive constituents of the earth and air and their characteristics and distribution are discussed together with methods for their measurement.

Toronto U. (Canada).
FINAL REPORT, by J. A. Jacobs. Rept. on Contract AF 19(604)2147. 27 Sep 57, 4p. AFCRC TR-57-243; AD-146 857.
Order from LC mi$1.80, ph$1.80 PB 138 238

Three phases of work are reported briefly: a continuation of the work on magnetic storms; a study of geomagnetic pulsations; and a statistical study of some problems concerning the analysis of geomagnetic data. These three phases of the work are reported separately.

ENGINEERING

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 5. ENGINEERING. 375p.
Order from OTS $3.75 PB 161 137

Contents:
Civil engineering
Electrical engineering
Mechanical engineering (aeronautical and automotive included)
Ordnance engineering
(See also PB 151 498)

Stanford U., Calif.
FLOW-INDUCED VIBRATIONS IN HEAT EXCHANGERS, by B. J. Grotz and F. R. Arnold. Technical rept. no. 31 on Contract Nonr-225(23). Aug 56, 57p. 9 refs. AD-104 568.
Order from LC mi$3.60, ph$9.30 PB 145 452

Fluid-induced oscillations are familiar in the form of "galloping" transmission lines, waving smokestacks or periscope tubes, the humming of telephone wires, airplane wing flutter, pulsations of the atmosphere in forced-draft fire rooms under pressure, humming of boilers, "chugging" or "screaming" of rockets, familiar musical instruments--even the prosaic reciprocating steam engine. This report deals with a study of the oscillations established in a gas (air) flowing normal to banks of tubes in tube-in-line heat exchanger cores. A set of design factors is presented which may be applied in the design stage to prevent the vibrations which otherwise are humanly unbearable when of sonic frequency, also lead to mechanical component failures, and are accompanied by undesirable increases in flow friction factors.

Aeronautical Engineering

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT AND TEST OF A BALLOON-BORNE MANNED VEHICLE, by Richard L. Geer and John F. Rayfield. Rept. on High Dive. June 59, 47p. 3 refs. WADC Technical rept. 59-226.
Order from OTS $1.25 PB 161 092

Balloon borne vehicles are well suited for use as a means of lifting parachutists to very high altitude for test jumping. The design, fabrication, and testing of a vehicle, developed at the Wright Air Development Center for this purpose, are discussed in this report. Included are presentations of novel designs for a pressure-retaining hatch and an energy-absorbing parachute landing device. (Author)

Boeing Airplane Co., Seattle, Wash.
ADHESIVE METAL BONDING PROCESSES DEVELOPMENT, by Donald L. Poggi. Final rept. on Contract AF 33(600)25661. 15 Oct 56, 125p. Document D-14559-F; AD-119 945.
Order from LC mi$6.30, ph$19.80 PB 138 215

A high-speed airfoil component was developed as a bonded metal part. This part was first designed as a honeycomb-sandwich component incorporating a variably expanded core. This design was later abandoned in favor of a design making use of foamed resin to adjust the final size of the bonded component to its curing mold. It is concluded that this latter method of construction can be used in many aircraft components in lieu of conventional riveted construction at a saving in cost and weight.

California U., Los Angeles.
A PARAMETER TRACKING SERVO FOR ADAPTIVE CONTROL SYSTEMS, by M. Margolis and C. T. Leondes. Rept. on Contract AF 49(638)438. Aug 59, 35p. 10 refs. AFOSR-TN-59-917.
Order from LC mi$3.00, ph$6.30 PB 144 769

This paper describes one very general approach to the design of adaptive control systems. The particular systems considered are process adaptive. The dynamic characteristics of the physical process are determined by the parameter tracking servo. The parameters thus determined are used to program the process' controller. The parameter tracking servo is a closed loop self-adjusting system. It consists of the following elements: (1) the physical process, (2) the learning model, and (3) the adjusting mechanism. The learning model and the physical process are subjected to the same input signals. Their outputs are compared and the resultant error is fed to the adjusting mechanism where some function of this error is used to adjust the parameters of the learning model.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
A REVIEW OF CERTAIN FERROUS CASTINGS APPLICATIONS IN AIRCRAFT AND MISSILES, by John Varga, Jr., Rept. on Contract AF 18(600)1375. 18 Dec 59, 54p. 34 refs. DMIC rept. 120.
Order from OTS $1.50 PB 151 077

This report is a general summary of the application of steel castings to aircraft. Representative types of castings are illustrated and discussed. The problems of the aircraft manufacturer and castings

producer are presented. Future casting requirements and work that is in progress toward the increased use of castings are discussed. The purpose of this report is to present background information rather than the complete coverage required for a state-of-the-art report. (Author)

Equipment Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AIRCRAFT STRUCTURAL VIBRATION INDUCED BY JET NOISE, by Neal Granick and C. E. Thomas. Dec 56, 20p. 6 refs. WADC Technical note 56-514; AD-110 620.
Order from LC mi$2.40, ph$3.30 PB 145 344

The question as to whether aircraft structures respond closely with random jet noise is investigated. Vibration measurements were made at locations repreaenting several types of structures in the B-52 airplane. It was found that continuous frequency vibration exists only on relatively light structures having large surfaces exposed to the jet source. However, on typical structures suitable for equipment locations, structural vibration was characterized by the presence of discrete frequencies with insignificant continuous frequency vibration. (Author)

Forest Products Lab., Madison Wis.
PRESSURE-SENSITIVE TAPE SUSPENSION SYSTEMS FOR AIRCRAFT PARTS IN SHIPPING CONTAINERS. PART II. EFFECTS OF ACCELERATED EXPOSURE ON TAPE PROPERTIES, by Arnold W. Voss. Rept. for Dec 57-Aug 58 on Finishes and Materials Preservation, Contract PO (33-600)53-4023. Oct 59, 35p. WADC Technical rept. 58-455, Pt 2.
Order from OTS $1.00 PB 161 362

Black pressure-sensitive tape backed with polyester film and reinforced with glass filaments was subjected to dynamic tests at room temperature and at -20°F. to determine its strength and toughness in tension and the shear strength and toughness of its bond to aluminum. Tests were made before exposure and after 4, 8, 12, 16, 20, and 32 cycles of accelerated exposure. Each cycle included 18 hours of ultraviolet light with alternate wetting and drying in a weatherometer, and 4 hours of freezing at below zero Fahrenheit. The initial effect of exposure was an improvement in these properties, but continued exposure beyond 12 cycles deleteriously affected the tensile strength and toughness of the tape. Principal conclusions are that suspension systems utilizing this tape have adequate weather resistance to withstand extended periods of outdoor exposure, and that the serviceability of the systems after extended exposure may be determined by visual inspection. (Author) (See also PB 151 945)

General Electric Co., Schenectady, N. Y.
HERMES B-1 AUTOMATIC PILOT, by A. B. Grafinger. Rept. on Project Hermes. Aug 50, declassified 17 Nov 58. 17p. Technical Information Series DF 50A0515.
Order from LC mi$2.40, ph$3.30 PB 144 947

The autopilot for the Hermes B-1 is a two axis system capable of atabilizing the missile attitude in roll and yaw during the desired portion of the flight. The roll control loop has fast response in order to minimize the effect of disturbances at separation, while the yaw channel has slow response, the cross-over frequency being well below the missile resonant frequency. (Author)

Institute of Flight Structures, Columbia U., New York.
AN ELASTO-PLASTIC THERMAL STRESS ANALYSIS OF A FREE PLATE, by Jerome H. Weiner. Rept. on Effect of Atomic Weapons on Aircraft, Contract AF 33(616)2071. June 55, 40p. 6 refs. WADC Technical note 55-512; AD-97 338.
Order from LC mi$3.00, ph$6.30 PB 145 145

The thermal stresses in a free plate of elasto-plastic material subjected to a varying heat input over one face are determined. A heuristic solution is first found by suitable modifications of the known elastic solution. It is then verified that the solution satisfies all the conditions of the appropriate uniqueness theorem and represents therefore the unique solution to the problem. Residual stresses are determined and found to depend markedly on the peak magnitude of the heat input. (Author)

Institute of Flight Structures, Columbia U., New York.
THERMAL STRESS ANALYSIS FOR AIRCRAFT STRUCTURES. PART II: BIBLIOGRAPHY, by Bruno A. Boley, Jerome H. Weiner, and Irwin S. Tolins. Rept. on Effects of Atomic Weapons on Aircraft, Contract AF 33(616)2071. Nov 55, 39p. 444 refs. WADC Technical rept. 56-102, Pt. 2; AD-97 340.
Order from LC mi$3.00, ph$6.30 PB 145 146

This report presents a chronological listing of the literature pertaining to thermoelasticity from the beginnings of this subject in the early nineteenth century to the present. A short summary is given of some of the works, particularly those of interest in aircraft stress analysis. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF LIGHTWEIGHT ALUMINUM CRATES FOR BULKY LOW DENSITY ITEMS, by Warren Hypes. Rept. for Jan 57-Mar 59 on Finishes and Materials Preservation. Sep 59, 40p. WADC Technical rept. 59-297.
Order from OTS $1.00 PB 161 364

Formed aluminum channels were used in assembling crates for lightweight, bulky airframe components. The crates passed the Level A rough handling requirements of Specification MIL-P-7936. In addition to possessing the required strength, the channels are reusable, thus a modular system of crate components could be developed. Use of the aluminum crates will provide a means for considerable reduction in tare weight when used as shipping containers for airframe components. The use of the aluminum channels also appears to be economical. (Author)

Michigan U., Ann Arbor.
AN INVESTIGATION OF FLIGHT EQUATION REQUIREMENTS FOR SIMULATORS OF AIRCRAFT UP TO MACH 3.5, by R. M. Howe. Rept. on Contract AF 33(616)2839. Mar 57, 45p. 8 refs. WADC Technical note 57-144; AD-210 834.
Order from LC mi$3.30, ph$7.80 PB 145 343

This report summarizes the results of an investigation of the computer-section requirements of flight simulators for aircraft up to Mach 3.5 in performance capabilities. Included in the report are the flight equations which, it is felt, represent the best mechanization of the required computations. The source, expected range in value, effect on the aircraft response, and estimated tolerance requirements for the lateral and longitudinal stability derivatives are presented. The effect of inertia coupling terms is discussed, as well as recommendations regarding which terms should be included in the simulator. A survey of the effect of aerodynamic heating and the probable simulator requirements which it may introduce is given. Finally, the expected dynamic performance range, both in regard to limiting velocities and accelerations, and in frequencies, is presented.

National Research Labs., Ottawa (Canada).
FLIGHT TESTS OF AN EXPERIMENTAL HELICOPTER ROTOR BLADE ELECTRICAL DE-ICER, by J. R. Stallabrass. Nov 59, 58p. 6 refs. Aeronautical rept. LR-263.
Order from LC mi$3.60, ph$9.30 PB 144 886

A sprayed metal in resin rotor blade de-icing mat employing the spanwise shedding principle was tested on a helicopter in flight under simulated icing conditions. The results showed that, despite shortcomings in the design of the heater elements used, this method of de-icing is practical and can result in clean, efficient shedding of ice. In particular, the negligible increase in vibration resulting from asymmetric shedding makes the spanwise shedding method attractive for small helicopters having limited electrical generating capacity. (Author)

Naval Air Test Center, Patuxent River, Md.
ANALYSIS OF TURBOJET ENGINE THRUST IN FLIGHT, by W. J. Hesse. Rept. on Proj. TED-PTR-PP-343. 18 July 51, declassified. 268p. 80 refs. NATC Serial TPTO3-1-51.
Order from LC mi$11.10, ph$44.10 PB 145 306

An F2H-1 airplane was extensively instrumented for the purpose of evaluating several methods of measuring gross and net thrust of a turbojet engine in flight. The theory and test results of 4 methods of gross thrust measurement are presented, and it is shown that several methods produce satisfactory results. The results of the net thrust data are compared to the airplane drag data as obtained from the same airplane by measuring the accelerations in a number of power off dives. It is shown that a satisfactory correlation exists between the flight thrust and flight drag data.

Pennsylvania State U. Coll. of Engineering and Architecture, University Park.
A STUDY OF TURBINE PERFORMANCE IN A NONSTEADY FLOW FIELD, by D. F. White. Final rept. on Contract Nonr-656(16). Feb 59, 21p.
Order from LC mi$2.70, ph$4.80 PB 145 213

The performance of a single stage axial flow turbine which is supplied with energy in the form of finite amplitude gas pressure waves was analyzed by means of a wave diagram technique based on the method of characteristics. The major portion of the analytical work is concerned with the case of full admission, and numerical solutions for given initial conditions can be obtained with the aid of a program written for the IBM 704 EDPM. Test data under actual nonsteady flow conditions were obtained from two experimental turbines. Within the range of validity of the assumptions used in the wave diagram analysis, the agreement between experimental and calculated results is excellent. Some very approximate calculations were made on the nonsteady effects due to partial admission, the results of which show order of magnitude agreement with test data. (Author) (See also PB 142 226)

United Aircraft Corp., East Hartford, Conn.
EFFECT OF GEOMETRIC PARAMETERS ON WEIGHT OF SEVERAL SUPERSONIC WINGS, by Robert F. Kahn. 16 Apr 51, declassified, 30p. 3 refs. Rept. no. R-72014-9; NEPA 1822; ATI-200 933.
Order from LC mi$2.70, ph$4.80 PB 137 451

Wichita U. School of Engineering, Kans.
TWO-DIMENSIONAL CIRCULATION CONTROL TESTS ON AN NACA 23015 AIRFOIL EQUIPPED WITH A SEALED AND SLOTTED FLAP TO DETERMINE JET MOMENTUM LOSS OVER THE FLAP. Supplementary rept. by Robert K. Wattson, Jr. and Keith R. David. Dec 58, 74p. 1 ref. Engineering rept. no. 311-1; FAMD rept. no. R246A-003.
Order from LC mi$4.50, ph$12.30 PB 145 042

See also PB 142 036

Chemical Engineering

American Potash and Chemical Corp., Henderson, Nev.
INDUSTRIAL PREPAREDNESS STUDY ON SYNTHETIC BATTERY GRADE MANGANESE DIOXIDE, by Jerome T. Muench. Quarterly progress rept. no. 6, 29 Sep-29 Dec 57, on Contract DA 36-039-sc-72715. [1958] 11p. 3 refs. AD-162 573.
Order from LC mi$2.40, ph$3.30 PB 137 821

Detailed drawings of one ton a day pilot plant. Battery test results indicate the chemical manganese dioxide produced by the sodium chlorate-manganous sulfate process is of military battery grade quality. (See also PB 130 743)

Applied Science Labs., Inc., State College, Pa.
RESEARCH ON SALT WATER PURIFICATION BY FREEZING, by Arthur Rose and Thomas B. Hoover. Rept. on Contract 14-01-001-69. Sep 55, 58p. Saline Water Research Development progress rept. no. 7.
Order from OTS $1.50 PB 161 382

The experiments of this project have shown that ice made from saline solution always consists of crystals of minute size, and that a mass of such crystals necessarily retains in its interstices a comparatively great volume of mother liquor which cannot be separated by ordinary draining or filtering, is only partially separated by centrifuging, and is displaced only slowly and inefficiently by ordinary washing. As a result of these experiments, the most promising method of making a sharp separation of salt from the ice appears to be countercurrent contacting.

Badger, W. L., and Associates, Inc., Ann Arbor, Mich.
CRITICAL REVIEW OF LITERATURE ON FORMATION AND PREVENTION OF SCALE. Rept. on Contract 14-01-001-99. July 59, 51p. 143 refs. Office of Saline Water Research and Development progress rept. no. 25.
Order from OTS $1.50 PB 161 399

This report is based primarily on a comprehensive survey of literature published since 1930 and unclassified reports put out by various research organizations and governmental laboratories. The literature review resulted in the preparation of some 900 abstract cards, which are on file at the Office of Saline Water.

Badger Mfg. Co., Cambridge, Mass.
RESEARCH CONTINUATION OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TESTING ON UNIT NUMBER 4. Rept. on Contract 14-01-001-81. Mar 57, 80p. Office of Saline Water Research and Development progress rept. no. 15.
Order from OTS $2.00 PB 161 390

The Badger-Hickman still is relatively insensitive to certain changes in feed rate or load rate, as far as heat transfer coefficient is concerned, and, thus is largely self managing. Contamination by partially consensable nonaqueous vapor or permanent gas is exceedingly repressive of distillation, but, simple precautions in design and operation obviate this hazard. The No. 4 still has conformed and extended the performance characteristics of the previous centrifugal phase barrier stills. A still with a rotor 4.5 ft. diameter has a steady state operating heat transfer coefficient at least 4 times the average of present commercial vapor compression stills. The No. 4 stills can operate for 200 hours and evidently much longer periods on sea water without serious loss of efficiency at temperatures of 150°F. and below.

Badger Mfg. Co., Cambridge, Mass.
RESEARCH ON AND DEVELOPMENT OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TECHNIQUES AND EQUIPMENTS. Rept. on Contract 14-01-001-65. Nov 56, 98p. Saline Water Research and Development progress rept. no. 12.
Order from OTS $2.25 PB 161 387

The development was continued of a radically new type of vapor-compression distillation apparatus for saline water, based on the principle of high-velocity flow of thin films of water over the heating surfaces at temperatures below the scale forming limit. A small machine with 18 inch rotors was constructed and operated successfully for over 300 consecutive hours on sea water to demonstrate heat transfer efficiency. A larger experimental machine, with 5 foot diameter evaporator disks was then constructed and operated on both sea water and tap water in order to extend and confirm the information obtained on the smaller machines. This research and development work has been directed toward reducing evaluation of variables with respect to unit design and operation, such as effect of heat transfer element shape and movement, and the effects of operating temperatures, pressures and rates of evaporation. As a result of this effort, a No. 5 unit of 25,000 gpd capacity has been designed and is under development. (Author)

Battelle Memorial Inst., Columbus, Ohio.
AVAILABILITY OF GEOTHERMAL ENERGY FOR THE DEMINERALIZATION OF SALINE WATER, by J. C. Bell, R. C. Crooks and others. Rept. on Contract 14-01-001-89. July 59, 63p. 53 refs. Office of Saline Water Research and Development progress rept. no. 27.
Order from OTS $1.75 PB 161 400

Cost estimates for a so-called "average" example of salt-water evaporation with geothermal energy (i.e. average thermal gradient, 20,000 foot vertical shaft in granite; 1 foot in diameter) resulted in a calculated cost of over $28 per 1000 gallons of fresh water. The cost of the hole represented about 75 per cent of the total estimated investment and the method of cost estimating used reflected the high investment in terms of various operating costs. Even if the hole were available free of charge, the calculated water cost would still be between $5 and $10 per 1000 gallons. Unusual thermal gradients and a free hole conceivable might bring this cost below $1 per 1000 gallons, but a rather unique set of circumstances ("free" hole, high gradient, large cooling water supply) would be required to produce even such a situation. A similar estimate for conversion of geothermal energy into electric power showed an estimated cost of 66 cents per kwh. The cost of the hole represented about two-thirds of the estimated investment. A "free" hole thus would bring the estimated power cost into the 20 cents per kwh range. The effect of unusual gradients would have to be even greater here than in the evaporation case to reduce further the cost into the range of today's U. S. power costs. (Author) (See also PB 161 392)

Battelle Memorial Inst., Columbus, Ohio.
RESEARCH INVESTIGATIONS OF MULTIPLE-EFFECT EVAPORATION OF SALINE WATERS BY STEAM FROM SOLAR RADIATION, by B. A. Landry. 17 June 53, 6p, Summary of Office of Saline Water Research and Development progress rept. no. 2, Dec 53, out-of-print.
Order from OTS $0.50 PB 161 377

Research investigations were conducted of multiple-effect evaporation of saline waters by steam from solar radiation. The work consisted of the preparation of preliminary designs, of the calculation of performance and of estimates of gross costs of water production. The information obtained is of use in estimating (1) the technical possibility of substituting solar energy for fuel energy for raising the steam required to operate a multiple-effect evaporator to produce pure water from saline waters, (2) how far such a plant might be made automatic in its operation, and (3) operating and maintenance costs including fixed charges and additional energy requirements.

Battelle Memorial Inst., Columbus, Ohio.
THE ZONE-PURIFICATION PROCESS AS A METHOD OF PREPARATION OF PORTABLE WATER FROM SEA WATER, by S. E. Miller, R. C. Himes, and H. L. Goering. Rept. on Contract 14-01-001-80. Jan 58, 16p. Office of Saline Water Research and Development progress rept. no. 17.
Order from OTS $0.50 PB 161 392

At the outset of this investigation, a number of process parameters were recognized as possible conditions influencing the effectiveness of zone refining and directional freezing of salt water. Among these parameters, temperature in the freezing compartment, rate of crystallization, solution concentration and agitation were found to influence the efficiency of the process. In an effort to clarify certain anomalies in the results of earlier studies conducted under this contract, apparatus was devised in which visual observations could be made directly and continuously in the freezing system. Studies (microscopic and analytical) of the nature of ice laid down from salt solutions at various rates and concentrations and under varying degrees of agitation have shown that, while good clear ice may be crystallized at reasonably high rates (2 inches per hour) from dilute solutions, the rate at which such ice may be grown is suppressed as solution concentration is increased (other conditions being held constant). In experiments performed to date, taking these factors into consideration qualitatively, it has been found possible regularly to remove with a single directional freeze 99.9+ per cent of salt from solutions containing up to 20 grams per liter. In the range 20 to 30 grams per liter, 97.5 per cent removals are effected, and in the range 30 to 70 grams per liter, about 82 per cent removal has been made. In directional freezing experiments on sea water it was found possible to prepare excellent drinking water (less than 50 ppm total salt concentration) in a two-stage program. The results indicate that with some additional refinement it may be possible to accomplish the task in a single stage. (See also PB 161 377)

Bjorksten Research Labs., Inc., [Madison, Wis.]
DEVELOPMENT OF PLASTICS SOLAR STILLS. Final rept. for July 57-Oct 58 on Contract 14-01-001-64. Feb 59, 34p. Office of Saline Water Research and Development progress rept. no. 24.
Order from OTS $1.00 PB 161 398

Contents
Development of plastic solar still design: triangular plastic solar still; "standard" greenhouse-type plastic solar still; air inflated solar still; tubular plastic solar still; polyethylene spiral solar still; wire-supported triangular plastic solar stills; suspended envelope type plastic solar still; Experiments with plastics for use in plastic solar still construction: results of tests with "standard" greenhouse-type stills; performance data, suspended envelope stills; resistance of films to solar radiation; transmissivities of plastic films.

Bureau of Reclamation, Washington, D. C.
POTENTIAL USE OF CONVERTED SEA WATER FOR IRRIGATION IN PARTS OF CALIFORNIA AND TEXAS. Apr 54, 27p. Saline Water Research and Development progress rept. no. 3.
Order from OTS $0.75 PB 161 378

This report is a rough inventory of arable lands and other potential uses of water which might conceivably benefit from development of a low-cost method of sea water conversion. There are identifiable estimated potential uses for water, over and above those which can be supplied from natural local sources, totalling as much as 21,000,000 acre-feet annually in southern California and Texas. Of this amount, over 8,000,000 acre-feet could be used by direct pumping of converted sea waters onto the arable lands within reasonable heights above or distance from the ocean. Some 3,250,000 acre-feet of converted sea water could be used directly by municipalities or industries near sea level. Releasing the water which is now being imported or is proposed to be imported to meet those needs would permit almost 10,000,000 acre-feet of that water to be used on other lands which may be beyond the economic reach of direct service with converted sea water.

Carrier Corp. [Syracuse, N. Y.]
DEVELOPMENT OF A DIRECT-FREEZING CONTINUOUS WASH-SEPARATION PROCESS FOR SALINE WATER CONVERSION, by C. M. Bosworth, S. S. Carfagno, and D. J. Sandell. Rept. for 1 Aug-15 Oct 57 on Contract 14-01-001-86. Jan 59, 94p. Office of Saline Water Research and Development progress rept. no. 23.
Order from OTS $2.25 PB 161 397

The experimental program has progressed to the point that ice has been produced in the freezer at design rate. Product ice of the freezer-separation column combination has a salt concentration of less than 500 ppm. Operational characteristics of the equipment have yet to be optimized. The cost of producing fresh water from sea water by the direct freezing, vapor compression, wash separation process is less than presently available distillation processes. This cost has been estimated to be $1.14 per 1,000 gallons, using the economic analysis system suggested by the United States Department of the Interior. If waste steam is available, the absorption refrigeration process is estimated at $1.02 per 1,000 gallons. (Author)

Carrier Corp. [Syracuse, N. Y.]
FURTHER DEVELOPMENT OF A DIRECT-FREEZING CONTINUOUS WASH-SEPARATION PROCESS FOR SALINE WATER CONVERSION, by C. M. Bosworth, S. S. Carfagno and others. Rept. for 1 Sep-30 Nov 58 on Contract 14-01-001-86. July 59, 82p. Office of Saline Water Research and Development progress rept. no. 32.
Order from OTS $2.25 PB 161 403

The experimental equipment constructed in 1957 has evaluated the feasibility of a direct freezer and of a wash separation column. This equipment produced ice, which when melted contained less than 500 ppm of dissolved solids, at the design rate of 100 lb. of ice per hour or 300 gallons fresh water per day. Recent modifications have resulted in greater capacity or about 400 gpd with an acceptable amount of wasted wash water. The objective of the experimental program during 1958 was the determination of operational variables of both the freezer and the column in order to design a pilot plant and this objective has been met. A summary of the experiments to produce more ice is included. Discussions of the correlations of the transfer rates in the separation column are also presented. A pilot plant has been designed to produce 15,000 gpd of fresh water from seawater. This plant utilizes an absorption refrigeration machine for water vapor removal. (Author) (See also PB 161 397)

Dodge, Barnett F. and Eshaya, Allen M.
ECONOMIC EVALUATION STUDY OF DISTILLATION OF SALINE WATER BY MEANS OF FORCED-CIRCULATION VAPOR-COMPRESSION DISTILLATION EQUIPMENT. Rept. on Contract 14-01-001-101. [1958] 194p. 38 refs. Office of Saline Water Research and Development progress rept. no. 21.
Order from OTS $3.00 PB 161 395

A vapor-compression cycle in which the brine is in forced circulation within the tubes and the steam condenses in dropwise manner on the outside of the tubes has been studied in order to determine the optimum combination of the important variables. To decrease the rate of scale formation, the hot brine is flashed in a separate chamber and no boiling occurs in the heat exchanger tubes. The investigation has covered the following values of the independent plant parameters: (1) Capacity of 10^5, 10^6, 10^7 gpd. (2) Maximum brine temperatures of 160°F and 212°F. (3) Tube sizes of 3/4", 1", 1 1/4", and 1 1/2" O. D., 16 BWG (4) Scaling and condensation heat resistance. (a) $h_s = \infty$ and $h_c = 13,000$ Btu/hr-°F-ft^2 (Condition I) (b) $h_s = 5000$ and $h_c = 9000$ Btu/hr-°F-ft^2 (Condition II)

Florida U., [Gainesville].
WATER AND ION FLOW THROUGH IMPERFECT OSMOTIC MEMBRANES, by Ernest Joseph Breton, Jr. Rept. on Contract 14-01-001-79. Apr 57, 74p. 44 refs. Office of Saline Water Research and Development progress rept. no. 16.
Order from OTS $2.00 PB 161 391

Contents:
Theory for the semipermeability of cellulose acetate
Experimental support of theory based upon semi-permeability determinations
Electrical measurements to support theory
Mechanism for loss of membrane semipermeability
Recommendations for an improved membrane

Griscom-Russell Co., Massillon, Ohio.
RESEARCH ON AND ANALYSIS OF SINGLE-EFFECT LOW TEMPERATURE FLASH EVAPORATION PROCESS. Rept. on Contract 14-01-001-90. [1955] 102p. 7 refs. Office of Saline Water Research and Development progress rept. no. 18.
Order from OTS $2.50 PB 161 393

Low temperature flash evaporation of warm saline waters is theoretically sound, technically feasible, and proven by actual installations which have been operating for a number of years. With a 30° total temperature difference between the incoming warm water and the incoming cooling water, cost estimates using the Office of Saline Water standardized procedure show that water could be produced by this process for approximately $1.20 per thousand gallons in a plant designed to produce 10,000,000 GPD, and for approximately $1.75 per thousand gallons for a plant designed to produce 100,000 GPD. The cost of water produced by such plants at a total temperature difference of 15° between the incoming warm water and the outgoing cold water would be very close to double the corresponding costs for 30°F The quantity of air which must be removed from the evaporators by vacuum pumping equipment was determined experimentally with a precision sufficient for purposes of selecting pumping equipment.

Ionics, Inc., Cambridge, Mass.
DESIGN, CONSTRUCTION, FIELD TESTING, AND COST ANALYSIS OF AN EXPERIMENTAL ELECTRODIALYSIS DEMINERALIZER FOR BRACKISH WATERS, by J. P. Dankese, T. A. Kirkham and others. Rept. on Contract 14-01-001-66. Dec 56, 176p. Office of Saline Water Research and Development progress rept. no. 11.
Order from OTS $3.00 PB 161 386

The purpose of the tests was primarily to determine the effects of operating the process under field conditions, to provide estimates of the cost of demineralizing brackish waters on a large scale, and as a means of planning further needed research in this field. An experimental apparatus capable of reducing the salinity of a brackish water containing 4,000 ppm dissolved solids to 350 ppm at a rate of 1,000 gph was built and tested. Two tests were made. The first, of six months duration, was in Arizona where the unit was operated on an irrigation water supply containing about 4,000 ppm dissolved salts. The second, of three months duration, was in Miller, South Dakota on a municipal water supply from a deep well which contained about 2,000 ppm dissolved salts. Both of these field tests demonstrated that the electrodialysis process could be used to reduce the salinity of those waters to below 350 ppm. (See also PB 161 376)

Ionics, Inc., Cambridge, Mass.
RESULTS OF SELECTED LABORATORY TESTS OF AN IONICS DEMINERALIZER, by N. W. Rosenberg, T. A. Kirkham and others. Rept. on Contract 14-01-001-52. Apr 54, 78p. Saline Water Research and Development rept. no. 1.
Order from OTS $2.00 PB 161 376

An electrical process has been developed for the demineralization of water, using the special properties of ion-transfer membranes. Estimates of the costs of this process have been made for the treatment of typical brackish waters. These costs vary widely, depending on the salt content of the raw water. The waters studied under the present contract and the projected costs of mass-produced installed units to treat 75,000,000 gal/day (10 acre ft/hr) are included. It is the opinion of Ionics, Incorporated, that sufficient promise has been shown by the membrane demineralizer to warrant field operation of a larger installation to confirm the estimates of this report.

Koenig, Louis, Research, San Antonio, Tex.
DISPOSAL OF SALINE CONVERSION BRINES: AN ORIENTATION STUDY, by Louis Koenig. Rept. for 11 Dec 56-18 Apr 57 on Contract 14-01-001-92. 1958, 129p. 1 ref. Office of Saline Water Research and Development progress rept. no. 20.
Order from OTS $2.75 PB 161 394

This report constitutes a preliminary exploration of the problem of disposing of waste salts, usually in the form of brine, resulting from the conversion of saline waters to fresh water. So far as known, this is the first attempt that has been made to assay the order of magnitude of these waste disposal costs. As a first attempt the result is definitely intended as a bird's-eye view which will allow selection of favorable areas for more intensive study. The cost estimates are of a "huddle" estimate type, usually a one man huddle. At the same time it was desired to present a general method by which the technical and economic aspects of any particular disposal method could be worked out. For that reason the report contains a number of correlations allowing extrapolation and interpolation which would not ordinarily be found in cost estimating for a specific process or a specific location.

Löf, George O. G.
DEMINERALIZATION OF SALINE WATER WITH SOLAR ENERGY, by George O. G. Löf. Rept. on Contract 14-01-001-55. Aug 54, 96p. 73 refs. Saline Water Research and Development progress rept. no. 4.
Order from OTS $2.25 PB 161 379

About 30 proposed methods for demineralizing saline water with solar energy have been analyzed from the engineering and economic standpoints, and probable minimum costs for producing fresh water by these methods have been estimated.

Löf, George O. G.
SOLAR DISTILLATION OF SEA WATER IN THE VIRGIN ISLANDS, by George O. G. Löf. Rept. on [Contract 14-01-001-55]. Feb 55, 42p. 7 refs. Saline Water Research and Development progress rept. no. 5.
Order from OTS $1.25 PB 161 380

It was found that under the average solar conditions which prevailed during the period of the tests, which corresponded very closely to normal winter weather in the Caribbean Islands, the distiller operated at about 35 percent solar utilization efficiency, resulting in a daily yield of about 0.6 pound of water per square foot of evaporator pan. Under the best sunshine conditions, approximately 1.0 pound of water was obtained per square foot per day, at an efficiency only slightly higher than 35 percent. The above values are only about half those which might be considered ideal for this type of equipment under the best operating conditions. The difference between the actual and the ideal performance is accounted for in the various heat losses which occurred. Improvements in distiller construction and operation would result in substantial reduction of these losses, and an average winter efficiency of about 55 percent should be obtainable in a large installation. This efficiency would permit the average daily production of 1 pound of water per square foot of evaporator surface, corresponding to a requirement of about 85,000 square feet for an average daily production of 10,000 gallons of water. (See also PB 161 379)

Murphy, George W.
THE MINIMUM ENERGY REQUIREMENTS FOR SEA WATER CONVERSION PROCESSES, by George W. Murphy, Robert C. Taber, and H. H. Steinhauser. Rept. on Contract 14-01-001-58. Apr 56, 79p. 10 refs. Office of Saline Water Research and Development progress rept. no. 9.
Order from OTS $2.00 PB 161 384

Chapter 1 deals with ultimate idealizations of saline water conversion processes, using a classical thermodynamic approach. The value of this approach is to provide a convenient classification of the various method based on thermodynamic criteria, to illustrate the fact that the thermodynamic minimum work done is the same regardless of method, and to provide a first approximation to the energy requirement as a basis for dealing with real processes. The aim of the remaining work is to furnish as good a second approximation to the actual minimum energy requirement as possible, taking into account the rate phenomena which are a part of every method. Although the groundwork has been laid for many methods, calculations have been performed for only two, compression distillation and the electrical membrane process. Some idealization is still present in the results of these calculations, but less than in those of Chapter 1. In both cases the practical minimum energy requirement is estimated to be about four times the thermodynamic minimum, exclusive of losses in energy conversion devices and of water transport requirements. This can be regarded as a crude second approximation, compared to the exact first approximation of the thermodynamic minimum. It is difficult to gauge at this point how much a further reduction in idealization will raise the energy value, but further work along this line is clearly in order. It is unrealistic to believe that other methods presently under investigation or yet to be devised can

operate with a lower "practical minimum", although it is still theoretically possible. The expected degree of generality in applying the thermodynamic equations of motion to all methods has not yet been achieved, but further progress in this line is to be expected. (Author)

Murphy, George W.
THE OSMIONIC PROCESS, by George W. Murphy. Rept. on Contract 14-01-001-58. 1957, 75p. 4 refs. Office of Saline Water Research and Development progress rept. no. 14.
Order from OTS $2.00 PB 161 389

An experimental program was initiated in 1954 on a new approach to saline water demineralization which uses as a power source (osmotic power) the free energy difference between concentrated brine and a saline water of lower concentration; the energy conversion principle is based on the properties of an assembly of permselective membranes. Experimental devices have been constructed and successfully operated over the concentration range 1,000-30,000 ppm NaCl for the purpose of obtaining basic equilibrium and rate data. In this report, the basic theory for the simplest or single-effect osmionic cell is developed first, followed by an extension of the theory to include multiple-effect cells and multiple-stage operation. Calculations are presented for typical cases. (See also PB 161 384)

Naval Research Lab., Washington, D. C.
EXPERIMENTAL VALVELESS PULSEJET DIESEL-FUELED FOG GENERATOR, by M. A. Persechino. Final rept. 22 Dec 59, 17p. 7 refs. NRL rept. 5414.
Order from LC mi$2.40, ph$3.30 PB 143 016

A valveless pulsejet fog generator has been developed and tested at NRL under a program sponsored by the Bureau of Ships. The unit consists of a ducted 3-1/2-in. valveless pulsejet engine capable of producing oil-droplet particle sizes within the operational range of 0.6 to 0.7 micron in diameter and a vaporizing capacity of 55 gph (using fog oil type SGF-2, MIL-F-12070A). The burner and vaporizing assembly without controls weighs approximately 65 lb fully insulated. The valveless pulsejet fog generator is capable of vaporizing a variety of fogging oils and offers the following possible advantages over existing units: (1) Low manufacturing costs; (2) Little or no carbon deposition in the vaporizing chamber; (3) Operation with no moving parts, thus promoting long service life with little or no maintenance; (4) Ability to operate on a variety of fuels, including the more viscous fuels, including the more viscous fuel oils; (5) Ability to operate at part load; (6) Resistance to high temperatures caused by the absence of the cooling effect from oil vaporization during starting and securing; (7) Simplicity. With little further development and modification, larger capacity units can be made available for operational purposes either by paralleling the present unit in multiple ducted pairs or by scaling up to larger sizes. Development work along these lines was terminated upon exhaustion of allocated funds. (Author)

New York U. Coll. of Engineering, N. Y.
NEW AND IMPROVED METHODS FOR LOWER COST SOLAR DISTILLATION, by Maria Telkes. Rept. on Contract 14-01-001-68. Aug 59, 40p. 3 refs. Office of Saline Water Research and Development progress rept. no. 31.
Order from OTS $1.00 PB 161 402

Further design and experimental work with flat, tilted single effect stills resulted in definite improvements. Most of the heat carried away by the outflowing brine could be recovered with a heat exchanger tube and used to preheat the feed water, resulting in an increased water yield of 10 to 15 percent on clear summer days, and considerably larger improvements on cloudy or partly cloudy days. Automatic regulation of the feed water was achieved by using solar radiation to operate a capillary flow rate governor. Experimental results indicated that temperature increase changes the fluidity of the feed water, and in this way increases the feeding rate in proportion to solar radiation intensity. Another simple feeder has been designed which changes the feeding rate by increasing the water-head. Several devices have been built and tested to determine the possibility of using the heat of condensation of the distillate. The results indicated that it is not possible to recover more heat from the condensate than is needed to preheat the feed water. Circulation of air within the still similarly failed to increase the water yield. Larger multiple effect stills were built and tested, using electrical heating during the sunless colder months. The use of aluminum sheet produced results comparable to those obtained previously with Mylar films. Perfect vapor-tight arrangement is essential, heat insulation must be used. Solar energy operated multiple effect stills were designed and tested. (Author) (See also PB 161 388)

New York U. Coll. of Engineering, N. Y.
RESEARCH ON METHODS FOR SOLAR DISTILLATION, by Maria Telkes. Rept. on Contract 14-01-001-68. Dec 56, 78p. 4 refs. Office of Saline Water Research and Development progress rept. no. 13.
Order from OTS $2.00 PB 161 388

The objective of this investigation is to reduce as much as possible the total cost of sustained conversion of sea, or other saline water, to fresh water in large quantities, by solar energy, by conceiving and developing new methods and improving existing methods, or both. Tilted flat type solar stills have been developed and compared with roof-type stills. The tilted stills had approximately 26 to 50 percent greater yield during the summer months. This was definitely in excess of the estimate, based on increased solar energy received by the tilted surface.

New York U. Coll. of Engineering, N. Y.
SOLAR STILL CONSTRUCTION, by Maria Telkes. Rept. on Contracts 14-01-001-68 and 102. Aug 59, 26p. Office of Saline Water Research and Development progress rept. no. 33.
Order from OTS $0.75 PB 161 404

Contents:
The amount of solar radiation and water yield
Structural components of the single effect solar still

Glass covered flat, tilted solar still
Operation of the still
Multiple effect still
Structural components of the multiple effect still
Operation of the multiple effect still
(See also PB 161 402)

[Office of Saline Water] Washington, D. C.
DEMINERALIZATION OF SALINE WATERS: A PRELIMINARY DISCUSSION OF A RESEARCH PROGRAM WITH AN OUTLINE AND DESCRIPTION OF POTENTIAL PROCESSES AND A BIBLIOGRAPHY. Oct 52, 70p. 217 refs.
Order from OTS $1.75 PB 161 373

A compendium of existing and potential separation processes, phenomena, and energy sources with discussion and literature references.

[Office of] Saline Water, Washington, D. C.
GRANTS AND CONTRACTS FOR SCIENTIFIC RESEARCH. GUIDES FOR THE SUBMISSION OF RESEARCH AND DEVELOPMENT PROPOSALS. Nov 52, 7p.
Order from OTS $0.50 PB 161 374

Public Law 448 is an act to provide for research into and development of practicable low-cost means of producing from sea water, or other saline waters, water of a quality suitable for agricultural, industrial, municipal, and other beneficial consumptive uses on a scale sufficient to determine the feasibility of the development of such production and distribution on a large-scale basis, for the purpose of conserving and increasing the water resources of the Nation. Two general types of proposals will be considered. One type relates to research and development work for which it is possible and desirable to define the objectives and procedures only in general terms. In the second type objectives, procedures and expected results can be determined in advance. Either type may take the form of a grant or a contract.

Office of Saline Water, Washington, D. C.
A STANDARDIZED PROCEDURE FOR ESTIMATING COSTS OF SALINE WATER CONVERSION. Mar 56, 50p. 20 refs.
Order from OTS $1.25 PB 161 375

This volume presents a standardized procedure for making initial cost estimates for demineralization of saline waters by various processes. It is believed that use of this procedure will provide sufficiently accurate cost estimates for initial economic comparisons between processes. More detailed estimates will become necessary for processes in advanced stages of development. The procedure is primarily for the use of the Office of Saline Water, its consultants, and its present and prospective cooperators for comparing processes and determining feasibility of conducting research and development work.

Purdue U., Lafayette, Ind.
AN ANNULAR JET PUMP, by Werner H. Haak and Frederick Vratný. Rept. on Contract AF 18(603)45. Oct 58, 4p. 2 refs. AFOSR-TN-58-937; AD-205 089.
Order from LC mi$1.80, ph$1.80 PB 137 842

A two stage pump was designed with the idea that the upper stage jet would aid the diffusion of mercury into the upper trapping mechanism without serious reduction of pumping speed. On testing the design the extent of mercury diffusion was significantly reduced over the single stage pump (a thin mirror was produced in an eight hour period), and the consumption of liquid nitrogen was likewise appreciably diminished (about 5 liter in a 10 hour period).

Rochester U., N. Y.
ADHESION OF PROTECTIVE COATINGS TO METALS BY TENSILE TESTS, by Gouq-Jen Su, Thomas R. Faucett, and Bogdan Gumowski. Rept. on Contract AF 18(600)1187. Sep 59, 71p. 37 refs. AFOSR-TR-59-172.
Order from LC mi$4.50, ph$12.30 PB 145 362

The results were obtained by tensile tests with butt joints, using steel, brass, and aluminum as the metal substrates, and various commercial resins and coating formulations. The following factors which affect adhesion are discussed: Effect of loading rate on measured bond strength. Surface treatment effects on adhesion to aluminum. Bond strength as a function of bond thickness. Bond strength as a function of curing time for thermosetting coatings.

School of Mines Research and Development Association, Rapid City, S. D.
INVESTIGATION OF AVAILABILITY OF GEOTHERMAL ENERGY FOR THE DETERMINATION OF SALINE WATER. Rept. on Contract 14-01-001-87. July 59, 50p. 9 refs. Office of Saline Water Research and Development progress rept. no. 28.
Order from OTS $1.25 PB 161 401

The Black Hills have many "hot wells," although the measured temperatures are not great. The highest well temperature measured was 168°F. at a depth of 6,250 feet. The data indicate that as a whole thermal gradients are not appreciably higher than the average thermal gradient reported for the earth's crust, except for certain local areas of two or three times the magnitude. Thus, the Black Hills do not seem to offer any unique advantage for extraction of geothermal energy. Pumping of existing hot wells offers the simplest possibility for extracting geothermal energy, but even at 168°F. and, say, 50°F. cooling water the theoretical availability would be only about 19%; the temperature level of the hot water is low, for practical purposes. Moreover, a huge heat-collecting area for the aquifer would have to be assured, something about which present knowledge does not cover. Sinking a deep shaft to reach a level of high temperature and constructing a heat-collecting area or zone would involve high capital expenditures and resulting excessive costs for the energy removed, without doubt. Moreover, there is the important

conclusion that the temperature at the heat-collecting zone is reduced significantly upon extracting a relatively small amount of heat, which inevitably reduces the availability. (Author)

South Dakota School of Mines and Tech., Rapid City.
INVENTORY OF PUBLISHED AND UNPUBLISHED DATA ON THE CHARACTERISTICS OF SALINE SURFACE AND GROUND WATERS OF SOUTH DAKOTA, by Edward H. Tullis, John P. Gries, and Joseph H. Cope. Rept. for 1 July 53-30 June 54 on Contract 14-01-001-56. June 54, 156p. 193 refs. Office of Saline Water Research and Development progress rept. no. 6.
Order from OTS $3.00 PB 161 381

Texas A. and M. Coll., College Station.
RESEARCH ON LIQUID-LIQUID EXTRACTION FOR SALINE WATER CONVERSION, by Richard Davison, Lela M. Jeffrey and others. Rept. on Contracts 14-01-001-60 (Final) and 14-01-001-77. Dec 58, 86p. 5 refs. Office of Saline Water Research and Development progress rept. no. 22.
Order from OTS $2.25 PB 161 396

A search for the most efficient solvent or solvents for use in the process was made by conducting a series of screening tests on a wide variety of solvents and obtaining detailed data such as phase equilibrium data on the most promising compounds. Particular emphasis was place on correlation of solvent properties with molecular structure. Solvent purity was given much consideration. Methods were investigated for the recovery of solvents from the brine and product water. Recovery by liquid-liquid extraction and adsorption on activated carbon and clay were studied. Preliminary data were obtained on the process operation by the use of a laboratory model. A preliminary engineering cost estimate was made for the demineralization of sea water on a large scale by the liquid-liquid extraction process.

Washington U., Seattle. Engineering Experiment Station.
RESEARCH AND DEVELOPMENT OF PROCESSES FOR DESALTING WATER BY FREEZING, by Harold M. Hendrickson and Ralph W. Moulton. Rept. on Contract 14-01-001-73. Aug 56, 173p. Office of Saline Water Research and Development progress rept. no. 10.
Order from OTS $3.00 PB 161 385

It was found that research on freezing methods for purification of sea water had not been very extensive. The second phase of the research was to run field tests with sea water on commercial and industrial icemakers of all available types, and evaluate the results obtained. Tests were made in can-ice plants, on flake-ice machines, on slush-ice machines, on tube-ice machines and on ice cream freezers. While a reduction in salinity was obtained in some cases, no commercial icemaker was found that would reduce sea water at 30,000 PPM total solids content down to potable water at 500 PPM or even down to irrigation water at 1500 PPM. The third phase of the study was to set up several representative icemakers in the laboratory to study their performance under more accurately controlled conditions, and to determine the best methods for separating the entrapped salt from the ice-brine mixture obtained by freezing. Also during this phase, theoretical studies were made of various freezing cycles in an effort to find the most efficient one, and economic studies were made of the most promising cycles.

Yale U., New Haven, Conn.
RESEARCH ON FORCED-CIRCULATION AND DROPWISE CONDENSATION TECHNIQUES FOR IMPROVING HEAT TRANSFER RATES FOR VAPOR COMPRESSION EVAPORATORS, by Harding Bliss. Rept. on Contract 14-01-001-59. Oct 55, 59p. 1 ref. Office of Saline Water Research and Development Progress rept. no. 8.
Order from OTS $1.50 PB 161 383

The experimental program was made up of two broad parts consisting of (a) measurement of over-all and film heat transfer coefficients with pure water or pure NaCl brine, (b) testing of sealing behavior over an extended period with synthetic sea water and Long Island Sound sea water. A forced circulation evaporator was built in which water and brine were heated with negligible boiling in the tubes, evaporation being accomplished by "flashing" after leaving the tubes. Two test sections were used, one of 0.951 inch inside diameter and the other of 0.761 inch inside diameter both 6 feet in length. Temperatures of steam, brine, and tube wall surface were measured.

Civil Engineering

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
FURTHER STUDIES OF CREEP BUCKLING OF CURVED BEAM UNDER LATERAL LOADING, by T. H. H. Pian and C. Y. Chow. Rept. on Contract Nonr-1841(22). Dec 58, 29p. 3 refs. Technical rept. 25-28.
Order from LC mi$2.70, ph$4.80 PB 144 860

The creep buckling analysis of curved beam given in Technical Report 25-26 (PB 139 334) has been extended to include the effect of antisymmetrical mode. It is shown that when the axial compressive stress becomes four times the Euler critical stress the antisymmetrical mode sets in to aid the snapping action and hence will yield a shorter creep buckling time. The paper also makes an analysis of the behavior of the beam succeeding the snapping action. (Author)

Bureau of Yards and Docks, Washington, D. C.
CONTRACT ADMINISTRATION. 17 Apr 57, 337p. Technical pub. NAVDOCKS TP-AD-4, Rev.; BUDOCKSINST 4330.5A.
Order from LC mi$11.10, ph$51.50 PB 144 512

This publication defines the authority and responsibilities of the Bureau of Yards and Docks, its field activities, and others concerned with the administration of contracts. It also contains information on the procedures for the award, preparation, and administration of contracts. Some of the specific subjects discussed are (a) competitive bid and negotiated fixed-price construction contracts, (b) architectural-engineering (A-E) and engineering-services (E-S) contracts, (c) many miscellaneous contracts, such as demolition and equipment repair, (d) cost-plus-a-fixed-fee (CPFF) contracts, (e) utility services contracts, (f) drawings and specifications, (g) industrial security, and (h) a tabulation showing the functions reserved to the Chief, Bureau of Yards and Docks, the District Public Works Officer (DPWO), the Officer in Charge of Construction (OICC), and the Resident Officer in Charge of Construction (ROICC) in the administration of contracts after award.

Bureau of Yards and Docks, Washington, D. C.
HOUSING HANDBOOK. Engineered Performance Standards, Public Works Maintenance. July 59, 89p. NAVDOCKS p-705.
Order from LC mi$4.80, ph$13.80 PB 145 003

The housing times are presented in three categories: (1) standard maintenance, (2) room maintenance, and (3) miscellaneous work. The Task Areas are: asphalt tile - remove, reinstall; miscellaneous: carpentry, pest control, plumbing, roofing; paint, brush: acoustical tile, bathroom, bedroom, dining, living rooms, hallway, stairwell, kitchen, utility room, wall, ceiling; paint - brush or varnish: floor, woodwork; and standard maintenance: carpentry, electrical, plumbing, venetian blinds.

Bureau of Yards and Docks, Washington, D. C.
PIPEFITTING AND PLUMBING FORMULAS. Engineered Performance Standards, Public Works Maintenance. Aug 58, 387p. NAVDOCKS P-711.1.
Order from LC mi$11.10, ph$59.10 PB 145 009

The time formulas developed for the Pipefitting and Plumbing Shop are: cut and thread small pipe, measure installation for pipe length, install and remove small pipe, make and install pipe supports, clean parts and machine components, dismantle or assemble machine components, install and remove pipe insulation, adjust position or setting of machine components, inspect and check machine components, make gaskets, miscellaneous time values, install and remove bell and spigot pipe up to 10" I. D., cut and assemble copper tubing, operate toledo "donkey" machine, assemble and install threaded pipe 21/2" to 6" I. D., hydrostatic test, maintenance of fire sprinkler systems, semi-annual maintenance of fire hydrants, pipe welding - pipefitters, burn pipe, operate medium size pipe machine, gas water heater repair, supply water to ships, and cut into water main.

Bureau of Yards and Docks, Washington, D. C.
PIPEFITTING AND PLUMBING HANDBOOK. Engineered Performance Standards, Public Works Maintenance. Rev. July 59, supersedes Aug 58, 100p. NAVDOCKS P-711.
Order from LC mi$5.40, ph$15.30 PB 145 005

Section I - Spread Sheets: A spread sheet is a form for presenting typical related tasks in a sequence of varying complexities so that an estimator can compare the work content of the known task with the work to be estimated. Individual crafts are subdivided into task areas. These task areas, which may include one or more spread sheets, are arranged in alphabetical order. The task areas are further subdivided into time groups which are presented in columnar form on each spread sheet. The specific tasks within each group column are arranged from top to bottom according to increasing work content. Section II - Task Times: Task Times are derived from Operation Time values. Task Time values are those required to perform all operations constituting the task, but not the variables, such as job preparation time, travel time, or allowances for delay. They are arranged in numerical order. Section III - Operation Times: Operation Times are the tabulation of the formula values taken from the formula manual. They represent the actual time required to perform a work portion of a task. These values become the components of a task and, when added together, become the time to perform the task. These task times do not contain travel, job preparation, or delay allowances. The operation times of Section III are used in various combinations in the Task Times. Most operation times are used in more than one task area. For ease of location, they are arranged in formula numerical order.

Naval Civil Engineering Lab., Port Hueneme, Calif.
ENGINEERING STUDY OF WAVES AND CURRENTS IN THE HARBOR OF PORT HUENEME, CALIFORNIA, by J. J. Leendertse. Final rept. 7 Dec 59, 87p. 31 refs. Technical rept. 052.
Order from LC mi$4.80, ph$13.80 PB 145 157

The report presents information as to the likely effect on the water wave environment of Port Hueneme Harbor, California, and on harbor operations in general of alterations to the major wharves, of deepening the Harbor, and of proposed changes in the existing channel with entrance at the Harbor. (Author)

Electrical and Electronic Engineering

Acoustics Research Lab., Harvard U., Cambridge, Mass.
PHASE SHIFT IN ELECTROACOUSTIC TRANSDUCERS, by W. Richard Stroh. Technical memo. no. 42 on Contract Nonr-1866(24). 18 Mar 58, 32p. 17 refs.
Order from LC mi$3.00, ph$6.30 PB 138 579

A complex transfer function is defined which relates the sound pressure at a point on the principal axis of an electroacoustic transducer to the electrical input of the transducer. The argument of this function is composed of a phase function representing phase shift in the transducer, plus a shift proportional to frequency representing travel time. By using an electrical delay line to match the travel time phase shift, the shift in

the transducer itself can be measured directly. Typical phase functions for moving-coil and electrostatic loudspeakers are shown and discussed. The effect of transducer phase distortion on correlation functions is discussed, as is the use of the phase meaaurement in "phasing" a multiple-transducer system. (See also PB 137 455)

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
DEVELOPMENT OF ALTERNATING-CURRENT OPERATED POWER RELAYS AND CONTACTORS FOR AIRCRAFT 400-CPS ELECTRIC SYSTEMS, by R. J. Coppola. Final rept. on TED Proj. ADC EL-52048. 27 Aug 58, 48p. Rept. no. NADC-EL-5862.
Order from LC mi$3.30, ph$7.80 PB 144 937

A complete study was conducted of existing unacceptable 400-cps a-c relays and all possible design methods for a-c relay construction. Such principles as rectified current, motor-generator, induction, mechanical rectification, and shaded poles for relay operation were investigated and found to be unacceptable for the particular purpose. The study revealed the potentialities of a polyphase operated relay and the use of permanent magnets in the magnetic structure of a single phase relay. Experimental models of such relays were designed and fabricated for test purposes. The resultant "Self Seal-In A-C Relay" and the "Polarized A-C Relay" performed within reasonable limits of military specification requirements, and indicated that the design principles were sound.

Aerovox Corp., Olean, N. Y.
ADAPTATION OF CERAMIC TUBE TYPES, by John D. Cronin. Rept. on Electronic Tubes and Transistors, Contract AF 33(600)33577. June 59, 166p. 31 refs. WADC Technical rept. 59-84; AD-210 230.
Order from OTS $3.00 PB 151 922

The use of the Eimac tubes at high temperatures was investigated by simulated high temperature circuitry and by measurement of the variations in the operating point for fixed grid bias and plate voltages as a function of the ambient tube temperature. A series of mechanical mounting configurations were analyzed for use at high temperatures. The most suitable appeared to be a cylinder, a flat plate, and a cavity approach; the flat plate was the primary choice. The material chosen for construction of the configuration was an alumina ceramic. A survey of non-classified literature was made to determine the effects radiation would have upon the materials used in the 500°C. circuitry. It was determined that the tensile strengtn, yield strength, and electrical resistivity of most alloys increase with radiation, while the creep strength, fatigue strength, impact strength, density, and elongation can decrease slightly, depending upon the alloy.

Air Force Cambridge Research Center, Bedford, Mass.
INCREASING THE RELIABILITY OF DIGITAL COMMUNICATIONS SYSTEMS UNDER POOR SIGNAL CONDITIONS, by Nathan Levine, Paul J. Daly, and Harold C. Porter. June 59, 36p. AFCRC-TR-59-158; AD-228 773.
Order from LC mi$3.00, ph$6.30 PB 144 967

Synchronous communication using phase modulation: A graphical analysis showed the improvement of the phase modulation system over amplitude modulation. The amplitude modulation system is recommended where reliable S/N levels of greater than 20 db and no serious fluctuations in signal amplitude are anticipated. For the type of military service envisioned with a mobile system, however, phase modulation is superior. Amplitude modulation using an autocorrelation receiver: Two methods of instrumentation were used for evaluation. The first method compared each message on a target-for-target basis registering each erroneous target. Each non-conforming target showed up as an error. In the second method, the detected data were inserted into a standard AN/TSQ-13 digital detector after the digital receiver, a conventional receiver circuit. Tests indicated that the basic receiver circuit performance was superior to the AN/TSQ-13 digital receiver. An over-all gain of 3 to 5 db was realized over conventional methods. The high frequency method showed no worthwhile gain over the second method. The consistently greatest single cause of errors was the 600-c burst.

Airtron, Inc., Linden, N. J.
FINAL ENGINEERING REPORT, by Tore N. Anderson. Rept. on Contract AF 30(602)1178. 1 Nov 56, 42p. 28 refs. Rept. no. 6035-I; RADC-TR-57-3; AD-114 208.
Order from LC mi$3.30, ph$7.80 PB 137 649

A high powered ferrite circulator was developed for duplexing in radar systems in conjunction with conventional TR's. The final version of the duplexer showed the following low-level characteristics: a 33.8- to 35.9-kmc range, less than 0.7-db insertion loss (of which the ferrite losses were only a small part), more than 20 db of isolation between all arms, and a maximum input VSWR of 1.30. The device has inherent load-to-magnetron isolation and it removes the bulk of the power from the TR. No breakdown occurred during high-power tests at 70-kw peak power pressurized with 2 atmospheres and at 100-kw peak power with a 2:1 mismatch on 4 atmospheres.

Antenna Lab., Ohio State U. Research Foundation, Columbus.
BEAM-DIRECTION INDICATING SYSTEMS FOR TRAVELING-WAVE ANTENNAS, by Ko-Hsin Liu. Master's thesis. Rept. on Polarization Dependence of Radar Echoes, Contract AF 30(635)2811. 15 Oct 56, 35p. 4 refs. Rept. no. 612-10; RADC-TR-57-14; AD-114 241.
Order from LC mi$3.00, ph$6.30 PB 137 567

Alternative methods of measuring the direction of maximum radiation from a traveling-wave scanning antenna are presented. The direction of maximum radiation can be determined if the relative phase constant withih the waveguide feed is known. Two types of non-mechanical indicating systems are considered: 1. Amplitude-measuring system, Simple amplitude system, Compound amplitude system. 2. Phase-measuring system, Simple amplitude system with added phase shifter. Conventional phase-measuring system.

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32( ) by Andrzej B. Przedpelski. Quarterly progress rept. (Engineering) no. 1, 15 July-15 Oct 54, on Contract DA 36-039-sc-64450. 18 Oct 54, 38p.
Order from LC mi$3.00, ph$6.30 PB 145 336

The main purpose of this Contract is to transistorize Frequency Meter AN/URM-32( ) and thus achieve a reduction in size, weight and power consumption and at the same time increase overall reliability. To accomplish this general purpose, the following work will have to be carried out. Conduct circuit studies to establish the feasibility of using transistors as active elements to reproduce or improve the electrical characteristics of Frequency Meter AN/URM-32( ). Ascertain the highest degree of accuracy and stability attainable in transistor equipment of this type. Develop data on which to base specifications for transistor characteristics which will provide reliable operation.

Armour Research Foundation, Chicago, Ill.
METHODS OF PURIFICATION OF METALS AND INTERMETALLIC COMPOUNDS, by Sherman Susman. Rept. for 15 June 58-14 May 59 on Electrical and Electronic Materials, Contract AF 33(616)5895. Nov 59, 86p. 38 refs. ARF-3133-11; WADC Technical rept. 59-303.
Order from OTS $2.25 PB 161 415

SiC, ThO_2, and ZrO_2 were studied to learn how impurities move in thermal gradients in potential materials for high temperature thermoelectric, thermionic, or photovoltaic generators. The electrical resistivity, thermal conductivity, and thermoelectric power of ThO_2 and ZrO_2 were studied at high temperatures. Thermal conductivity was measured by a method which eliminates common errors. ZrO_2 had a much lower electrical resistivity than ThO_2. ThO_2 doped with CeO_2 was minimally changed in its electrical properties. The band structure of CeO_2-stabilized ZrO_2 was more complex than that of CaO-stabilized ZrO_2. Impurity transport in polycrystalline SiC was studied by inductive coupling and spectrometric diffusibility. The total (p) of all purification effects in a thermal gradient were 32.8 and 8.4 for Ca and Al in polycrystalline SiC. Single crystal SiC was studied by spectrometric diffusibility to obtain an index, $J_t S_t / C^2 o i$, of the ease with which an impurity is transported through the solid. Values for Cu, Ca, and Al were 113, 194, and 58, respectively. (Author)

Armour Research Foundation, Chicago, Ill.
RESEARCH ON THE PYROLYTIC DEPOSITION OF THIN FILMS, by F. V. Schossberger, S. Spriggs and others. Rept. for 1 May 58-30 Apr 59 on Research on Physical Phenomena Affecting the Characteristics of Electronic Components, Contract AF 33(616)5720. Oct 59, 50p. 14 refs. WADC Technical rept. 59-363.
Order from OTS $1.25 PB 161 417

This report describes the results of a one year program devoted to the preparation, chiefly by pyrolytic deposition, of thin films potentially useful in composite molecular electronics. Of particular interest was the pyrolytic deposition of thin films with high temperature stability. Compact polycrystalline films of translucent, yellow β-SiC have been reproducibly prepared on tungsten substrates by the pyrolysis of trimethylchlorosilane vapor at 1 to 2 mm pressure and 1700°C. Unsupported films of β-SiC have been made by dissolving away the tungsten in melted sodium nitrite. Spectrochemical analyses and spectral transmission measurements verify that these films are of high purity. Nonporous films of silica on molybdenum have also been made by the low pressure pyrolysis of tetraethylsilicate; and the films of nickel metal mixed with NiO have been prepared with high temperature coefficients of electrical resistance. These films, and films of a number of ferrites such as $(Ni, Zn)Fe_2O_4$, have been made by spraying ethanol-ethyl acetate solutions of metal acetylacetonates on alumina substrates heated to 600° to 950°C. Dielectric films adherent to copper have been prepared by the vacuum alloying of a titanium-copper-nickel bonding layer, followed by the pyrolytic decomposition of triethanolamine titanate to titanium dioxide. The limits of composition, the conditions of firing, and the optimum thickness required for a flexible alloy layer were determined. Finally, beta-ray back-scattering has been shown to be a useful method for the measurement of film thickness. (Author)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
A STUDY ON THE EFFECTS OF CONTINUOUS WAVE JAMMING ON THE DETECTION OF ANTI-AIRCRAFT OPERATIONS CENTER SYMBOLS, by Charles Fried, Claude D. Patton and Raymond F. Blackmer. Sep 59, 25p. 5 refs. Technical Memo. 9-59.
Order from LC mi$2.70, ph$4.80 PB 144 951

Detection time was studied for four geometric shapes, considered for adoption as Antiaircraft Operations Center Symbols, that were exposed to three degrees of simulated continuous wave jamming. The shapes studied were the Circle, Cross, Half Circle and Cross-Within-Circle. Their diameters remained constant at 5/16". The shapes were generated electronically on a Planned Position Indicator display. Detection time increased for all four symbols as the intensity of continuous wave jamming increased, but this increase was not significant for the increase from the no noise to the mild noise level. All symbols, except for the Cross, had approximately the same detection time for each of the three noise levels. Any differences were not significant. The number of errors made by the subject were small and did not show any trend. The significantly lower detection time for the Cross at all noise levels is discussed. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PROCEEDINGS OF THE ANNUAL BATTERY RESEARCH AND DEVELOPMENT CONFERENCE [NO. 12] 21-22 MAY 1958. [1958] 141p. 35 refs.
Order from LC mi$7.20, ph$22.80 PB 145 520

Symposia included were on fuel cells; nickel-cadmium batteries; special purpose batteries; special purpose batteries; battery symposium; on power sources of the future. (See also PB 137 392)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PROCEEDINGS OF THE ANNUAL POWER SOURCES CONFERENCE [NO. 13] 28-30 APRIL 1959. [1959] 183p. 148 refs.
Order from LC mi$8.40, ph$28.70 PB 145 521

Sessions included were on space power; thermal energy conversion; nuclear energy sources; solar energy sources; secondary batteries; comparison of energy conversion systems; fuel cell batteries; primary batteries; high rate batteries.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
TRANSISTORIZED EQUIPMENT FOR MEASURING TRANSISTOR FREQUENCY RESPONSE, by Bernard Reich and William Orloff. 2 Mar 59, 17p. USASRDL Technical rept. 2016; AD-214 650.
Order from LC mi$2.40, ph$3.30 PB 145 138

The theory and operation of a transistorized equipment capable of measuring the frequency response of transistors is described. The characteristic chosen for representing this parameter is the f_t frequency or the frequency at which the current gain is unity. The equipment employs a transistor oscillator and small-signal r-f amplifier as the basic elements of the system. Although the equipment is capable of representing frequency responses in excess of 1000 mc/sec, the actual frequency used by the set does not have to exceed 100 mc/sec. (Author)

Bartol Research Foundation, Franklin, Inst., Swarthmore, Pa.
RESEARCH INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth, D. L. Goldwater and others. Scientific rept. no. 2 on Contract AF 19(604)3904. 15 Oct 58, 31p. 25 refs. AFCRC-TN-58-550; AD-160 859.
Order from LC mi$3.00, ph$6.30 PB 138 434

Fabrication and testing of thorium impregnated matrix cathodes. A study of the formation of ions by collision between electrons and thorium atoms in the cathode-anode space investigation of desorption of thorium from a tungsten surface by electron bombardment. (See also PB 137 001)

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING ON TASK XV. RESISTORS, VARIABLE, SUBMINATURE, by L. H. Stember, Jr. and P. G. Perry. Final rept. on Contract DA 36-039-sc-63136. 12 Aug 55, 115p. AD-115 178.
Order from LC mi$6.00, ph$18.30 PB 137 810

This is the final report on a program of investigation of subminiature, variable resistors. These resistors are one of a number of components studied in an evaluation program conducted under Contract No. DA 36-039-sc-63136. The general objective of this work is to determine the component's ability to meet the performance characteristics required by guided missiles, missile guidance systems of the Army Ordnance, and the highly specialized electronic equipments of the Signal Corps. The information obtained will be utilized to guide the component application engineer in the use of components, the component development engineer in furthering component improvement, and the specification specialist in defining a minimum quality level from production that will be acceptable for military service. Eight hundred and sixty one variable resistors were procured from six designated manufacturers to provide the specimens required to conduct the investigations scheduled in the program. These were separated into six groups and the investigations conducted on these were as follows: Group I. Initial resistance and linearity measurements; II. Rotational life; III. Load life; IV. Vibration (10-55 cps); Moisture resistance cycling (temperature cycling with high relative humidity). V. Minimum resistance measurements; Low-temperature storage; Low-temperature operation; Temperature cycling; VI. Temperature coefficient measurements; Short-timed overload; Insulation-breakdown voltage; Strength of mechanical rotation stops. (See also PB 137 866)

Bell Telephone Labs., [Whippany, N. J.]
MICROWAVE SOLID-STATE DEVICES. Interim rept. no. 7, 1 July-30 Sep 58, on Contract DA 36-039-sc-73224. 15 Nov 58, 34p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 144 943

Results of the Solid-State Maser studies are reported. Work on the spectra of Cr doped Al_2O_3 (ruby), Cr doped $3BeO \cdot Al_2O_3 \cdot 6SiO_2$ (emerald) and Co doped Al_2O_3 has been completed. A 6 kmc unilateral travelling wave maser (TWM) using a ruby loaded comb type digital structure has been built and tested. A gain of 23 db with a 25 mc bandwidth was obtained over an electronically tunable frequency range of 350 mc. By employing stagger tuning a gain of 13 db with a bandwidth of 67 mc was obtained in the same structure. Preliminary results obtained for diffused germanium nonlinear-capacitance diodes are reported. The best cut-off frequencies obtained (~80 to 100 kmc) are comparable to results obtained for silicon, but the best noise figure obtained in a 6 kmc amplifier (4.5 db) is inferior to that obtained for silicon varactor diodes (2.5 db). The inferior noise figure of the germanium diode appears to be due to shot noise, inasmuch as the silicon and germanium diodes had comparable figures of merit. A theoretical treatment of broadband harmonic generation effected by non-linear capacitance is described. The treatment is similar to that reported earlier, except that an attempt is made to evaluate the effects of parasitics by including a fixed parallel capacitance and a series resistance. Results show that the parasitics do not produce appreciable degradation of performance provided the frequency of the desired harmonic is sufficiently lower than a cut-off frequency defined in terms of the parasitic resistance and capacitance. (Author)

Bell Telephone Labs., [Whippany, N. J.]
MICROWAVE SOLID-STATE DEVICES. Interim rept. no. 8, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-73224. 15 Feb 59, 32p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 144 934

Noise temperature measurements have been made on a traveling wave maser preamplifier. The measured noise temperature referred to the input terminals at room temperature is $10.7 \pm 2.3^{\circ}K$. This compares favorably with a calculated noise temperature of $11.4 \pm 1.2^{\circ}K$. Feasibility tests have been made on a ruby maser for a signal frequency of 1500 mc. The measured spin temperature of $-0.28^{\circ}K$ indicates that compact traveling wave masers may be built at this frequency. A theoretical analysis of the gain and noise figure of a lower sideband nonlinear capacitance diode amplifier is presented. Approximate values of noise figure are calculated and compared with several measured noise figures. The comparison indicates that the diodes were operated at close to optimum conditions. The generation of subharmonics by a nonlinear capacitance diode is discussed briefly, from a theoretical point of view, and an experiment is described, in which the one-half harmonic was generated. (Author) (See also PB 144 943)

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO FREQUENCY METER FR-67( )/U AND MANUFACTURE OF EXPERIMENTAL MODELS, by Hamilton Chisholm, Robert Ellsworth, and Robert Evans. Final rept. on Contract DA 36-039-sc-63238. 10 Feb 56, 60p.
Order from LC mi$3.60, ph$9.30 PB 145 260

Two complete frequency meters were manufactured and tested for conformance with all electrical specifications. The major portion of the final report dwells upon the circuitry of the final units. The theory and characteristics of each major function is given in detail. Following this is a section on operating techniques which should serve as a complete guide in the use of the instrument. Maintenance procedures are then given with emphasis on precautions peculiar to the instrument. The text of the report makes frequent reference to photographs, sketches, and complete schematics. (Author)

Chatham Electronics, Livingston, N. J.
INDUSTRIAL PREPAREDNESS MEASURE FOR POLYOPTIC SEALING OF HYDROGEN THYRATRON TUBES. Quarterly progress rept. no. 1, 1 July-30 Sep 59, on Contract DA 36-039-sc-81289. 30 Nov 59, 10p.
Order from LC mi$1.80, ph$1.80 PB 145 220

The first quarter of the contract was spent in ordering necessary materials and equipment such as glass, lap material, grinding and lapping compounds, a life test unit, and an automatic exhaust machine. Different polishing procedures and techniques were investigated, and old methods revised and improved to make the process more suitable for production. (Author)

Clevite Research Center, Cleveland, Ohio.
INITIAL STUDY AND DEVELOPMENT OF PIEZOELECTRIC CERAMIC 1-F TRANSFORMERS, by O. E. Mattiat and W. F. Ford. Final rept. for 15 May 55-14 June 56 on Contract DA 36-039-sc-64644. 15 July 56, 84p. AD-115 854.
Order from LC mi$4.80, ph$13.80 PB 145 205

The two basic approaches of using piezoelectric ceramic resonators for band-pass filter purposes are described. The first is to employ such resonators as electric network elements in otherwise conventionally designed filters. The simplest two structures, as reported in detail in the First Quarterly Progress Report, are reviewed and impedance and insertion loss curves are presented. The second approach, employing ceramic resonators in new unconventional ways is summarized and impedance and attenuation behavior of one-, two- and three-disk filters are described. Some technical details (polarization and electroding) and material problems including aging, temperature-coefficient, dielectric constant, and quality factor are discussed. Conclusions are drawn for the application of one- and three-disk filters and recommendations are made for future development work. Representative sample filters are described in detail. (Author)

Colorado U. Engineering Experiment Station, Boulder.
STATIC TRANSVERSE POTENTIAL SOLUTIONS FOR DENSE DRIFTING ELECTRON BEAMS, by J. E. Lauer and J. C. Twombly. Technical rept. no. 1 on Contract Nonr-1147(06). 1 Mar 59, 53p. 7 refs.
Order from LC mi$3.60, ph$9.30 PB 144 896

The concept of supercritical perveance is reviewed, and nomenclature is established for the distinct regions of perveance separated by abrupt changes in potential state. Static transverse-potential functions are obtained for long drifting beams operating in the high- and low-potential modes. Change from one of these potential modes to the other is effected by excursions of beam perveance past certain critical values. These are calculated for each beam configuration.

Columbia U. School of Engineering, New York.
GENERAL FLOW GRAPH TECHNIQUE FOR THE SOLUTION OF MULTI-LOOP SAMPLED SYSTEMS, by R. Ash, W. H. Kim, and G. M. Kranc. Technical rept. T-37/B on Contract AF 18(600)677. 31 July 59, 33p. 10 refs. CU-57-59-AF-677-EE; AFOSR-TN-59-824.
Order from LC mi$3.00, ph$6.30 PB 144 752

This paper presents a flow-graph approach for analyzing multi-loop sampled-data systems. Two techniques for finding the sampled output are examined. These are: first, construction of a "sampled" signal flow-graph from the original system; second, a general

gain formula which can be directly applied to the original system. The theorems necessary to establish the formula are rigorously proven. The first technique allows two possible modes of solution. The sampled output can be found directly from the "sampled" flow graph by the use of Mason's Formula, or in case of a more complicated multi-loop system, the problem of enumerating non-touching feed-back loops can be simplified by the use of topological matrices. Techniques developed in the paper are also applied to the solution of multirate systems. (Author)

Columbia U. School of Engineering, New York.
OPTIMUM MULTIRATE CONTROLLER FOR A SAMPLED FEEDBACK SYSTEM, by G. M. Kranc. Technical rept. T-38/B on Contract AF 18(600)677. 1 Oct 59, 31p. 8 refs. CU 59-59-AF-677-EE; AFOSR-TN-59-1095.
Order from LC mi$3.00, ph$6.30 PB 145 100

This paper extends optimum design procedures to sampled-data systems with a multirate controller used as a discrete compensator. The multirate controller used as a discrete compensator. The multirate controller is a discrete network which in response to input samples at time t = 0, T, 2T, . . . produces output samples at time t = 0, T/n, 2T/n, . . . (where n is an integer), any output sample being a linear combination of the past and present inputs and outputs. It is shown in this paper how to design this controller to achieve a least mean square continuous error with random inputs or a least integral continuous error with known test input functions. The advantages of the multirate controller over the single-rate compensator are demonstrated. (Author)

Convair, Fort Worth, Tex.
FAST-RESPONSE LINEAR MICRO-MICROAMMETER, by J. R. Gardner. Rept. on Contract AF 33(600)32054. 20 Aug 58, 19p. MR-N-181; NARF-58-36T.
Order from LC mi$2.40, ph$3.30 PB 145 346

A prototype fast-response linear micromicroammeter has been developed which uses the 100 percent-feedback type of circuit without the usual dc-to-ac input converter. The circuit consists basically of an ORNL electrometer and a new type of push-pull magnetic amplifier. The output impedance of the electrometer matches the input impedance of the magnetic amplifier. The magamp output is fed back to the electrometer input to obtain fast response time (<0.1 sec) and negligible drift. The accuracy of measurement depends on the values of input and feedback resistors, and voltage gain is eliminated as a measure of accuracy and linearity. The ranges of current measurement extend from 10^{-11} amperes full scale to 5×10^{-6} amperes full scale, in 18 steps. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
ELECTRON TUBE RESEARCH FOR RELIABILITY: HIGH FREQUENCY AMPLIFIER STUDIES, by G. C. Dalman and N. DeClaris. Final rept., Part III, 15 May 55-31 Oct 58, on Contract DA 36-039-sc-64646. [1958] 518p. 1221 refs. Research rept. EE-412; AD-217 093.
Order from LC mi$11.10, ph$78.90 PB 145 473

Included are the following reports:
Wideband amplifier studies, Technical rept. no. 46, EE-413
Triode distributed amplifiers, Technical rept. no. 36, EE-400, AD-219 801
Input admittance of tubes for distributed amplifiers, Technical rept. no. 41, EE-405, AD-219 805
Wideband amplifiers and related topics: a selected bibliography, Technical rept. no. 38, EE-402, AD-219 802L
How to obtain properties of the solutions of differential equations without actually solving them, Technical rept. no. 39, EE-403, AD-219 803
(See also PB 145 472)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
ELECTRON TUBE RESEARCH FOR RELIABILITY: PHYSICAL ELECTRONICS STUDIES, by G. C. Dalman and N. DeClaris. Final rept., Part II, 15 May 55-31 Oct 58, on Contract DA 36-039-sc-64646. [1958] 362p. 91 refs. Research rept. EE-411; AD-217 092.
Order from LC mi$11.10, ph$56.10 PB 145 472

A summary of studies of important tube parameters affecting reliability including measurement of (1) cathode parameters such as cathode emission, cathode resistance, cathode temperature; (2) measurement of correction potential, and (3) residual gas in vacuum tubes. Included are the following reports:
The estimation of total cathode emission from shot noise measurements, Technical rept. no. 42, EE-406, AD-219 806
A theoretical basis for the determination of the total emission of oxide cathodes with the shot-noise method, Technical rept. no. 40, EE-404, AD-219 804
Preliminary studies on the limitations of radio frequency mass spectrometer, Technical rept. no. 45, EE-409, AD-219 809
The measurement of residual gas in vacuum tubes, Technical rept. no. 31, EE-330, AD-135 822(a)
The measurement of cathode resistance using retarding and accelerating fields, Technical rept. no. 37, EE-401, AD-206 833L
A dynamic conductance and transconductance measuring equipment for electron tubes, Technical rept. no. 35, EE-352, AD-159 136
Measurement of correction potential ε in electron tubes, Technical rept. no. 28, EE-285
Study of a cathode temperature measuring device, Technical rept. no. 27, EE-272
(See also PB 145 471)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
ELECTRON TUBE RESEARCH FOR RELIABILITY: STATISTICAL STUDIES, by G. C. Dalman and N. DeClaris. Final rept., Part I, 15 May 55-31 Oct 58, on Contract DA 36-039-sc-64646. [1958] 353p. 32 refs. Research rept. EE-410.
Order from LC mi$11.10, ph$54.60 PB 145 471

A summary of statistical studies dealing with the analysis of field failure of tubes, specifying tube reliability quantitatively, and special statistical problems that arose during the course of investigations. Included are the following reports:
Determination of vacuum tube catastrophic and wear-out failure properties from life-testing data, Technical rept. no. 44, EE-408, AD-219 808
Computer methods for estimating Weibull parameters in reliability studies, Technical rept. no. 34, EE-344
The Weibull distribution in reliability studies, Technical rept. no. 33, EE-343
Quantifying the life quality of electron tubes with the Weibull distribution, Technical rept. no. 26, EE-271
Summary of the tube analysis program, Technical rept. no. 43, EE-407, AD-219 807
A study of factors influencing electron tube failures, Technical rept. no. 32, EE-331
On tube replacement policy, Technical rept. no. 30, EE-315
A generalization in the calculation of equipment reliability, Technical rept. no. 29, EE-314
Statistical analysis of tube failures by cause of defect, Technical rept. no. 25, EE-259

Diamond Ordnance Fuze Labs., Washington, D. C.
ELECTRICAL CHARACTERISTICS OF COILED WAVEGUIDE, by H. S. Jones and H. K. Morlock. 3 Nov 58, 18p. 2 refs. Technical rept. TR-637; AD-209 130.
Order from LC mi$2.40, ph$3.30 PB 144 857

A comparison is made between the performance of a coiled waveguide section and a straight section of equivalent length. Stages of development and properties of coiled waveguides are discussed, and test results of several coils and assembled units are given. Theoretical calculations and an empirical determination of waveguide time delay are given. Some characteristics of coaxial delay lines are also discussed. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
FLAT VIBRATION-GENERATOR FOR MICROPHONIC INVESTIGATIONS, by J. D. Rosenberg. 30 Aug 54, 44p. 10 refs. Technical rept. TR-102.
Order from LC mi$3.30, ph$7.80 PB 145 617

A vibration-generator which was developed for the investigation of subminiature tube microphonics is described. Its characteristic frequency-acceleration curve, when properly adjusted, is flat within ±20% at 10 g from 100 to 10,000 cps. The fabrication blueprints of the generator and of a convenient quick-change tube clamp and tube-lead clamp are included. In addition, microphonic test techniques - white noise production test, swept frequency test, and white noise resonance test - which are dependent upon the generator, are presented, as well as a few sample recordings, and a general discussion of the tests. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
OSCILLATOR PERFORMANCE OF TRANSISTORS IN THE HF TO UHF RANGE, by Wolfgang M. Feist. 16 Oct 59, 51p. 6 refs. Technical rept. TR-724.
Order from LC mi$3.60, ph$9.30 PB 145 270

An outline is given of the factors to be considered in the design and construction of high-frequency transistor oscillators having optimal output efficiency. The design and construction of test oscillators covering the range from about 10 to over 1000 Mc is described. Results of oscillator performance of transistor types M2039, 2N500, 2N502 and 2N700 are given. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A SAMPLING PULSE OSCILLOSCOPE UNIT TRANSISTORIZED, 'SPOUT', by Philip Emile, Jr. and George R. Yetter. 6 Nov 59, 44p. 4 refs. TR-761.
Order from LC mi$3.30, ph$7.80 PB 144 706

A Sampling Pulse Oscilloscope Unit Transistorized, "SPOUT", capable of resolving repetitive pulses with risetimes in the order of 1 mμs was designed and built. SPOUT was built as a plug-in unit for a standard oscilloscope. A narrow pulse (approximately 1 mμs wide) is generated by an avalanche transistor switch and used to sample repetitive, unamplified input pulses. From the samples, a composite picture of the input pulse is formed on a cathode-ray tube (CRT). The main advantage of SPOUT and sampling oscilloscopes in general, is the possibility of viewing narrow (mμs) pulses with a low frequency CRT by trading sampling time for bandwidth. The disadvantages of the sampling method are that the pulse must be repetitive, the maximum and minimum input pulse rates are limited, and only a small dynamic range of input pulses can be observed. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
UTILIZING AN ELECTRONIC COMPUTER TO OPTIMIZE A TRANSISTOR NOR CIRCUIT, by E. L. Cox and L. L. Hall. 20 Oct 59, 21p. 2 refs. TR-748.
Order from LC mi$2.70, ph$4.80 PB 144 707

The accuracy with which a transistor NOR circuit can be designed for minimum power dissipation has been increased by including an additional parameter not considered in a previous analysis. The method of design involves determining the values of the input resistors, R_1, the maximum collector current, I_C, the collector resistor, R_C, and the collector supply voltage, V_{CC}, from the basic NOR circuit parameters (β/S, I_{CBO}, M, N, V_{BE}). The determination of R_1 consists of obtaining two analytical expressions, one larger and one smaller than the optimum R_1. The optimum R_1 is then obtained by numerical interpolation on an electronic computer and is subsequently used to compute the other quantities. The flow diagram of the computer program is included, as are graphical results indicating the trends of minimum power dissipation with changes in the basic NOR circuit parameters. (Author)

Eastman Kodak Co., Rochester, N. Y.
DEVELOPMENT OF AMMONIA VAPOR ACTIVATED BATTERIES, by V. M. Bryant, Jr., B. K. Burke, and J. B. Schliff. Quarterly rept. no. 7, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-71232. [1959]. 35p.
Order from LC mi$3.00, ph$6.30 PB 144 915

Task A (High Rate Battery). Report of work progress accomplished on the following phases: (2) testing and experiments: battery stack-properties of impregnated electrolyte pads, (5) redesign and evaluation: stack components; activator. Task B (Low Rate Battery). Report of work progress on the following phases: (2) testing and experiments: package-A-Section, B_1 Section, B_2 Section, C Section, (3) preliminary design and construction: stack, activator. (Author) (See also PB 139 061)

Electrical Engineering Research Lab., U. of Texas, Austin.
ANTENNA PATTERN FLUCTUATIONS AT 4.3 MILLIMETER WAVELENGTHS DUE TO ATMOSPHERIC INHOMOGENEITIES, by C. W. Tolbert, C. O. Britt, and A. W. Straiton. Rept. on Contract Nonr-375(01). 13 Dec 57, 15p. 6 refs. Rept. no. 96; AD-151 653.
Order from LC mi$2.40, ph$3.30 PB 138 074

A comparison was made between the fluctuation of optical images and the fluctuation of signal strength at millimeter wavelengths owing to inhomogeneities of the atmosphere. Measurements were made at 4.3-mm wavelengths to determine some of the characteristics and orders of magnitude of dancing, pulsation, and scintillation that might affect seeing at these wavelengths. Simultaneous measurements were made with 2 receivers of the signal strength over a 7.5-mi propagation path. The separation between the 2 receivers was varied from 1 to 50 ft. Results showed a limitation on the resolving power of narrow beam antennas owing to the inhomogeneities of the lower atmosphere. The seeing ability of easily obtainable antennas operating at millimeter radio wavelengths is limited by the atmosphere similar to the manner in which the seeing ability at optical wavelengths is limited.

Electrical Engineering Research Lab., U. of Texas, Austin.
PHANTOM RADAR TARGETS AT MILLIMETER RADIO WAVELENGTHS, by C. W. Tolbert, A. W. Straiton, and C. O. Britt. Rept. on Contracts Nonr-375(01) and Nonr-375(07). 21 Feb 58, 20p. 5 refs. Rept. no. 99; AD-156 772.
Order from LC mi$2.40, ph$3.30 PB 138 133

This report describes the techniques and the measured radar returns from "phantom targets" using 8.6 & 4.3 millimeter radars. The radar returns are compared to the measured back-scattering cross sections of water drops, insects, steam and other materials at 8.6 millimeter wavelength as measured by a c. w. radar at this wavelength. Within the limits of the conditions used in the laboratory, it was impossible to produce returns from synthesized refractive index gradients of sufficient magnitude to account for those noted on the radar. It is, therefore, concluded that for the millimeter wavelengths and the short ranges considered, the observed phantom returns were due to solid or liquid particles in the atmosphere.

Electron Tube Research Lab., U. of Minnesota, Minneapolis.
STUDIES ON BASE NICKELS FOR OXIDE COATED CATHODES, by W. G. Shepherd. Scientific rept. no. 3, 15 Oct 58-15 Jan 59, on Contract AF 19(604)3890. [1959]. 72p. AFCRC-TN-59-377; AD-217 857.
Order from LC mi$4.50, ph$12.30 PB 144 955

Coating adherence studies: The procedure for the co-precipitation of $(BaSr)CO_3$ from $Ba(NO_3)_2$ and $Sr(NO_3)_2$ is detailed; any deviation from the specified temperature, pH, or concentrations of reactants will affect the density and particle size of the carbonates. The density of the radioactive carbonates was nearly doubled when radioactive $Sr(NO_3)_2$ was used. To obtain the desired density it was necessary to redissolve the high density carbonates in a low normality HNO_3 solution and reprecipitate. Studies of controlled chemical activation: A series of experiments concerning the interactions between active-based and passive-based cathodes are described. The experiments consist in exposing a passive-based cathode to a controlled pressure of free Ba or to the evolution of an active metal (Mg) from a heated anode. An experimental study of the nature of chemical activation: A system was designed to permit the controlled variation in the rate at which a reducing additive is dispensed to the oxide coating from the cathode base. Alloy based cathodes: The emission characteristics were determined for oxide coatings on an 0.22% Al-Ni alloy base operating at 1119°K for 442 hr. Titanium anode studies: Extended operation of a passive-based oxide cathode exposed to a heated Ti anode resulted in a slow decay in peak emission. (See also PB 140 679)

Electronic Communications, Inc., Timonium, Md.
A PRECISION PHASING ELEMENT. Interim engineering rept. for 1 July-30 Sep 58 on Contract AF 30(602)1776. [1958] 51p. 1 ref. RADC-TR-58-148; AD-205 915.
Order from LC mi$3.60, ph$9.30 PB 138 128

A system for obtaining precision electronically controllable phase shift in the C-band region is presented. The system utilizes a folded-waveguide ferrite phase shifter element whose phase shift is controlled by a servo system referenced to a variable frequency microwave signal. With this system 360° phase change can be accomplished in 2.5 milliseconds. Bench tests indicate that temperature changes, magnetic field interaction effects, and hysteresis effects are held to negligible proportions within the operating limits of the phase shifter. The phase shifter element will handle peak power levels up to 50 kw without appreciable increase in loss. Auxiliary investigation on ferrite materials made during the course of this contract are discussed and typical results are given. Limits on the capabilities of phase shifters and switching circuits are given along with recommendations for future work. (Author)

Electronics Research Lab., U. of California, Berkeley.
THE ANALYSIS OF SAMPLED-DATA CONTROL SYSTEMS WITH PERIODICALLY TIME VARYING SAMPLING RATE, by F. J. Mullin and E. I. Jury. Rept. on Contract AF 18(600)1521. 30 June 58, 25p. 12 refs. Series no. 60, issue no. 207; AFOSR-TN-58-665; AD-162 196.
Order from LC mi$2.70, ph$4.80 PB 138 060

The z-transform is used to solve sampled-data feedback systems which have a periodically time varying sampling rate. Such systems are described by linear difference equations with periodic coefficients; however the difference equation which describes the system at the sampling instants corresponding to KN, where N is the period of the coefficients and K = 0, 1, 2, ... is a linear difference equation with constant coefficients. Thus, by forming a series of constant coefficient difference equations which individually describe the system at sampling instants corresponding to n = KN, KN+1, KN+2, ... (K+1)N-1, the time varying features of the system are in essence removed from the analysis. The z-transform can then be used to solve the resulting constant coefficient difference equations. The response between sampling instants can also be obtained from the solution of the difference equations.

Electronics Research Lab., Stanford U., Calif.
COMMUNICATION TECHNIQUES (MODULATION) PROJECT, by Oswald G. Villard, Jr. Final rept. for 1 June 51-31 Aug 53 on Contract W28-099-ac-131. 31 Aug 53, declassified 4 Nov 53. 59p. 8 refs. AD-22 024.
Order from LC mi$3.60, ph$9.30 PB 145 335

Electronics Research Lab., U. of California, Berkeley.
ANALYSIS OF INTEGRAL-SQUARE ERROR IN SAMPLED-DATA CONTROL SYSTEMS, by Behram Homi Bharucha. Rept. on Contract AF 18(600)1521 30 June 58, 52p. 11 refs. IER Series no. 60, issue no. 206; AFOSR-TN-58-679; AD-162 211.
Order from LC mi$3.60, ph$9.30 PB 137 786

Finite moments of the squared error of a linear time-invariant (continuous or sampled-data) control system for a non-random input are developed as integrals in the modified z-transform domain. An explicit solution of the zero moment of the total squared error integral is given as the ratio of determinants of two nxn matrices where n is the order of the system characteristic polynomial in z and the elements of the matrices are obtained readily from the coefficients of the rational form in z of the modified z-transform of the error signal.

Electronics Research Lab., U. of California, Berkeley.
A GASEOUS-CONDITION LINEAR AMPLIFIER WITH MAGNETIC FOCUSING, by John Noland Dukes. Master's thesis. Scientific rept. no. 5 on Contract AF 19(604)2270. 30 June 59, 58p. 9 refs. IER series no. 60, issue no. 240; AFCRC-TN-59-589.
Order from LC mi$3.60, ph$9.30 PB 144 593

An investigation is described to determine the feasibility of linear amplification by means of a cold-cathode tube with the electrode configuration and the gaseous-conduction properties of the Philips Ion Gauge but, unlike the latter, with electrically independent cathodes. The characteristics of this tube indicate that linear amplification can be attained with the tube operating either as a current-gain amplifier or as a "regenerative direct-coupled" amplifier in a manner similar to a negative-resistance amplifier. The negative-resistance property of the device is also utilized for oscillator operation, and a graphical analysis of the results is made. A theory is developed, based in part on the results of particle-extraction experiments in which a modified version of the tube was used, to explain the voltage-current characteristics of the device, including the negative-resistance effects. The negative resistance observed was of the short-circuit-stable variety, which is unusual in a gaseous-conduction device. (Author)

Electronics Research Lab., U. of California, Berkeley.
LOSS EQUALIZER SYNTHESIS UTILIZING THE IBM 701, by R. H. Mitchell. Rept. on Contract N7onr-29529. 12 Jan 59, 47p. 6 refs. IER series no. 60, issue no. 224.
Order from LC mi$3.30, ph$7.80 PB 144 520

The equalization problem has long confronted the engineer with the design of networks to produce a given loss over a specified frequency band. This given loss of the equalization network, coupled with that of the transmission line, some other networks, etc., will (it is hoped) produce a flat loss over this same frequency band. In the past, the choice of networks to produce this desired loss has been rather haphazard--depending on cut-and-try and, most generally, on the experience of the design engineer. This paper was written in order to give a straight-forward design procedure for developing a network of constant-R circuits in cascade which will produce any desired loss in the frequency band. The IBM 701 computer at the University of California Computer Center was used in the analysis of four curves to check the validity of the process. In Appendix D will be found the results of analysis; and it can be seen that, by expanding the program as presented here, practically any loss function may be approximated to a very good degree by this method.

Electronics Research Lab., U. of California, Berkeley.
OPTIMUM SYNTHESIS OF R. C. LADDER NETWORKS, by E. S. Kuh and A. Paige. Rept. on Contract N7onr-295(29). 12 Jan 59, 38p. 3 refs. IER Series no. 60, issue no. 223; Rept. no. 78.
Order from LC mi$3.00, ph$6.30 PB 144 862

Electronics Research Lab., U. of California, Berkeley.
QUARTERLY PROGRESS REPORT. Rept. for 1 Oct-31 Dec 58 on Contracts N7onr-29529, Nonr-222(53, 54, 57). 15 Jan 59, 19p. 4 refs. Series no. 60, Issue no. 23.
Order from LC mi$2.40, ph$3.30 PB 145 072

Contents:
Backscattering cross-sections of perfectly conducting objects of revolution
Stripline between curved boundaries
Frequency independent antennas
Network theory
Electronic circuit research
Ferrite field-displacement device for slot coupling control
(See also PB 143 555)

Frankford Arsenal, Philadelphia, Pa.
A PROPOSAL FOR EVALUATING AND IMPROVING ACCELEROMETERS, by Vernon Ames, Meyer Shulman, and Saul Wanetick. 15 Oct 58, 13p. Technical note TN-1108, AD-204 454.
Order from LC mi$2.40, ph$3.30 PB 145 616

A program for improving conventional piezoelectric accelerometers is proposed. New concepts in accelerometer design are proposed using other than the piezolectric principle as a solution to eliminate secondary effects which affect sensitivity and linearity characteristics. (Author)

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, by N. J. Hawkins and J. H. Affleck. Scientific rept. no. 1 on Contract AF 19(604)4093. 29 Aug 58, 24p. 6 refs. AFCRC-TN-58-372; AD-160 820.
Order from LC mi$2.70, ph$4.80 PB 137 710

The object of this investigation is to study experimentally the emission and evaporation rate of cathodes composed of refractory salts with low work function activator elements. Also, an attempt will be made to evolve a correlation theory which will aid in design of practical cathodes and give an insight into the emission properties of untried combinations of related materials. Initially, the general problem of a relation between emission of electrons and evaporation rate activator elements is examined by methods of thermodynamics. This leads to the effective dipole moment present at a surface and is expressed in an equation of state for the film. Next, considering the evaporation of adsorbed particles using Langmuir's approach a general equation of state is obtained for a sorbed film. Then in the case of an ionic film of one metal on another a relation is derived between the relative evaporation rate of electrons at zero field and the adatom evaporation in terms of the numbers of monolayers, the number of atoms per unit area to produce a complete monolayer, the temperature of the system and the condensation coefficient. The assumptions used in deriving the general relation between emission and life are discussed. Some of these assumptions may have to be modified in the systems that are to be studied. (Author)

General Electric Co., Schenectady, N. Y.
STUDY OF NUMERICAL INTEGRATION METHODS FOR ANTENNA PATTERN CALCULATIONS, by C. C. Allen. Scientific rept. no. 1 on Antenna Beam Scanning, Contract AF 19(604)1848. 15 Aug 58, 61p. 5 refs. AFCRC-TN-58-389; AD-160 855.
Order from LC mi$3.90, ph$10.80 PB 137 794

A study of numerical integration methods suitable for antenna pattern calculations was conducted for the purpose of determining their accuracy and relative costs. The general principles of numerical integration are discussed and four methods outlined in detail. The results of applying these methods to a simple cosine distribution are presented and analyzed. The relation of these results to those for a pattern integral having a nonlinear phase function is discussed. The Gaussian quadratures are shown to have the highest degree of precision and lowest cost in general, while Filon's method is preferable when integrals having a linear phase function are calculated over a large range of pattern angle. The procedure for applying these methods to double numerical integration is outlined. (Author)

Georgetown Coll. Observatory [Washington, D. C.]
A STABLE DIRECT-CURRENT AMPLIFIER FOR A PHOTOELECTRIC PHOTOMETER, by Charles F. Dohne and Francis J. Heyden. Technical rept. no. 11 on Contract AF 19(604)880. Feb 58, 5p. GCO monograph no. 8; AFCRC-TN-58-226; AD-146 882.
Order from LC mi$1.80, ph$1.80 PB 138 135

A direct current amplifier has been designed for use with a Multiplier Phototube. Stability and simplicity are obtained by using balanced circuitry, silicon power rectifiers and transistors. Light filters and voltage control of the Multiplier Phototube are employed. The purpose for which this amplifier was developed is to provide a stable and relatively simple direct current amplifier for photoelectric observation and recording of the total solar eclipse in the field.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, S. N. Witt, Jr. and William R. Free. Progress rept. no. 2, 16 July-15 Oct 56, on Contract DA 36-039-sc-71191. [1956] 37p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 138 497

Work has continued on the development of a more sensitive detector system for use with standard impedance bridges. Two experimental crystal oscillators, the Plate Degenerative Oscillator and a capacitance bridge oscillator, appear suitable for use as driving sources for the coaxial crystal parameter bridge being developed. Experimental models of each have been successfully operated with various crystals at frequencies up to and above 300 mc/sec. A calorimetric system utilizing a thermistor bridge makes possible the measurement of crystal power dissipation without any electrical connection to the crystal parameter bridge. (See also PB 138 498)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Vernon Crawford and Donald W. Fraser. Progress rept. no. 1, 1 Feb-1 May 53, on Contract DA 36-039-sc-42590. [1953]

45p. 7 refs.
Order from LC mi$3.30, ph$7.80 PB 138 184

A conference with representatives of the Signal Corps early this quarter resulted in a decision to concentrate upon two phases of experimental work during the year. These two phases are respectively: (1) continuation of research on coaxial cavities as mediums for oscillator control, utilizing the information gained under a previous project, and (2) initiation of studies of the absorption and transfer characteristics of piezoelectric quartz crystals when excited at very high orders of mechanical overtones. Three new cavities have been designed during the period of this report. The one to which the most attention has been devoted is constructed, in the main, of Stupalith, a ceramic material having a claimed coefficient of expansion of zero parts per million per degree centigrade. Another cavity was constructed completely of brass. It was intended to serve as a convenient test vehicle for oscillators and for the Cavity Q-Meter described below. The third and final cavity contains a silver-plated brass outer conductor, a silver-plated Vycor inner conductor, plus a compensation section designed to produce a first order correction for temperature effects on frequency. A Cavity Q-Meter has been constructed to permit studies of the coaxial cavities as passive resonators rather than as active parts of an oscillating system. This device features a frequency-swept oscillator, a variable-frequency oscillator, and a band-pass amplifier.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Vernon Crawford and Donald W. Fraser. Progress rept. no. 2, 1 May-1 Aug 53, on Contract DA 36-039-sc-42590. [1953] 49p. 11 refs.
Order from LC mi$3.30, ph$7.80 PB 138 185

A temperature-compensated cavity using an outer conductor of brass and an inner conductor of silver-plated Pyrex has been constructed and has been given extensive tests. This resonator, operating at a frequency of 300 megacyles, has exhibited an average frequency-versus-temperature change of about 0.5 parts per million per degree centigrade over a temperature range of seventy five degrees centigrade. A cavity has been constructed which utilizes a ceramic, Stupalith, having a claimed small (approximately zero) coefficient of expansion. Problems arising during silver-plating and during final assembly of the completed resonator have been discussed in detail. Cavity-controlled oscillators operating in the 500 megacycle range have been constructed and tested. In these oscillators the cavity serves as a reactive element. Further investigations of the high-order overtone responses of quartz crystal resonators have shown that some crystals may be excited at overtones as high as the fifty-ninth, and that the responses of various crystals are virtually independent of holder capacitance and of the Q of the holder. (See also PB 138 184)

Hughes Aircraft Co., Culver City, Calif.
SILICON TRANSISTOR, by J. S. O'Flaherty, M. Cutler and others. Final rept. for 1 Nov 53-31 Dec 54 on Contract DA 36-039-sc-56755, continuation of Contract DA 36-039-sc-42574. [1955] 71p. 19 refs. Rept. no. SC-14-F.
Order from LC mi$4.50, ph$12.30 PB 145 192

Research and development of silicon for semiconductor devices; and on semiconductor devices--primarily transistors--employing silicon. Improved techniques of silicon crystal growth and new methods of transistor fabrication, together with supplementary studies of silicon chemistry, silicon surface properties, and electrical characteristics, are described. (See also PB 137 354)

Johns Hopkins U., Baltimore, Md.
REPRESENTATION AND ANALYSIS OF SIGNALS. PART III. SIGNAL REPRESENTATION USING DIRAC'S NOTATION, by David C. Lai. Rept. on Contracts AF 19(604)1941 and Nonr-248(53). 31 Oct 58, 75p. 21 refs. AFCRC-TN-58-560; AD-160 869.
Order from LC mi$4.50, ph$12.30 PB 137 788

In this report, Dirac's Notation, originally applied by him to problems in quantum mechanics, is adopted and interpreted to provide a new representation of signals. Based upon the four operations most often encountered in the laboratory, viz., sampling, time reversing, filtering, and modulating, we introduce new compact symbols and operators to represent their mathematical counterparts, viz., sifting, tilding, convolution, and multiplication. In establishing any operation or equation, we have emphasized the physical and operational significance of the mathematics. The justification for this formulation depends, aside from its internal consistency, upon its ability to express compactly and concisely the various experimental processes used in analyzing signals.

Markite Co., New York.
INVESTIGATION OF CONDUCTIVE PLASTICS FOR USE IN BATTERIES, by Sidney A. Corren and Arnold S. Louis. Quarterly progress rept. no. 12 (Final) 15 Apr-Aug 57, on Contract DA 36-039-sc-64463. 15 Sep 57, 104p. Rept. no. 107-12.
Order from LC mi$5.70, ph$16.80 PB 144 917

Phase A: Continuation of work on improvement of stability, reproducibility and voltage life at 130°F of high voltage miniature molded batteries. Reported is a structure and a process for making sealed multiple cell battery stacks by machine assembly. Such stacks with magnesium anodes, conductive plastic cathodes and aqueous electrolyte exhibit more than 200 volts per cubic inch after 4 years of storage at 130°F. Phase B: A nickel-cadmium battery system with conductive plastic plates was investigated. Active battery plates were made by incorporating active material in porous conductive plastic. Characteristics of plates fabricated as continuous strip are described. Positive plates were produced which yielded 3 ah/cu in and negative plates with a capacity of 6 ah/cu in to a 1.0 v cut-off. BB403/U sized cells were made

which yielded 2 ah to 1.0 v at a 3a rate. Progress is reported in the direction if improved cycling life, volumetric capacity and voltage level at high discharge rate. (Author)

Melpar, Inc., Falls Church, Va.
RESEARCH STUDY OF THE CAPABILITIES AND LIMITATIONS OF CABLE BURYING TECHNIQUES IN THE MILITARY WIRE PLANT, by W. Bradley, M. J. Costello and others. Final rept. on Contract DA 36-039-sc-73130. 15 Jan 58, 148p. 112 refs. AD-153 115.
Order from LC mi$7.20, ph$22.80 PB 138 218

The history and development of cable burying is reviewed and recent military tests summarized. The resources required for the construction and maintenance of military cable lines by laying on the ground, installing aerially, and direct burial are developed from an evaluation of available information. An assumed basic situation is described to establish a basis for comparing characteristics of the 3 alternative methods of cable installation. An analysis is made of significant factors affecting the choice of installation method. The relative importance of cable burying in theaters of operations is discussed in the light of restrictions imposed by geography and the increased mobility of operational units. The probable use of cable in area grid systems is also examined. Commercial experience is examined for guidance in arriving at recommended techniques and procedures for military cable burial. Methods of analyses to be employed by signal officers in the field in determining the optimal method of construction of cable lines are covered. Means of controlling buried cable and a method of camouflaging a plow trace are discussed.

Michigan U. Research Inst., Ann Arbor.
DETECTION OF A SIGNAL SPECIFIED EXACTLY WITH A NOISY STORED REFERENCE SIGNAL, by T. G. Birdsall. Rept. on Contract AF 49(638)369. Sep 59, 29p. 5 refs. Technical rept. no. 93; 2803-1-T; AFOSR-TN-59-909.
Order from LC mi$2.70, ph$4.80 PB 144 784

This report treats the optimization problem of detecting the presence of a signal in a background of white Gaussian noise, under the restriction that the signal is specified exactly but the receiver memory contains only a noisy version of the signal. The optimum receiver is specified. The performances of both the optimum receiver and the crosscorrelation receiver with a noisy memory are calculated and compared for a special case. (Author)

Michigan U. Research Inst., Ann Arbor.
STUDIES IN RADAR CROSS SECTIONS 30. THE THEORY OF SCALAR DIFFRACTION WITH APPLICATION TO THE PROLATE SPHEROID, by R. K. Ritt, appendix by N. D. Kazarinoff. Scientific rept. no. 4 on Contract AF 19(603)1949, Aug 58, 54p. 21 refs. 2591-4-T; AFCRC-TN-58-351; AD-160 791.
Order from LC mi$3.60, ph$9.30 PB 137 831

It is shown that the inhomogeneous wave equation, $\nabla^2 u - u_{tt} = \rho e^{i\omega t}$, with prescribed initial conditions and subject to outer boundary conditions on a smooth closed surface, has a solution of the form $v(x,t)e^{i\omega t}$, and that $\lim_{T\to\infty} T^{-1} \int_0^T v(x,t)\,dt$ is given by the formula $\phi(x) = \lim_{s\to 0} \phi(x,s)$, where $\phi(x,s)$ is the solution of $\nabla^2\phi + (\omega - is)^2\phi = \rho$, subject to the same boundary conditions as u, and which is square-integrable in the exterior region. The theory of analytic resolvents of Sims and Phillips is applied to obtain a representation of the solution of this equation as a contour integral.

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH, by M. Chodorow. Scientific rept. no. 7, 1 Apr - 30 June 58, on Contract AF 19(604)1930. July 58, 14p. 1 ref. M. L. rept. no. 528; AFCRC-TN-58-360; AD-160 803.
Order from LC mi$2.40, ph$3.30 PB 137 862

Four projects are presently supported by this contract. In the electron velocity spectrograph project, much of the recent quarter's activity has been devoted to improvement in the experimental equipment. In the connected-ring structures project, work has continued on the design of a traveling-wave amplifier which is expected to produce between 25 and 50 kw peak power output at S-band. In the coupled-cavity-theory project, work has continued on the more detailed verification of the equivalent circuits which are now being used. The present equivalent circuit representation of the clover-leaf structure has succeeded in predicting a number of the characteristics actually observed with this circuit. In the electron gun studies project, the original gun design has been revised because of certain difficulties which were encountered with secondary emission and grid interception. (See also PB 137 681)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
FACTORS AFFECTING MICROWAVE ELECTRICAL BREAKDOWN AND TRANSMISSION NEAR MISSILE ANTENNAS, by R. M. Hill, A. J. Penico and others. Final rept. on Contract AF 19(604)3883. 28 Aug 59, 75p. 24 refs. AFCRC-TR-59-188.
Order from LC mi$4.50, ph$12.30 PB 144 544

Two experimental investigations have been made into intrinsic properties of atmospheric gases which affect microwave transmission. One experiment has measured the electron collision frequency for electrons of thermal energy in neon, nitrogen and oxygen. The method depends upon a measurement of the electron-cyclotron-resonance line width for thermal electrons. The other experiment has been a study of the rate of build up of electron density associated with the microwave pulse breakdown of air. The experiment was specifically designed to study attachment control in the pressure region of interest for missile antennas. A 10 cm cavity was used with the pulsed breakdown field applied to the TM_{010} mode.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ELECTRONIC WARFARE APPLICATION OF MICROWAVE ELECTRONICS, by John W. E. Griemsmann. Final rept. on Contract AF 30(602)1650. 7 July 59, 122p. 24 refs. Rept. R-743-59; PIB-671; RADC-TR-59-156.
Order from LC mi$6.30, ph$19.80 PB 144 861

Strip line high pass filters which can be fabricated completely by photoetching techniques have been developed for the frequency band from 100 to 1000 Mc/sec. The short circuited terminations for the shunt lines used in earlier designs have been eliminated by the use of wide band open circuited shunt inductive structures. Series overlap capacitors were avoided by employing an alternative design procedure to yield a structure containing only transmission line sections. A narrow band bandpass filter employing coupled lengths of line to simulate the behavior of series inductors appears to exhibit desireable electrical and mechanical properties in the frequency range below 1000 Mc/sec. A savings in the overall size of the filter can be effected by coupling successive filter sections of this type through series capacitors. Other types of bandpass filters for the frequency band from 50 to 1000 Mc/sec. have also been considered. These include quarter wave coupled cavity types of filters and conventional strip line filter structures in low characteristic impedance lines.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
OPTIMUM TWO-TERMINAL INTERSTAGE DESIGN FOR HIGH-FREQUENCY TRANSISTOR AMPLIFIER, by W. H. Ku and H. J. Carlin. Rept. on Contract Nonr-839(05). 13 Feb 59, 64p. 5 refs. Rept. no. R-679-58; PIB-607.
Order from LC mi$3.90, ph$10.80 PB 144 821

The design of optimum two-terminal interstage is treated. In transistor feedback amplifier design, the most satisfactory interstage networks are two-terminal structures. For high-frequency transistors in cascade, we can consider the equivalent network to consist a shunt resistance-capacitance load in parallel with the two-terminal interstage structure. The problem is to design a coupling network to obtain maximum gain-bandwidth product consistent with physical realizability conditions of a two-terminal structure for the prescribed shunt R-C load. The theoretical limitations on the performance of the optimum two-terminal interstage are examined and three basic methods of design are given. It is concluded that the optimum gain-bandwidth of a two-terminal interstage is reduced by the presence of the shunt resistive element. Optimum gain-bandwidth characteristics are deduced and used to determine the shunt equalizer network. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
VARIABLE PARAMETER DELAY LINES, by G. Aaronson. Rept. on Contract Nonr-839(05). 13 Mar 59, 78p. 10 refs. Research rept. R-720-59; PIB-648.
Order from LC mi$4.50, ph$12.30 PB 145 149

This report is concerned with a study of the delay properties of networks containing several variable parameters. The effect of a parameter change on the delay function of the network yields information that aids in the synthesis of high order variable delay lines. The Bridged-T network is used as a prototype section in this investigation.

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by E. Snitzer and R. Strong. Quarterly progress rept. no. 1 for 1 June-1 Sep 55 on Contract DA 36-039-sc-64622. [1955] 26p. B. I. rept. no. 9203-2.
Order from LC mi$2.70, ph$4.80 PB 145 222

The coexistence of the solid, liquid, and vapor phases of a substance, or the coexistence of only the solid and liquid phases under conditions of approximately constant pressure, insures the constancy of the temperature over wide ranges of heat exchange with the surroundings. A constant temperature oven can be designed which takes advantage of this type of thermal ballast.

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by E. Snitzer and R. Strong. Quarterly progress rept. no. 2, 1 Sep-1 Dec 55, on Contract DA 36-039-sc-64622. [1955] 25p. B. I. rept. no. 9203-3.
Order from LC mi$2.70, ph$4.80 PB 145 223

Designs are discussed for ovens which are based on a solid-liquid system. The change in volume on phase change is detected by a bellows which operates a microswitch. The Class A oven is based on the use of the triple point temperature. The actuating mechanism is a float connected to a bellows whose movement controls the heater supply through a microswitch. (See also PB 145 222)

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by E. Snitzer and R. Strong. Quarterly progress rept. no. 3, 1 Dec 55-29 Feb 56, on Contract DA 36-039-sc-64622. [1956] 17p. B. I. rept. no. 9203-4.
Order from LC mi$2.40, ph$3.30 PB 145 224

Preparation of pure para-dibromobenzene. The Class "B" oven designed for the HC-13 crystal holder was filled. The other Class "B" oven is in the process of being assembled. The detailed drawings on the Class "C" ovens were completed. (See also PB 145 223)

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by R. C. Whitehead and R. K. Strong. Final rept. for 1 June 55-1 Oct 56 on Contract DA 36-039-sc-64622. [1956] 33p. B. I.

rept. no. 9203-6.
Order from LC mi$3.00, ph$6.30 PB 145 225

Three classes of crystal ovens were built utilizing paradibromobenzene at its melting temperature of 87.36°C as the thermostatic material. In this report the design construction and filling are discussed. The Class B and C ovens were within the temperature stability specification. The Class A ovens did not operate satisfactorily. (See also PB 145 224)

National Bureau of Standards, Boulder, Colo.
APPLICATION OF RF MICROPOTENTIOMETERS FOR CALIBRATION OF SIGNAL GENERATORS TO 1000 Mc, by L. F. Behrent. Jan 60, 19p. 2 refs. Technical note no. 37.
Order from OTS $0.50 PB 151 396

With the RF Micropotentiometer, signal generator output voltage can be calibrated to 1000 Mc simply and accurately if the procedures outlined in this paper are carefully followed. The sources of error are discussed and methods for minimizing or eliminating them are described. Topics discussed include: rf shielding, selection of a suitable rf detector, impedance matching and the proper selection of voltage reference planes. (Author)

Naval Ordnance Lab., Corona, Calif.
MAGNETIC RING TELEMETER DEVELOPMENT, by M. G. Pawley and T. B. Jackson. Feb 54, declassified 17 June 54, 27p. NOL-CORONA rept. 110.
Order from LC mi$2.70, ph$4.80 PB 144 747

The Magnetic Ring Telemeter is a multichannel pulse position modulated telemeter that utilizes small saturable reactors in place of vacuum tubes in the ring counter chains required in the transmitter premodulator to affect time division for the several channel pulses. A magnetic ring counter chain is also used in the receiver decoder for separating the channel pulses prior to recording of the transmitted intelligence. The development of the Magnetic Ring Telemeter was initiated for the purpose of providing a telemeter with increased intelligence-handling capabilities. The size was to be kept at a minimum and the reliability increased over former models by utilization of new techniques. The development has been reported periodically in the PETREL progress reports. A general description was presented at the 3rd National Telemetering Symposium sponsored by the Research and Development Board at Patrick Air Force Base, Florida, March 17, 1953.

Naval Ordnance Lab., Corona, Calif.
VHF MULTIPLE-SLOT FIN-TYPE AND MICROWAVE DIELECTRIC ROD ANTENNA ASSEMBLY, by D. E. Rowe, Ivan Rainwater, and D. A. Schriner. 31 Aug 59, 26p. 2 refs. NOLC rept. 467; NAVORD rept. 5966.
Order from LC mi$2.70, ph$4.80 PB 144 942

The Naval Ordnance Laboratory Corona has developed a fin-type multiple-antenna structure for mounting on a supersonic rocket sled. It provides four slot antennas for simultaneous signal transmission on four telemeter channels without mutual interference and a dielectric rod X-band antenna for receipt of command signals. The antenna assembly has given satisfactory performance under severe rocket-sled service conditions in the transmitting range of 215 to 235 Mc. It is believed that the design can be adapted to fulfill other special antenna requirements. (Author)

Naval Ordnance Test Station, China Lake, Calif.
FUZING APPLICATION OF THE FOUR-LAYER DIODE, by Duane J. Russell. 15 Sep 59, 33p. 3 refs. NOTS TP-2317; NAVORD rept. 6587; AD-228 825.
Order from LC mi$3.00, ph$6.30 PB 144 986

A new semiconductor device called the Shockley Four-Layer Diode has appeared recently on the market. Its electrical characteristics make the device of special interest for application to fuzing systems since it can perform both the operations of timing and energy switching. Energies of up to one million ergs can be switched using units with higher breakover voltages. A limited testing program indicated that the usefulness of the four-layer diode as a timer would probably be restricted by its temperature sensitivity. Testing programs also indicate that the diode can withstand at least 10 g vibration near its resonant frequency and a steady acceleration of at least 9,000 g. (Author)

Naval Research Lab., Washington, D. C.
RADAR TARGET ANGULAR SCINTILLATION IN TRACKING AND GUIDANCE SYSTEMS BASED ON ECHO SIGNAL PHASE FRONT DISTORTION, by D. D. Howard. Interim rept. 23 Dec 59, 12p. 8 refs. NRL rept. 5430.
Order from LC mi$2.40, ph$3.30 PB 143 942

The slope of the echo signal phase front from a finite-size complex target is identical to the angular error caused in tracking radars by target angle noise. Thus, the target angle noise is contained in the echo signal as a distortion of the phase front. This new concept aids in visualizing the source of target angle noise and in assessing, in general, the effects of target angular scintillation or target angle noise on any target locating device. As an example, identical errors in target location also occur in a search radar. (Author)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by H. E. Stauss. Status rept. no. 1, Feb 59, 124p. NRL Memo rept. 901.
Order from LC mi$9.90, ph$34.80 PB 145 601

New materials and new methods of preparation indicate that a survey of thermoelectricity at this time is desirable and hold out promise that the development of practical thermoelectric generators is possible. Practical applications of Peltier cooling is already a fact. Overall efficiencies of 20% to 35% appear to be within the realm of possibility. There is a high probability that the figure of 20% can be achieved. Actual work on new materials for generators has hardly been started in this country. Intensive efforts have been made to derive guide lines for materials development. From the strictly experimental side, several types of materials have shown promise.

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by H. E. Stauss. Status rept. no. 2, June 59, 56p. Memo. rept. 940.
Order from LC mi$3.60, ph$9.30 PB 145 602

In this report the material presented consists of: (1) the power to weight ratios of several thermoelectric generators, (2) the characteristics of thermoelements cooled by radiation, (3) the effect of increasing temperature upon efficiency, (4) materials data, and (5) changes and corrections in contracts. (See also PB 145 601)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by H. E. Stauss. Status rept. no. 3, Dec 59, 75p. 16 refs. Memo. rept. 969.
Order from LC mi$4.50, ph$12.30 PB 145 603

The progress on development of new materials is encouraging up to intermediate temperature levels. No results have yet been obtained from the small, early efforts to develop high temperature materials. Design and construction of the several generators on order is reported to be on schedule with no particular problems arising that were not anticipated. More efforts are now directed toward materials that will diffuse into the semiconductor with a minimum deterioration to the thermoelectric properties. Interest in nuclear powered thermoelectric generators is becoming more widespread, and efforts to explore material behavior in high energy environments are just starting. The materials data presented includes information of unusual interest on encapsulated materials. The results show the possibility of operating efficiently at appreciably higher temperatures than measurements have shown on material not enclosed. A review of Russian progress on thermoelectricity is presented as an Appendix. (See also PB 145 602)

New York U. Coll. of Engineering, N. Y.
AIR TRANSPORTABLE SHELTER FOR GROUND ELECTRONIC EQUIPMENT, by William D. Murray, Alan M. Nathan, and Harold Gussaroff. Rept. on Contract AF 30(602)205. 15 May 54, 129p. 51 refs. Technical rept. 222.05; RADC-TR-54-69; AD-43 896.
Order from LC mi$6.30, ph$19.80 PB 145 607

Analytical and experimental studies produced a shelter consisting of a structural framework with aluminum faced sandwich panels serving as walls, floors, and ceiling. Included are an air conditioning system, means for electronic shielding, and a mechanism for lifting the assembled shelter into or out of a flat bed truck or C-119 aircraft.

New York U. Coll. of Engineering, N. Y.
TRANSIENT RESPONSE AS A DESIGN CRITERION FOR STABILIZATION OF FEEDBACK AMPLIFIERS, by J. H. Mulligan, Jr. Rept. on Contract AF 49(638)586. Sep 59, 30p. 9 refs. Technical rept. 400-5; AFOSR-TN-59-1075.
Order from LC mi$2.70, ph$4.80 PB 144 770

A design criterion for use in the stabilization of feedback amplifiers is discussed which is concerned directly with pole locations and with a feature of the transient response. The criterion is the relative damping of the amplifier step-function response, i.e., the ratio of the deviations from unity in the normalized time response at two successive extreme values. Use of the proposed criterion in conjunction with a dominant term approximation to the transient response to formulate design equations for representative transistor and vacuum tube amplifier stages is demonstrated. Transient response curves for a particular design using various values of mid-band loop gain illustrate the effect of parameter changes on the stabilization design parameter. (Author)

Office of Scientific Research and Development. Div. 6.
RECOGNITION OF UNDERWATER SOUNDS. Summary technical rept. vol. 9 on [Contract OEMsr-1130] 1946, declassified 23 Apr 58. 291p. 185 refs.
AD-200 787.
Order from LC mi$11.10, ph$45.60 PB 145 086

Contents:
The ear and hearing
  Structure of the ear
  Behavior of the ear
Listening
  Characteristics of target sounds and noise background
Laboratory measurements on masking of target sounds
Field measurements on masking of target sounds
  Summary of listening studies
Echo ranging
  Characteristics of echoes and reverberation
  Noise masking of echoes
  Reverberation masking of signals without doppler
  Reverberation masking of signals with doppler
  Summary of echo studies

Office of Scientific Research and Development. Div. 14.
SUPERSONIC DELAY LINES, by Herbert Shapiro (Radiation Lab., Mass. Inst. of Tech.). Rept. on Contract OEMsr-262. 15 Mar 46, declassified. 46p. 2 refs. Radiation Lab. rept 850.
Order from LC mi$3.30, ph$7.80 PB 137 822

The structural features of supersonic delay lines, together with some investigations bearing on their acoustic and electrical properties, are described. The lines were designed specifically for laboratory use as signal storage devices for an MTI (Moving Target Indication) system and have delays of the order of 0.5 to 1.6 milliseconds. (Author)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 2, 1 May-31 July 53, on Contract DA 36-039-sc-42670. [1953] 29p.
Order from LC mi$2.70, ph$4.80 PB 145 195

See PB 145 194.

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 3, 1 Aug-31 Oct 53, on Contract DA 36-039-sc-42670. [1953] 90p.
Order from LC mi$4.80, ph$13.80 PB 145 196

The aging curves of seventy crystal units have revealed three important characteristics. Heavily contoured 1000 Kc AT-cut units show a positive frequency shift followed by a stabilization. Third overtone 50 Mc plated crystals are negatively at a rapid rate with no indication of stabilization. There is very low aging of both fundamental 10 Mc and fifth overtone 50 Mc units wherein the quartz plates had been polished by optical methods. (See also PB 145 195)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 4, 1 Nov 53-31 Jan 54, on Contract DA 36-039-sc-42670. [1954] 135p.
Order from LC mi$6.90, ph$21.30 PB 145 197

Factors of evacuation, gas filling and sealing are of paramount significance in achieving low aging crystal units. The individual aging curves of 105 units are presented. (See also PB 145 196)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 5, 1 Feb-30 Apr 54, on Contract DA 36-039-sc-42670. [1954] 147p.
Order from LC mi$7.20, ph$22.80 PB 145 198

This report shows the aging characteristics of 103 crystal units. The gold evaporation plating problem has been resolved. The two most important factors in obtaining the required adhesion are freedom from crystal surface contamination and infra-red heating of the quartz plates to a temperature between 300°C and 400°C before plating. (See also PB 145 197)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 6, 1 May-31 July 54, on Contract DA 36-039-sc-42670. [1954] 125p.
Order from LC mi$6.30, ph$19.80 PB 145 199

This report contains actual aging curves for more than 125 units, with a brief description of the aging characteristics of each group. (See also PB 145 198)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 7, 1 Aug-31 Oct 54, on Contract DA 36-039-sc-42670. [1954] 165p.
Order from LC mi$7.80, ph$25.80 PB 145 200

There appear to be three phases of aging effects. The initial deviation in frequency experienced by the majority of units is during the first month after fabrication. The second phase covers a period of about six months and is characterized by a tendency towards frequency stabilization. The third phase is a retarded effect, not greatly influencing crystal unit performance until six or seven months after fabrication and exposure to an elevated temperature such as +75°C. Latest techniques in lapping, etching, plating and mounting of the crystal units currently being produced. (See also PB 145 199)

Radio Corp. of America, Somerville, N. J.
INDUSTRIAL PREPAREDNESS STUDY ON DEVICE 1, by J. E. Wright and P. A. Wemett. Quarterly rept. no. 2, 1 Nov 57-31 Jan 58, on Contract DA 36-039-sc-72709. 1 Apr 58, 22p. AD-160 634.
Order from LC mi$2.70, ph$4.80 PB 138 053

Both p-n-p and n-p-n versions of device 1 are being developed to meet Spec MIL-T-19500A. Both versions are being fabricated.

Radio Receptor Co., Inc., Brooklyn, N. Y.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON JUNCTION CRYSTAL DIODES, by William E. Harding and Melvin Klein. Final engineering rept. on Contract DA 36-039-sc-70264. [1958] 225p. AD-161 315.
Order from LC mi$9.90, ph$24.80 PB 138 096

The developmental history, design, construction, electrical characteristics, and pilot line manufacturing process are discussed for the 1N658 glass-encapsulated, Si junction diode. The diode has high forward conductance, fast reverse recovery, and low leakage at room and elevated temperatures. The basic rectifying structure is a p-n-n+ assembly consisting of an n-type Si die with an Al wire alloyed to one surface to form the p-n junction; an Sb-doped Au disk is alloyed to the opposite side to form the n-n+ junction. External connections consist of a Dumet lead spot welded to the Al wire and a Dumet lead soldered to a Kovar disk. The leads are hermetically sealed in a glass capsule which is evacuated. A pilot production yield of 25% was obtained for the diode. (See also PB 132 079)

Raytheon Mfg. Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freedman. Quarterly rept. no. 9, 28 Mar-28 June 57, on Contract DA 36-039-sc-66038. [1957] 72p. AD-159 993.
Order from LC mi$4.50, ph$12.30 PB 138 050

The stability resulting from packaging processes was investigated. The use of SR-98 base coat required DC-4 silicone grease or other protective processing to eliminate the collector diode current (I_{co}) and the floating potential (V_{if}) problems encountered in environmental testing. Exhausting of the weld gases and solder sealing in a nitrogen atmosphere did not reduce the I_{co} problem. The change from the type E to the type 30 package in itself produced no significant change in in-line yields. Two package processing experiments showed that if no base coat, or silicone grease or oil is used, high in-line rejection levels occur for I_{co} and V_{if}. Units packaged with 50% SR-98 base coat and DC-4 silicone grease applied around the unit resulted in the highest in-line yields coupled with the best over-all stability. (See also PB 138 094)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
NEW METHOD OF MEASURING THE NOISE PARAMETERS OF THE ELECTRON BEAM, ESPECIALLY THE CORRELATION BETWEEN ITS VELOCITY AND CURRENT FLUCTUATIONS, by Shigebumi Saito. Rept. on Contract DA 36-039-sc-64637. 22 Aug 57, 52p. 8 refs. Technical rept. no. 333; AD-201 537.
Order from LC mi$3.60, ph$9.30 PB 145 132

The noise figure of a microwave beam amplifier has a lower limit that depends entirely upon the noise process in the electron gun at and near the potential minimum. This report is chiefly concerned with the theory and experimental results of a new method of measuring the noise parameters of the electron beam, especially the correlation between its velocity and current fluctuations, by using a selective beam coupler that has properties similar to the conventional microwave directional coupler. The value of the correlation coefficient of the velocity and current fluctuations was found to be from 0.2 to 0.35 in the space-charge-limited region and zero, or slightly negative, in the temperature-limited region. The probable error of this measuring method is discussed by taking account of the residual selectivity of the selective beam coupler, the effect of the pickup cavities upon the beam, the thermal noise from these cavities, and the higher-order modes.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
A STUDY OF ASYNCHRONOUS LOGICAL FEEDBACK NETWORKS, by Stephen H. Unger. Doctoral thesis. Rept. on Contract DA 36-039-sc-64637. 26 April 57, 47p. 13 refs. Technical rept. no. 320; AD-150 502.
Order from LC mi$3.30, ph$7.80 PB 145 436

The systems considered are asynchronous, dc-level, sequential switching circuits; that is, there are no clock pulses, and the signals are represented, not by pulses, but by variables that can assume values in either of two nonoverlapping ranges. The analysis of these circuits is discussed, with emphasis on the problem of choosing state variables. A relationship has been established between the number of rows of a reduced flow matrix and the feedback index of the associated circuit and, furthermore, the need for amplification around each feedback loop has been proved. The major portion of the research is devoted to a study of the effects of stray delays on the operation of sequential switching circuits.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORY OF LOW-DISTORTION TRANSMISSION OF FM SIGNALS THROUGH LINEAR SYSTEMS, by Elie J. Baghdady. Rept. on Contract DA 36-039-sc-64637. 30 July 57, 50p. 10 refs. Technical rept. 332.
Order from LC mi$3.30, ph$7.80 PB 145 340

The convergence properties of the Carson and Fry and of the van der Pol-Stumpers expansions for the complex amplitude of the steady-state response of a filter to an FM excitation are discussed. The theory of quasi-stationary analysis and of FM-to-AM conversion with low distortion is presented. The use of Taylor's formula leads to error estimates and to a simple condition that specifies an upper bound on the error incurred in restricting the solution to the quasi-stationary term (the instantaneous-frequency method). A sluggishness ratio and an index of stiffness are defined for filters whose system functions have poles only in the left half-plane. Sluggishness ratios and indices are given for various filters of wide practical interest.

Sage Labs., Inc., Wellesley, Mass.
INVESTIGATION INTO THE DESIGN OF ROTATING MECHANICAL PHASE SHIFTING DEVICES, by Jay J. Chacran and Theodore S. Saad. Final rept. on Contract AF 19(604) 1844. 31 Dec 58, 51p. AFCRC-TR-59-156; AD-216 764.
Order from LC mi$3.60, ph$9.30 PB 145 301

The advent of more complicated antenna systems has lead to the need for various components that make such systems practical. One of these components, a continuous phase shifter, is described. This phase shifter operates over the 400- to 440-mc band with VSWR≤1.13, insertion loss≤0.8 db, rotational variation≤0.3 db, and deviation from phase linearity ≤ + 7.0 to -3°.

Stanford Electronics Labs., Stanford U., Calif.
A CLASS OF SYSTEMATIC CODES FOR NON-INDEPENDENT ERRORS, by N. M. Abramson. Technical rept. no. 51 on Contract Nonr-225(24). 30 Dec 58, 35p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 144 933

A class of systematic codes has been obtained which will correct all single errors and all double errors which occur in adjacent digits. These codes use significantly fewer checking digits than codes which correct all double errors. In addition, because of inherent regularities in their structure, these codes may be instrumented in a strikingly simple fashion. (Author)

Stanford Electronics Lab., Stanford U., Calif.
AN INVESTIGATION OF THE MAGNETRON AMPLIFIER, by B. A. Wightman. Technical rept. no. 52 on Contract Nonr-225(24). 9 Feb 59, 99p. 32 refs. AD-211 869.
Order from LC mi$5.40, ph$15.30 PB 144 812

The magnetron amplifier is investigated because of its promise of efficiencies in excess of fifty percent. Two problems are dealt with: an analytical investigation of the interaction at small signal levels, and an experimental effort to adapt the zig-zag line for the higher power requirements in the magnetron amplifier. The model for the space-charge effects

postulated by Heffner and Unotoro is inserted into the Pierce analysis of the magnetron amplifier. The result includes a determinantal equation for the space-charge-wave interaction which is the same as Gould's, but the analysis embraces all interactions. These interactions are examined with respect to the energy exchange between beam and circuit in order to determine which interactions are useful. The selection of a slow-wave circuit for the magnetron amplifier is discussed, and the zig-zag line is chosen for its low dispersion. This circuit was adapted for higher powers by mounting on a ceramic of high thermal conductivity which was undercut to minimize dielectric loading. The circuit thermal capacity was satisfactory, but the effect of the undercutting was not as great as anticipated. The coupling impedance was reduced and the attenuation increased excessively for a high-efficiency application. An experimental amplifier using this circuit had an efficiency of only twelve percent. (Author)

Stanford Electronics Labs., Stanford U., Calif.
PHYSICAL PRINCIPLES OF AVALANCHE TRANSISTOR PULSE CIRCUITS, by D. J. Hamilton, J. Gibbons, and W. Shockley. Technical rept. no. 53 on Contract Nonr-225(24). 17 Feb 59, 22p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 144 811

A simple physical theory is developed which permits a calculation of the significant points of avalanche transistor transient behavior. A model for the transistor is defined in terms of charge variables and the physical parameters of the device. The transient performance of the model is calculated by focusing attention on the minority carrier charge stored in the base region and the influence of base-width modulation upon this stored charge. In the charge formulation of the problem the physical details of the avalanche multiplication process need not be considered; multiplication is accounted for by the boundary conditions which it imposes upon the stored charge. Good agreement has been obtained between calculated and experimentally observed data for a simple avalanche transistor relaxation oscillator. (Author)

Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF PRINTED CIRCUIT ECM ANTENNAS, by E. M. T. Jones. Final rept. for 1 Dec 55-15 Aug 58 on Contract AF 19(604)1571. July 58, 12p. AFCRC-TR-58-176; AD-160 817.
Order from LC mi$2.40, ph$3.30 PB 137 448

Summaries are given of studies in the following categories: novel types of printed circuit driving elements, wideband radiating structures, and modulated surface-wave antennas. Novel types of wideband driving circuits are being investigated which can be constructed by printed circuit techniques and have particular application to ECM antennas. These circuits included strip-line 3-db directional couplers, broadband 90° phase shifters, and wideband baluns. The studies of wideband radiating structures were concerned with flush-mounted leaky-wave antennas, printed-circuit zig-zag radiators, and dielectric-filled ECM-horn antennas.

[Stelma, Inc., Stamford, Conn.]
DEVELOPMENT AND CONSTRUCTION OF REPEATER, TELEGRAPH TH-18( )/FG, by L. M. Carver. Final rept. for 23 June 53-26 Jan 57 on Contract DA 36-039-sc-52675. [1957] 127p. AD-126 100.
Order from LC mi$6.30, ph$19.80 PB 145 193

The purpose of the contract is to develop a general purpose electronic regenerative repeater to correct dc teleprinter signal distortion and improve transmission on wire and radio circuits and to produce 13 service test repeaters after tests were performed on the first two prototypes. Specifications for the equipment are outlined in Technical Requirement SCL-1436. A breakdown of tasks in the job can be made generally following circuit sections of the equipment as follows: (A) Packaging; (B) Input circuits; (C) Timing circuits; (D) Synchronous circuits; (E) Sampling circuits; (F) Output circuits and (G) Power Supply circuits.

Technische Hochschule, Munich (West Germany).
WAVE PROPAGATION AND OSCILLATIONS IN PLASMA BODIES, by W. O. Schumann. Technical final rept. for 1 Apr 58-31 Mar 59 on Contract AF 61(052)79. [1959] 44p. 11 refs. AD-225 053.
Order from LC mi$3.30, ph$7.80 PB 145 170

The propagation of electromagnetic waves and appearances of oscillations in a coaxial cable, the inner conductor of which was a plasma, were investigated under the influence of an external longitudinal magnetic field and the results were compared with the theory. (Author)

Transitron Electronic Corp., Wakefield, Mass.
THE FABRICATION OF SILICON CARBIDE JUNCTIONS, by Karl M. Hergenrother. Scientific rept. no. 1 on Contract AF 19(604)4989. 5 Nov 59, 13p. AFCRC-TN-59-960.
Order from LC mi$2.40, ph$3.30 PB 144 974

It has been found possible to grow P-N junctions in silicon carbide by depositing a single crystal film from the vapor phase onto a silicon carbide seed. The junction is made by adding impurities to the ambient gas in the furnace during the crystal growth. These P-N junctions are suitable for fabricating diodes and other junction devices which will operate at 500°C and have relatively good resistance to high energy radiation.

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer, H. S. Weaver and others. Quarterly rept. no. 4, 1 Apr-30 June 58, on Contract DA 36-039-sc-73266. [1958] 33p. 8 refs. Engineering rept. no. 218-4Q.
Order from LC mi$3.00, ph$6.30 PB 145 232

Measurements have been completed on the new parabolic beam focuser. The results show that at a given power output the molecular flow rate is reduced by a factor of eight, and at maximum power output the power has been increased by a factor of 2.5. An experiment is described which conclusively shows

that paramagnetic resonance in $BaTiO_3$ is a volume rather than a surface effect.

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer, R. C. Rempel and others. Quarterly rept. no. 5, 1 July-30 Sep 58, on Contract DA 36-039-sc-73266. [1958] 43p. 23 refs. Engineering rept. no. 218-5Q.
Order from LC mi$3.30, ph$7.80 PB 145 233

Research in molecular beam masers has included the investigation of noise in quantum mechanical systems, the frequency-mixing properties of quantum mechanical systems, and the determination of methods for improving maser performance and reducing the threshold beam intensity required for oscillation. In the solid-state maser program, it has been shown that $SrTiO_3$ containing an Fe^{3+} impurity is a suitable material for a zero field, three-level maser. Methods have been developed for growing single crystals of $BaTiO_3$ and $SrTiO_3$. (See also PB 145 232)

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer and H. E. Weaver. Quarterly rept. no. 6, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-73266. [1958] 38p. 17 refs. Engineering rept. no. 218-6Q.
Order from LC mi$3.00, ph$6.30 PB 145 234

A summary of the dielectric properties of $SrTiO_3$ at low temperatures is included. Equations are set up for the design of molecular beam masers with prescribed characteristics. It is shown that it is necessary to compromise between molecular Q and power output. The problems of detecting oscillation are considered, and solutions are proposed for novel types of particle and photon detectors. (See also PB 145 233)

Westinghouse Electric Corp., Boston, Mass.
RESEARCH ON SILICON CARBIDE TRANSITORS. Scientific rept. no. 4, 15 Jan-15 July 59, on Contract AF 33(616)5592. [1959] 42p. 5 refs. AFCRC-TN-59-951.
Order from LC mi$3.30, ph$7.80 PB 144 975

Boron-tin-platinum alloy was found to be promising for forming p-n junctions in n-type silicon carbide. The rectification ratios for the fused junctions were higher for higher fusion temperature and greater temperature gradient normal to the regrowth layer.

Westinghouse Research Labs., Pittsburgh, Pa.
SYNTHESIS AND PURIFICATION OF DIELECTRIC MATERIALS, by T. W. Dakin, R. N. Wenzel and others. Rept. for 1 July 58-30 June 59 on Electrical and Electronic Materials, Contract AF 33(616)5979. Oct 59, 141p. 37 refs. WADC Technical rept. 59-337, Pt. 1.
Order from OTS $2.75 PB 161 366

This project seeks to improve the dielectric properties in inorganic insulating materials, for use at 500°C through rigorous exclusion of impurities. Results to date with boron nitride, alumina, silica and reconstituted mica are presented. Methods of synthesizing the pure materials and preparing test specimens without contamination are described. Dielectric measurements are reported over the temperature range 25° to 500°C and at frequencies 60, 10^3 and 10^5 cycles per sec. Boron nitride prepared from purified chemicals showed lower low frequency dissipation factors and higher resistances at 500°C than have heretofore been reported for any known material. With alumina, the high temperature dielectric properties of the best single crystal sapphire examined were equalled and somewhat surpassed. Little improvement could be effected, however, in reconstituted mica through purification by dialysis or electrodialysis. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
A CALIBRATED SHAKE TABLE FEATURING LINEAR AIR SPRING SUSPENSION, by James H. Prout, John W. Wescott, and William H. Follett. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Aug 58, 15p. 2 refs. Rept 2144-309-T.
Order from LC mi$2.40, ph$3.30 PB 145 120

In an electromechanical transducer designed especially for calibration of geophones wide frequency response is made possible by the use of feedback within the driver amplifier and over-all feedback from a sampling coil mounted on the moving platform. An adjustable "air spring" accommodates static loads up to 30 pounds. Integration of the shaker with a complete automatic calibration system is described. (Author)

Ordnance, Missiles, and Satellite Vehicles

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A STUDY OF THE SATELLITE EQUATIONS OF MOTION AND TRANSFER ORBITS, by Lynn E. Wolaver. Dec 58, 174p. 3 refs. WADC Technical note 58-378; AD-215 854.
Order from LC mi$8.10, ph$27.30 PB 144 858

The equations of motion are derived for a satellite moving about a spherical earth and subject to a direct or retro-grade impulse thrust. The cases of direct thrust to lengthen the apogee and retro-grade thrust to initiate re-entry into the earth's atmosphere are considered. Direct thrust values needed to obtain a given apogee are found and presented graphically. Thrust errors in magnitude and alignment angle are considered. For the retro-grade thrust at apogee, the re-entry velocity, re-entry angle, and re-entry distance from apogee are determined and shown graphically. The effects of thrust errors both in magnitude and misalignment angle, including the radial thrust case, are derived and shown in graphs. The same quantities are also found for the case of retro-grade thrust applied at perigee. The general transfer orbit case is considered. Given any initial elliptical orbit and a point on that in terms of its

angular distance from apogee, and given the thrust components to be applied at that point, then the re-entry velocity and re-entry angle may be found by a simple graphical solution. Use is made of relationships in the energy-angular momentum plane. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
SPACE PROBES AND PERSISTENCE OF STRONG TROPOPAUSE LEVEL WINDS, by H. Salmela and N. Sissenwine. Dec 59, 15p. 1 refs. GRD Research notes no. 26; AFCRC-TN-59-652.
Order from OTS $0.50 PB 161 431

When current military missiles are used as boosters of scientific space probes, additional components required for certain experiments will result in missile configurations which are more critical to strong tropospheric wind profiles than for the basic military missile. The persistence of certain critical tropopause-level Cape Canaveral-Patrick Air Force Base wind speeds is investigated. The probabilities of various durations are presented in tables. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
DETERMINATION OF RADIANT ENERGY REQUIREMENTS FOR PHOTOGRAPHIC SPACE VEHICLE TRACKING, by Thomas P. Rona. Nov 59, 19p. 3 refs. AFMDC-TN-59-31.
Order from LC mi$2.40, ph$3.30 PB 144 978

Photographic tracking, known to supply far better accuracy in angular resolution than conventional CW and pulsed microwave radar techniques, is not in widespread use for missiles and artificial satellites mainly because it lacks appropriate flash transponders. It is shown that the signal-to-noise ratio is, for optical tracking in clear atmosphere, at least equal to, but often superior to, radar communication; it is further shown that techniques for vehicle-borne flash sources are within the state of the art, and finally that star background reference can be made available for increased absolute accuracy. Daylight optical tracking is possible with optics of sufficient aperture. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
THEORETICAL ANALYSIS OF DOPPLER RADIO SIGNALS FROM EARTH SATELLITES, by William H. Guier and George C. Weiffenbach. Rept. on Contract NOrd-7386. Apr 58, 64p. 12 refs. Bumblebee series rept. no. 276; AD-162 756.
Order from LC mi$3.90, ph$10.80 PB 145 144

This report describes a method of determining the orbit of an artificial satellite from measurement of the Doppler shift of its radio signals.

Army Chemical Warfare Labs., Army Chemical Center, Md.
E15R1 COLORED-SMOKE GRENADE (FOR USE IN AIRBORNE OPERATIONS) by Woodrow W. Reaves and Kenneth G. Carlon. Sep 58, 40p. 1 ref. CWL Special pub. 1-5.
Order from LC mi$3.00, ph$6.30 PB 138 342

The object of the work described in this report was to develop a colored-smoke grenade suitable for use as a pathfinder aid in airborne operations.

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
ROCKET FLIGHT AND EARTH SATELLITE ORBITS, by James E. Norman. 1 July 58, 32p. 6 refs. Rept. no. 2R28p; AD-200 412.
Order from LC mi$3.00, ph$6.30 PB 145 618

The problem of rocket propulsion of an earth satellite into orbit is analyzed, utilizing Kepler's laws for description of orbital parameters. The motion of the rocket during powered flight is treated subject to certain simplifying assumptions, and final vehicle energy related to orbital energy. Examples of hypothetical satellite missions are given. (Author)

Avco Research Lab., Everett, Mass.
REDUCTION OF FLIGHT TIME AND PROPELLANT REQUIREMENTS OF STAELLITES WITH ELECTRIC PROPULSION BY THE USE OF STORED ELECTRICAL ENERGY, by Morton Camac. Rept. on Contract AF 49(638)61. Oct 58, 28p. 8 refs. Research rept. 36; AFOSR-TN-58-1013; AD-206 156.
Order from LC mi$2.70, ph$4.80 PB 138 439

This paper analyzes flight plans for satellites having a lower thrust than the local gravitational forces. The minimum impulse plan to go from a low circular orbit to a high altitude orbit is accomplished with the Hohmann transfer ellipse which requires two short impulses. It will be shown that electrical propulsion can also use impulse and still have a complete utilization of the available energy when energy storage is incorporated in the propulsion system. The extent to which this electrical storage is useful for reducing the flight time and propellant consumption is the subject of this paper.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPLOSION IN WIND TUNNEL AIR LINE, by T. L. Smith. Sep 59, 20p. 2 refs. Memo. rept. no. 1235.
Order from LC mi$2.40, ph$3.30 PB 144 901

On 10 February 1959 a pipe line carrying compressed air at 750 psi exploded in two places. The air had been contaminated with oil. This report covers the explosion, and some pertinent facts learned as a result of the ensuing investigation. Total damage will be about $250,000. (Author)

Directorate of Labs., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EFFECTS OF SMALL CHANGES IN POSITION AND VELOCITY AT BURNOUT ON THE ORBIT OF A BALLISTIC MISSILE, by Edouard E. Perret and John C. Corbin, Jr. Oct 59, 33p. WADC Technical note 59-336.
Order from OTS $1.00 PB 161 409

The effects of small changes in position and velocity at burnout on the orbit of a ballistic missile have been examined. It is shown that assumed spherical distributions of error in position or velocity at burnout propagate as error ellipsoids of position of increasing eccentricity with time. The results can be used to assess the accuracy required in establishing the position and velocity of the missile at burnout (1) to accomplish interception at various points on the orbit (defensive sense), or (2) to achieve a desired CEP at impact (offensive sense). In addition, the relative motion of closely spaced missiles and/or decoys having the same or slightly different velocities can be examined. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF TEST APPARATUS TO MEASURE SHOCK PROTECTION OFFERED BY PACKAGING TO MISSILE COMPONENTS, by George Zell. Aug 59, 9p. Final engineering rept. FR: 1-60.
Order from LC mi$1.80, ph$1.80 PB 144 737

The extremely high cost and shock sensitivity of complex missile system components necessitates elaborate and expensive protective packaging to eliminate damage from shocks sustained in transit. Since the shock response of components, containers and isolation systems is a function not only of shock magnitude, but also of the duration and waveshape of the shock, the laboratory shock apparatus must be capable of reproducing all three parameters as they occur in the environments. A survey of the shock simulation systems currently available indicated that the HYGE shock tester most closely met the performance criteria that had been established through extensive study of transportation shock data.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DYNAMIC TESTING OF CUSHIONING MATERIALS FOR PACKAGING, by Theodore Fruchtman and Samuel A. Gee. Final engineering rept. Aug 59, 6p. 1 ref. FR: 2-60.
Order from LC mi$1.80, ph$1.80 PB 145 152

This assignment is related to the general object of improving sensitive devices, by the consideration of packaging to protect the devices during transportation and handling. Specifically, cushioning material of various kinds and dimensions, were tested and information compiled for the determination of optimum efficiency and economy in reducing the shock below the breaking point or fragility factor of the item to be packaged. Resultant data were recorded and charted. Incidentally, improvements were made in the original test equipment specified for this work. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
GAS GENERATOR FOR THE E120 BOMBLET, by Arthur Graff. Dec 59, 29p. 2 refs. Technical rept. 2633.
Order from LC mi$2.70, ph$4.80 PB 145 151

An igniter composition and an intermediate composition were developed for ignition of the gas-generating propellant composition for use in the E120 bomblet. The igniter contains barium chromate (78.2%), zirconium (20.8%), and vinyl alcohol-acetate resin (1.0%). The intermediate is a 50/50 mixture of the igniter and the propellant. A one-piece molded plastic insulator cup was developed. A technique for loading the igniter, intermediate, and propellant compositions as a single increment was devised. A test fixture of the liquid pressurizer type was designed, fabricated, and used in testing the gas generator. Functioning characteristics of the gas generator in the test fixture were established. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
MALFUNCTION OF A TNT-LOADED 155 MM M101 HE SHELL AT THE PUEBLO ORDNANCE DEPOT, by Samuel D. Stein. Nov 58, 22p. 17 refs. Technical rept. 2585.
Order from LC mi$2.70, ph$4.80 PB 138 348

Frankford Arsenal, Philadelphia, Pa.
A THEORETICAL INTERIOR BALLISTIC STUDY OF RECOILLESS HIGH-LOW-PRESSURE GUNS, by D. J. Katsanis. June 59, 55p. 17 refs. Rept. R-1513.
Order from LC mi$3.60, ph$9.30 PB 144 977

The general theory of high-low-pressure recoilless guns is derived and discussed. Analytical solutions are obtained for the high-pressure section; performance stability is evaluated for tubular and cord shaped propellant grains with a linear burning rate and for tubular grains with a plateau type burning rate.

General Electric Co., Schenectady, N. Y.
COMPLETE MISSILE: - NORMAL FORCE COEFFICIENTS AND CENTER OF PRESSURE, by Otto Klima, Jr. and Margaret M. Iavelle. 28 Oct 52, declassified, 4p. Hermes A-3B Aero Data memo. no. 14B.
Order from LC mi$1.80, ph$1.80 PB 145 080

In addition to the slightly revised curves here recommended for the chosen fin size (58" root chord) all available test points are also shown. The tests were made, however, only for models representing 50" and 60" fullscale fins.

[General Electric Co., Schenectady, N. Y.]
EFFECT OF LARGE PITCH ANGLES ON STATIC STABILITY IN YAW FOR SMALL YAW ANGLES, by Otto Klima, Jr. and Helen C. Engvold. 27 Oct 52, declassified. 5p. Hermes A-3B Aerodynamic data memo. 14C.
Order from LC mi$1.80, ph$1.80 PB 144 888

Results of wind-tunnel tests recently conducted at

Aberdeen at M = 3.80 and 2.47 to determine the effect of large angles of attack (in pitch) on the center of pressure in the yaw plane, for small yaw angles, are presented.

General Electric Co., Schenectady, N. Y.
FORCE AND BENDING MOMENT IN PLANE OF FIN, by R. B. Chamberlin. 5 Feb 54, declassified. 1p. 2 refs. Hermes A-3B Aerodynamic data memo. no. 11F.
Order from LC mi$1.80, ph$1.80 PB 145 081

This memorandum supplements the other memorandums in this series. The maximum and nominal forces and bending moments on one fin are presented for power-on and power-off flight. The force vector is contained in the plane of the fin and also in a plane which is perpendicular to the plane of the fin and is parallel to the body axis. The bending moment is in the plane of the fin and is measured about the intersection of the hinge line and the body skin. These data are pertinent to a test of a fin actuator under flight conditions.

General Electric Co., Schenectady, N. Y.
MAXIMUM TAIL LOADS DURING POWERED FLIGHT, by R. B. Chamberlin. 31 Dec 53, declassified. 1p. 4 refs. Hermes A-3B Aerodynamic data memo. no. 11E.
Order from LC mi$1.80, ph$1.80 PB 145 082

The maximum load (including tolerances stated below) normal to the missile axis on one fin is 5250 pounds for A-3B missiles having command guidance equipment with a maximum output as specified in reference 1 and launched under fair weather conditions at White Sands Proving Grounds.

Metallurgical Research Labs., Syracuse U. Research Inst., N. Y.
COMPOSITE MATERIALS AND COMPOSITE STRUCTURES: PROCEEDINGS OF THE SAGAMORE ORDNANCE MATERIALS RESEARCH CONFERENCE [NO. 6] AT SAGAMORE CONFERENCE CENTER, RAQUETTE LAKE, NEW YORK, AUGUST 18, 19, 20, 21, 1959. Rept. on Contract DA 30-069-ORD-2566. [1959] 561p. 78 refs. MET661-601.
Order from OTS $7.00 PB 161 443

Contents:
Composite materials and structures, present and future
Aspects of strengthening of composites
Metallic composites
Glass reinforced plastics
Composite pressure vessels
Composite systems for thermal protection

Naval Avionics Facility, Indianapolis, Ind.
STATISTICAL METHODS IN AIRBORNE FIRE CONTROL THEORY. ERROR STUDIES, by Melvin D. Springer. 8 Apr 57, 66p. 3 refs. NAFI-TP-15; AD-129 382.
Order from LC mi$3.90, ph$10.80 PB 144 663

A study is made of mechanization and input errors which arise in connection with a fire-control system. Two methods of evaluating mechanization error are explained: (1) the errors which occur when each component unit alone is malfunctioning are calculated and then combined statistically to determine a confidence interval for the system output error which applies when all component units are malfunctioning simultaneously; and (2) the component errors are considered simultaneously and the resultant error in the output of the system is evaluated by calculating a total differential. The procedures involve static or dynamic methods of error analysis, respectively. The errors in the system output caused by input errors are also analyzed by these methods. If the combined effect of mechanization error and input error are analyzed, the methods may be employed provided the 2 types of errors are mutually independent.

Naval Ordnance Lab., Corona, Calif.
THE NOLC ROCKET SLED AS A SUPERSONIC ENVIRONMENT SIMULATOR, by D. E. Rowe, J. L. Day, and L. H. Witbeck. 27 Aug 59, 32p. 5 refs. NAVORD rept. 5967; NOLC rept. 468.
Order from LC mi$3.00, ph$6.30 PB 144 988

The NOLC Rocket Sled was designed and built by the Naval Ordnance Laboratory Corona as a research test vehicle for use on the Supersonic Naval Ordnance Research Track (SNORT) at the Naval Ordnance Test Station, China Lake, Calif. It provides NOLC with a reliable means for the supersonic environment testing of guided missile components and ordnance items during their development and evaluation stages. It is believed that the design ideas incorporated in the sled can be adapted to the needs of other activities interested in building test vehicles for similar purposes. (Author)

Naval Weapons Lab., Dahlgren, Va.
WATER IMPACT TESTS OF THE MOD 6 AND MOD 7 DATA CAPSULE, FINAL REPORT, by D. W. Culbertson. Final rept. 4 Nov 59, 83p. 8 refs. NWL rept. no. 1681.
Order from LC mi$4.80, ph$13.80 PB 144 983

The Mod 6 and Mod 7 Data Capsule and its payload will reliably survive water impact at terminal velocities of 450 ft/sec when impacted within the spherical sector defined respectively for the Mod 6 by a 16.9" and for the Mod 7 by a 18" diameter circle on the lower hemisphere of the capsule. Separation and breakaway of the shell fragments do not occur until after complete penetration by the capsule. (Author)

Springfield Armory, Mass.
COMPARATIVE EVALUATION OF CHROMIUM PLATED M14 RIFLE BARRELS FABRICATED FROM CHROME-MOLY-VANADIUM STEEL AND ORD 4150 RESULPHURIZED STEEL, MIL-S-11595(ORD), by T. P. Jones, S. D. Caloccia and others. 3 Aug 59, 88p. SA-TR11-2621.
Order from LC mi$4.80, ph$13.80 PB 144 924

Results of erosion tests, and standard and accelerated firing tests for both materials were satisfactory. Bore damage for both materials was nearly equal. In view of known potential savings, use of ORD 4150 resulphurized steel is recommended.

Sanitation and Safety Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
HABITABILITY OF A DIFFUSION-TYPE PROTECTIVE SHELTER IN SUMMER WEATHER (KIT, CONVERSION, MEDIUM G. P. TENT, PROTECTIVE SHELTER, E21) by F. N. Craig and P. J. Edgar. Aug 59, 29p. 18 refs. CWLR-2300.
Order from LC mi$2.70, ph$4.80 PB 144 683

The E21 protective shelter kit provides an assembly for a protective shelter within a tent to permit 10 to 12 men to function without personal protective equipment during a CBR attack. A physiological assessment of the shelter is described. The method involved placing 12 subjects within the shelter for 7 to 8 hours on 2 days and 3 subjects for the same period on one other day. Oral temperatures and pulse rates were taken periodically as indices of thermal stress. Environmental data included analysis of CO_2 and O_2 concentration of the shelter air, air temperatures, relative humidities, wet-bulb-globe temperature indices, and wind velocities. The usefulness of the shelter appears to be limited in hot weather due to an interference with the loss of body heat from the men. (Author)

Bureau of Yards and Docks, Washington, D. C.
SEWERAGE SYSTEMS. 1 May 54, 133p. Technical pub. NAVDOCKS TP-PW-15; BUDOCKSINST 11345.2.
Order from LC mi$6.90, ph$21.30 PB 145 542

This publication provides guidance to Bureau and field personnel concerned with the planning, design, construction, maintenance, and operation of sewerage systems and appurtenant facilities for the collection, transportation, treatment, and disposal of sewage at naval shore activities. Part A delineates the general authority under which the Bureau of Yards and Docks is delegated administrative and operational responsibilities for sewerage systems. It also presents the policies, standards, and responsibilities of this Bureau in performing its mission, as well as operational policies and procedures and a list of definitions and abbreviations. Part B deals with design and construction criteria for sewerage systems and includes an analysis of sewage quantity and characteristics, collection systems, pumping facilities, treatment and disposal methods and equipment, and safety measures. Part C covers maintenance and operation procedures for collection systems, pumping facilities, and treatment and disposal systems. Emphasis is placed on gas-handling and backflow-prevention devices, personnel safety measures, stream pollution supervision and laboratory test procedures. Appendix A contains a report on the hazards of production and use of sludge gas. Appendix B contains further information on the responsibilities of the District Public Works Officer for sanitation control. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
NUCLEAR RADIATION SHIELDING PROVIDED BY BURIED SHELTERS, by J. C. LeDoux. Interim rept. 27 Oct 59, 76p. 17 refs. Technical rept. 025.
Order from LC mi$4.50, ph$12.30 PB 145 155

This report presents methods of calculating the attenuation of initial gamma, initial neutron, and residual gamma radiation incident upon buried shelters from fission-type weapons. Attenuation curves are presented which account for variation in the moisture content and density of the soil cover. The effect of the various energy spectra for each type of radiation has been considered. Three types of shelter configurations have been investigated: the rectangular or slab, the hemisphere, and the arch. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
PROTOTYPE 250-POUNDS-PER-HOUR ADVANCED BASE INCINERATOR, by K. B. Edwards and E. C. Morales. Final rept. 2 Dec 59, 27p. 4 refs. Technical rept. 053.
Order from LC mi$2.70, ph$4.80 PB 145 159

A prototype, 250-pounds-per-hour incinerator was developed for garbage-and waste-burning at Advanced Bases. It is rugged, portable, easily erected, and designed to be manufactured as a factory prefabricated kit including bagged powdered refractory for monolithic casting in the field. To determine the adequacy of the design, a kit was purchased, erected, and tested. This report gives the results of erection and performance tests of the prototype incinerator. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
PERFORMANCE SPECIFICATIONS FOR A SOUND NATIONAL SHELTER SYSTEM, by W. E. Strope. 13 Feb 57, 27p. 5 refs. Research and Development Technical rept. USNRDL-TR-132; AD-207 928.
Order from LC mi$2.70, ph$4.80 PB 144 696

The urgent need for a national shelter program because of the advance of megaton nuclear weapons and guided missile delivery systems is pointed out. Conclusions, based on five years of military atomic defense studies are presented regarding shelter performance specifications and estimated cost for a sound and feasible national shelter program. Utilizing three classes of shelter, the program is designed to provide adequate protection to the nation's population against the effects of fallout radiation, air blast, heat, and fire resulting from land-surface detonations of megaton weapons. Basic criteria used for establishing the shelter classes are ranges of weapon effects, building density, and population density. The classes of shelter are: Class I – fallout, 10-psi air blast; Class II- fallout, 10-psi air blast, mass fires; Class IIIa fallout, 25-psi air blast, mass fires; and Class IIIb–fallout, 100-psi air blast,

mass fires. The interior arrangement and equipment of a typical shelter are illustrated. Estimated shelter construction costs per person range from about $30 to about $300 depending on shelter class, resulting in an estimated total construction cost for the national shelter system of about $15 to 20 billion. Additional costs for the total program would include those for development and engineering, land acquisition, and shelter equipment; but it is explained how these costs could be minimized. Feasibility of the program is discussed, together with modified programs that would take advantage of using existing construction and of integrating shelter construction into other construction programs. (Author)

New York U. Coll. of Engineering, N. Y.
THERMAL ENERGY EXCHANGE WITH SPECIFIC APPLICATION TO WASTE HANDLING IN A CLOSED ECOLOGICAL SYSTEM, by Lawrence Slote. Progress rept. on The Engineering Biotechnology of Handling Wastes Resulting from a Closed Ecological System, Contract AF 18(603)71. July 57, 8p. 5 refs. AFOSR-TN-58-268; AD-154 169.
Order from LC mi$1.80, ph$1.80 PB 137 795

The analysis attempts to show the variation in the total surface temperature of a perfect heat conducting or spinning biosatellite for a given orbit and for various conditions of irradiation. As the thermal capacity of the satellite is reduced a temperature distribution is obtained about the surface of the sphere. Therefore, it becomes evident that various temperatures can be obtained depending upon the geometry, surface and trajectory of the biosatellite. With this in mind, it seems feasible to use thermal energy sources in connection with processes for cracking of human waste and for the purification of urine by freezing, if these processes are used.

Ship Building

Bureau of Yards and Docks, Washington, D. C.
MOORING GUIDE. VOLUME 1. 1 Mar 54, 342p. 13 refs. Technical Pub. NAVDOCKS TP-Pw-2
Order from LC mi$11.10, ph$53.10 PB 145 540

This publication provides guidance to Bureau and field personnel concerned with determining the most practicable method of mooring vessels at a given site, either singly or in groups, and with effecting the planning, design, assembly, placement, inspection, repair, and maintenance of the Navy's permanent or temporary mooring facilities. Part A presents this Bureau's authority, policy, and responsibilities for providing the Navy's mooring facilities and defines related terms. Part B describes the various types of mooring devices and related equipment, including mooring buoys and anchors. Part C provides information on the design of mooring of various types. Part D covers the operation and care of all types of Fleet moorings, including inspection and maintenance of camels, fender piles, and dolphins, also the placement and recovery of moorings.

Bureau of Yards and Docks, Washington, D. C.
MOORING GUIDE. VOLUME 2. DRAWINGS. 12 Feb 57, supersedes 1 May 54, 68p. 3 refs. Technical Pub. NAVDOCKS TP-Pw-2; BUDOCKSINST 11153.2A, supersedes BUDOCKSINST 11153.2.
Order from LC mi$3.90, ph$10.80 PB 145 541

See PB 145 540

David Taylor Model Basin, Washington, D. C.
A CONTROL-SURFACE FLUTTER STUDY IN THE FIELD OF NAVAL ARCHITECTURE, by R. T. McGoldrick and D. A. Jewell. Sep 59, 47p. 25 refs. Rept. 1222; AD-226 588.
Order from LC mi$3.30, ph$7.80 PB 144 856

This study of control-surface flutter was initiated because of serious hull vibration on destroyers of the DD 931 Class. The source of the vibration had been traced to the twin rudders by the Boston Naval Shipyard. For making experimental observations on control-surface flutter phenomena in the towing basin, the David Taylor Model Basin constructed the TMB Control-Surface Flutter Apparatus. With this equipment, a marked decrease in overall damping was demonstrated when the downstream mass unbalance was increased during underway tests. A condition in which hydrofoil oscillatory motion results in low damping without oscillatory instability is defined as "subcritical flutter." Such a condition, which greatly magnifies the sensitivity of the mechanical system to external sources of vibration, may be quite significant in the field of naval architecture. Analyses varying in complexity are explored and compared with experimental results. (Author)

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
PRELIMINARY EVALUATION OF A SEMI-SUBMERGED SHIP FOR HIGH-SPEED OPERATION IN ROUGH SEAS, by Edward V. Lewis and Clayton Odenbrett. Rept. on Contract Nonr-263(10). Mar 59, 21p. 6 refs. Rept. no. 736.
Order from LC mi$2.70, ph$4.80 PB 144 647

This report describes the evaluation by means of model tests of an unusual hull form intended for high-speed operation in rough seas. The form can be described as a surfaced submarine, made longer and more slender in order to attain high calm-water speed A long natural pitching period is obtained by fine, hollow waterline endings and use of large peak ballast tanks for rough water operation. It was considered best not to attempt to keep water off the deck, and therefore comparatively low freeboard and tumblehome were adopted. Tests in regular head seas of model length and twice model length confirmed the expectation that at high speeds the semi-submerged ship could exceed the speeds at which the peaks of synchronous pitching and heaving motions occur. Consequently, in irregular head seas corresponding to a storm of Beaufort force 6, motions decreased as speed increased. Heaving was more pronounced than pitching, but accelerations were not prohibitively high even at a speed of 40 knots. It is concluded that a semi-submerged ship of the type tested shows promise of attaining much higher rough-water speeds than conventional destroyers, provided sufficient power can be installed.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. III: THE EVALUATION OF PEMMICAN UNDER WINTER FIELD CONDITIONS, by Horace F. Drury, David A. Vaughan, and John P. Hannon. Jan 59, 37p. 24 refs. Technical rept. 58-6.
Order from LC mi$3.00, ph$6.30 PB 144 832

Pemmican, a dehydrated high-fat, high-protein, carbohydrate-free meat preparation was fed, with and without an isocaloric supplement of sugar, to 10 human subjects undergoing simulated survival in a severely cold environment for 9 days. No ill effects were noted that could not be attributed to caloric restriction, and the performance of the subjects was considered adequate for survival situations involving moderate activity. An isocaloric supplement of 40 grams of sugar increased the fasting blood-sugar levels, decreased the nitrogen balance, and decreased the excretion of ketones. During the 3 days following initiation of the dietary regimen, fasting blood-sugar levels and daily nitrogen balances fell precipitately, while ketone excretion rose. After this, however, the blood-sugar levels rose somewhat and leveled off, the nitrogen balance increased appreciably, and excretion of ketones fell gradually to quite low levels irrespective of the isocaloric supplement of sugar. These results have been interpreted to mean that the subjects were becoming adapted to the combination of pemmican and restricted caloric intake. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. VII: ALTERATIONS IN SERUM ELECTROLYTES DURING WINTER FIELD TESTS OF SURVIVAL RATIONS, by John P. Hannon, Anna F. Larson and others. Sep 59, 11p. 8 refs. Technical rept. 58-25.
Order from LC mi$2.40, ph$3.30 PB 144 842

The levels of plasma sodium, potassium, calcium, magnesium, chloride, and phosphate, as well as blood hemoglobin and packed cell volume, were determined before and during simulated arctic winter survival. During the 5-day semi-starvation survival situation the following blood changes were noted: (a) an increase in magnesium and a decrease in calcium after the first day with subsequent return toward normal levels over the next 3 or 4 days; (b) a progressive decline in plasma phosphate during the first 4 days; (c) slight decreases in sodium, chloride, hemoglobin, and packed cell volume; (d) no significant change in plasma potassium. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE DISTRIBUTION IN ALASKA OF PLANT AND ANIMAL LIFE AVAILABLE FOR SURVIVAL, by John L. Buckley and Wilbur L. Libby (U. of Alaska). May 59, 47p. 8 refs. Technical rept. 58-10; AD-220 762.
Order from LC mi$3.30, ph$7.80 PB 144 846

This project was undertaken to determine the abundance of native foods, both plant and animal, available for survival in the Alaskan subarctic. In general, forest types produce the greatest amounts of edible materials; however, no single type is as productive as the ecotone between types. The supply of wild foods available fluctuates seasonally and between years. In good years, especially during late summer, native foods would probably be sufficient to prevent starvation in a well-trained individual. In poor years the chances of finding adequate foods would be greatly reduced. Recommendations for equipment for procuring native foods are given. (Author)

Army Medical Research and Nutrition Lab., Denver, Colo.
THE EFFECT OF HIGH TEMPERATURE STORAGE ON THE ACCEPTABILITY, DIGESTIBILITY AND COMPOSITION OF THE U. S. ARMY RATION, INDIVIDUAL, COMBAT, by Irvin C. Plough, Richard S. Harding and others. Final rept. on Metabolism and Nutrition. 22 Oct 58, 45p. 34 refs. Rept. no. 228.
Order from LC mi$3.30, ph$7.80 PB 138 597

Two groups of C rations, both from the same procurement in 1954, were obtained from the Quartermaster Food and Container Institute. One group had been stored at 100°F., and the other at 34°F., for 20 months. Analysis showed that storage had caused no changes in nutrient composition, except for considerable losses of thiamine and of vitamin B_6. These changes were more marked in the rations stored at high temperature. These two rations were fed to nine test subjects in comparison with a diet of approximately the same composition made up of fresh foods. The C rations, particularly those stored at high temperature, evoked a number of mild symptoms, but these were doubtless of psychological origin. The protein and carbohydrate of the C ration were less digestible than were the nutrients in the fresh ration. High temperature storage further reduced the digestibility. The C ration stored at high temperature produced evidence of vitamin B_6 deficiency manifested by increased net excretion of xanthurenic acid, in response to a tryptophane load.

Quartermaster Food and Container Inst. for the Armed Forces, Chicago, Ill.
INVESTIGATION OF THE USE OF MONOSODIUM GLUTAMATE IN COMMERCIAL PRODUCTION OF PRECOOKED MEALS, by Mary B. Brown. Interim rept. no. 2, Dec 57, 6p. QMFCI rept. no. 42-57; AD-154 839.
Order from LC mi$1.80, ph$1.80 PB 144 880

This study reports the results of sensory evaluations of eight different precooked frozen meals and two casseroles prepared with and without monosodium glutamate after storage at -20° F., 0° F., and at fluctuating temperatures. Monosodium glutamate improved the acceptance of all food items with the exception of the chicken items and tenderloin steak with mushroom sauce. The lack of improvement in acceptance of these two items may be attributed to the high concentration of MSG used. (Author)

Quartermaster Food and Container Inst. for the Armed Forces, Chicago, Ill.
THE STABILITY OF VITAMIN-FORTIFIED DEHYDRATED SOUPS, by Mariam H. Thomas. Interim rept. on Simplified Food Logistics. Aug 58, 19p. 7 refs. QMFCI rept. no. 21-58.
Order from LC mi$2.40, ph$3.30 PB 144 881

Dehydrated cream of onion and cream of potato soups fortified with thiamine, ascorbic acid, and vitamin A palmitate have been evaluated after storage. Samples were packed in rigid and flexible containers for storage at 70° and 100°F. Analyses for palatability and vitamin content were made initially and after storage for six, twelve, and twenty-four months. There was evidence of flavor deterioration during storage. However, there was no significant difference in palatability ratings for fortified and unfortified samples throughout storage. Samples stored in cans were preferred to those stored in packages. In general, better vitamin retention was obtained in dehydrated soup which was canned and stored at 70°F.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Aerophysics Development Corp., Santa Barbara, Calif.
NON-STATIONARY COMBUSTION STUDIES, by D. Bitondo and D. Perper. Rept. on Contract AF 18(600)1509. Aug 58, 51p. 11 refs. Aerophysics TR 58-98; AFOSR-TR-58-144; AD-204 734.
Order from LC mi$3.60, ph$9.30 PB 137 951

A study of gaseous fuel ignition in transient flow by means of a "heated wall" mounted in the test section of a shock tube is the subject of this report. The process was followed photographically by means of schlieren apparatus and a high speed Fastax movie camera. Pressure in the test section and in the immediate vicinity was followed by means of high frequency pressure recorders.

Douglas Aircraft Co., Inc., El Segundo, Calif.
INVESTIGATION OF THE EFFECTIVENESS OF A WINDMILL ON IMPROVING FLOW UNIFORMITY IN A DUCT, by J. S. Murphy and D. W. Clutter. Rept. on Contract NOa(s) 54-321. 8 Oct 57, 103p. 4 refs. Rept. no. ES-26393; AD-161 446.
Order from LC mi$5.70, ph$16.80 PB 145 206

Tests have been made to determine the effectiveness of a freely rotating windmill in smoothing out nonuniform duct flow. The action of the windmill is to transfer total head from high-speed regions to low-speed regions. The design of a windmill and the forces on a windmill due to changes in wind speed are discussed. The experimental results show the effect of blade angle and number of blades on the windmill's effectiveness in smoothing out a wide variety of disturbance profiles, both circumferential and radial.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ELECTRON TEMPERATURE DEPENDENCE OF THE RECOMBINATION COEFFICIENT IN PURE HELIUM, by C. L. Chen, C. C. Leiby, and L. G. Goldstein. Scientific rept. no. 7 on Contract AF 19(604)2152. 1 Sep 59, 158p. 45 refs. AFCRC-TN-59-597.
Order from LC mi$7.50, ph$24.30 PB 144 961

Recombination of oppositely charged particles of a helium gas discharge plasma is studied in this work. Attention has been focused especially on investigating the law governing the variation with electron temperature of the recombination coefficient, characterizing the process of recombination of free electrons with positive ions in decaying plasmas produced in pure helium. A better treatment to the guided wave propagation in a waveguide filled with ionized gases has been given, which is believed to give more accurate determination of the fundamental parameters in a gaseous discharge plasma confined in the geometry used. In the determination of the electron temperature, correction due to thermal conduction has also been included in an approximate way.

Fairchild Guided Missiles Div., Fairchild Engine and Aircraft Corp., Wyandanch, N. Y.
FIBERGLASS CONTAINERS FOR J-57 ENGINE, by Harry E. Kellar (Materials Lab.) Rept. for June 56-May 58 on Finishes and Materials Preservation, Contract AF 01(608)832. Feb 59, 74p. 10 refs. WADC Technical rept. 58-268; AD-209 911.
Order from LC mi$4.50, ph$12.30 PB 144 991

Twenty fiberglass containers were manufactured for the Air Force to serve as shipping containers for the J-57 jet aircraft engine. The application of fiberglass for this purpose has proved successful with the exception of a liner sealing problem. The fiberglass container assembly weighs approximately 50% less than its metal counterpart, and testing has proved it to be rugged enough to withstand the rough handling it may receive in shipment. The container consists of two shells, upper and lower, with the basic construction utilizing plies of bidirectional roving fabric impregnated with polyester resin. The sealing liner is made of rigid vinyl, thermoplastically drawn under vacuum into the shells. Provisions have been incorporated for fork lift, cable hoisting, rollover and stacking of the containers three high while in storage. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMODYNAMIC PROPERTIES AND CALCULATED ROCKET PERFORMANCE OF HYDROGEN AT 20,000°K, by David Altman. Rept. on Contract DA 04-495-ORD-18. 3 Sep 56, 32p. 12 refs. Rept. no. 20-106.
Order from LC mi$3.00, ph$6.30 PB 144 761

A tabulation is made of the equilibrium thermodynamic properties of hydrogen between 300 and 20,000°K. Consideration is given to molecular dissociation, atomic excitation, and ionization. The data are presented in Mollier charts, for the purpose of simplifying rocket performance calculations. Tables are presented which list the specific-impulse and power values required to develop a given thrust at a specified chamber temperature. A tabulation is also given of the loading factors required for escape from the earth by a hydrogen missile operating at various temperatures. (Author)

Koppers Co., Inc. [Pittsburgh, Pa.]
EVALUATION OF DESIGNS AND MATERIALS FOR HIGH SPEED-HIGH TEMPERATURE SHAFT SEALS FOR TURBOJET ENGINE APPLICATIONS, by John J. Brenza, John H. Fuchsluger and others. Rept. on Gas Turbine Technology, Contract AF 33(616)5015. 31 Dec 58, 110p. 5 refs. WADC-Technical rept. 56-267, Pt. 2; AD-219 109.
Order from OTS $2.50 PB 151 915

The demand for higher performance aircraft engines has resulted in increase in engine operating temperatures and pressures. In turn, this has necessitated the adoption of new shaft seal materials and refinement in shaft seal design. This development program was undertaken to develop rubbing seals that would operate for 1000 hours, at 1000°F, and at a rubbing speed of 30,000 feet per minute. Accordingly new materials were investigated; these materials were incorporated in seals; and their performance as seals was evaluated. In all, one hundred and sixty-three materials were screened on the basis of room temperature and 1000°F, dry, rubbing, wear tests and 1000-hour, 1000°F oxidation tests. Material combinations found to be promising were next evaluated as seals under increased operating conditions, and eventually under conditions duplicating those existing in a jet engine. (Author) (See also PB 121 992)

Massachusetts Inst. of Tech. [Cambridge].
OPTIMIZATION OF SPACE VEHICLE DESIGN WITH RESPECT TO PROPULSION SYSTEM, by Paul E. Sandorff. Rept. on Contract AF 49(638)363. 1 July 58, 11p. 6 refs. AFOSR-TN-58-580; AD-158 402.
Order from LC mi$2.40, ph$3.30 PB 137 861

A mathematical analysis was made of propulsion systems necessary to move a desired useful payload to a given destination in as feasible and as efficient a manner as possible. The specific impulse to the most significant factor is the performance of the propulsion system of contemporary chemical rockets. Optimum specific impulse was shown to depend on the particular duty for which the engine was designed. Typical characteristics for various types of reaction engines as they are currently conceived are presented.

Pennsylvania State U. Coll. of Engineering and Architecture, University Park.
THE FILM VAPORIZATION PRINCIPLE FOR GAS TURBINE COMBUSTORS, by Gunter W. Maybach. Final rept. on Contract Nonr-656(13). Mar 59, 46p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 145 212

A new combustion principle for gas turbine engines is developed that inherently reduces the formation of smoke and of carbon deposits inside combustion chambers, and should permit more compact combustor designs without increasing the pressure loss across the combustors. The new combustion principle is based on the vaporization of the fuel from a liquid film spread along the inner wall surface of a cylindrical combustor section. Several problems relating to the mixture formation and combustion mechanisms of the new principle were treated. A research prototype combustor incorporating the film vaporization principle was built and its operational characteristics determined. (See also PB 144 371)

Picatinny Arsenal, Dover, N. J.
SUITABILITY OF CARBON BLACK PRODUCED BY THE OIL FURNACE PROCESS FOR USE IN ROCKET PROPELLANTS, by J. S. Merten. Dec 58, 43p. 8 refs. Technical rept. DB-TR: 16-58.
Order from LC mi$3.30, ph$7.80 PB 138 357

Commercial furnace blacks adversely affect the stability of M7 propellants and therefore were not suitable for M7 propellant manufacture. The poor stabilities obtained with the M7 propellant using the furnace blacks cast doubt on the use of these blacks for the manufacture of M16, T16, and T19 compositions. Further study of furnace blacks is unwarranted because the very small mobilization requirements for carbon black should be readily available from commercial sources.

Plasmadyne Corp., Santa Ana, Calif.
EQUILIBRIUM THERMODYNAMIC PROPERTIES OF HELIUM TO 60,000°K, by Gordon L. Cann and Adriano C. Ducati. Technical note no. 4 on Contract AF 49(638)54. 18 June 59, 90p. 4 refs. P-4TN069-54; AFOSR-TN-59-633; AD-228 710.
Order from LC mi$4.80, ph$13.80 PB 144 864

Helium was considered as a possible propellant for a plasma propulsion system because of its low molecular weight. To obtain reasonable exhaust velocities (greater than 10,000 m/sec.) it is necessary to heat the gas to temperatures at which an appreciable percent ionization occurs. In order to assess the potentially available exhaust velocities when ionization is

present, it is necessary to have a Mollier chart to determine isentropic expansions, hence the thermodynamic properties of helium were computed over a temperature range of 6000-60, 000°K and a pressure range of 10^{-4} -10^{-2} atm. A Mollier chart was constructed from this data. (Author)

Plasmadyne Corp., Santa Ana, Calif.
RESEARCH ON HIGH INTENSITY IONIC JETS, by Gordon L. Cann and Adriano C. Ducati. Final technical rept. on Contract AF 49(638)54. 5 Nov 59, 30p. 7 refs. P-FR109-54; AFOSR-[TR]-59-167.
Order from LC mi$2.70, ph$4.80 PB 144 907

The various steps that have been completed in the development of a practical plasma jet propulsion unit are outlined and detailed references to the work made. The steps that still need to be completed before a prototype unit can be constructed are indicated. (Author)

Space Research Labs., Litton Industries, Beverly Hills, Calif.
RESEARCH STUDY ON PLASMA ACCELERATION, by G. Fonda-Bonardi. Final rept. for 1 Mar 58-30 Sep 59 on Contract AF 49(638)345. 30 Sep 59, 76p. 207 refs. AFOSR-TR-59-170.
Order from LC mi$4.50, ph$12.30 PB 144 906

This report contains a summary of the principles of operation, design criteria, construction details and instrumentation of a pulsed plasma accelerator. The purpose of the project was twofold: to provide verification of the theory previously developed, and to supply engineering information and design data for further applications of the principles involved. A bibliography on pertinent magnetohydrodynamics research and related subjects is appended.

Manufacturing Equipment and Processes

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RAPID LOADING OF ALUMINUM ALLOY RIVETED JOINTS, by Robert T. Ault. Rept. for Nov 58-June 59 on Materials Analysis and Evaluation Techniques. Dec 59, 23p. 3 refs. WADC Technical rept. 59-433.
Order from OTS $0.75 PB 161 434

Slow and rapid loading tensile shear tests were conducted at room temperature to determine the failure strength of multiple riveted lap and butt joints. Both concentric and eccentric loading conditions were used. The time to failure for the rapid loading tests ranged from 0.02 to 0.08 seconds. All failures were by rivet shear. The results indicate that for both eccentric and concentric loading conditions, rapid loading has no significant effect on the strength of the joint. (Author)

Metcut Research Associates, Cincinnati, Ohio.
MACHINING CHARACTERISTICS OF HIGH STRENGTH THERMAL RESISTANT MATERIALS, by Leonard J. Nowikowski. Interim Engineering rept. no. 6, Phase II, 1 Apr-10 July 59, on Contract AF 33(600)35967. 14 Aug 59, 424p. Wright Aeronautical Serial rept. no. MP. 00-192; AD-220 540.
Order from OTS $6.00 PB 161 369

A study of the machining characteristics in turning, milling, drilling, and tapping on twenty-five high strength, thermal resistant alloys. The data is presented in graphical form to show the relationships between tool life, cutting speed, feed, tool geometry, tool material and cutting fluids. Cutting and thrust force measurements, average power requirements, coefficient of friction for the turning operation and thrust force and torque measurements were made for drilling. The data for these tests is shown in graphical form to show the torque and thrust requirements for drilling these materials for various machine conditions. The average power required for drilling these materials was computed. Grinding characteristics for six alloys show the effect of wheel speed, table speed, cross feed, down feed, wheel grade, and grinding fluid on wheel wear and surface finish. Grinding and face milling tests on three materials show workpiece distortion and residual stress as a function of machine variables. (See also PB 140 798)

Metcut Research Associates, Inc., Cincinnati, Ohio.
MACHINING CHARACTERISTICS OF HIGH STRENGTH THERMAL RESISTANT MATERIALS. PHASE III. MACHINE TOOL REQUIREMENTS, by Leonard J. Nowikowski. Rept. for 2 Sep-18 Dec 59 on Subcontract to Contract AF 33(600)35967. 18 Dec 59, 55p. Wright Aeronautical serial rept. no. MP. 00-204.
Order from LC mi$3.60, ph$9.30 PB 145 016

Machine tool requirements were established for machining the high strength thermal resistant alloys. The required range of speeds, feeds and power in turning, milling, drilling, tapping and grinding are listed in tables for each alloy group. Several recent developments in machine tools designed specifically for machining the high strength thermal resistant alloys are also described.

Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF ELECTROPOLISHING AS A TECHNIQUE FOR PRODUCING TAPERED WIRE, Technical note no. 1, 1 May-15 Sep 59, on Contract AF 08(635)391. Nov 59, 35p. 6 refs. APGC-TN-59-59.
Order from LC mi$3.00, ph$6.30 PB 144 573

Tests were run on carbon steel music wire and Type 302 stainless steel wire to determine what loss in unit strength would result from electropolishing 0.050- and 0.033-inch diameter wire down to 0.020 inch. The purpose was to discover whether electropolishing might be a feasible method of manufacturing a continuously tapered tow cable for aerial targets. The stainless steel increased in unit strength from 276,000 psi at 0.0495-inch diameter to 374,000 psi at 0.023-inch diameter. The carbon steel music wire unit strength remained substantially constant. It was concluded that electropolishing is a technically feasible technique, and it was recommended that design

parameters be determined for a production setup to produce a tapered tow wire. (Author)

Transport, Traction and Hoist Facilities

American Machine and Foundry Co., Chicago, Ill.
DYNAMIC MODES OF TRANSPORTATION STUDY. Addendum to Final rept. on Contract AF 30(635)2903. 14 Feb 57, 3p. RADC-TR-57-16B AD-114 500.
Order from LC mi$1.80, ph$1.80 PB 137 568

This addendum to the Final Report on the "Dynamic Modes of Transportation Study" contains further suggestions regarding techniques of programming a platform-type shaker; such a machine had been proposed for the simulation of the shock and vibration environments to which military electronic equipment is subjected in field transit.

Bureau of Yards and Docks, Washington, D. C.
MOVING AND RIGGING HANDBOOK. Engineered Performance Standards, Public Works Maintenance. Oct 59, 97p. NAVDOCKS P-709.
Order from LC mi$5.40, ph$15.30 PB 145 002

The Engineered Performance Standards set forth time values which cover most of the work performed by the Moving and Rigging Craft. Spread Sheets are task times grouped by subject area and time. The time to perform a specific task is obtained by using the group value time covering equal work content described on the spread sheet. Task Times are derived from operation time values. Task times include all operations constituting the task but not job preparation time, travel time, or allowances for delays. Operation Times are the formula values taken from the formula manual. They represent the actual time required to perform a portion of a task and, when several are added together, they become the time to perform the task. The task areas included in this manual are: crane operations, equipment moving, reeving, shop operations, and weight capacity testing.

Bureau of Yards and Docks, Washington, D. C.
MOVING AND RIGGING FORMULAS. Engineered Performance Standards, Public Works Maintenance. Oct 59, 101p. NAVDOCKS P-709.1.
Order from LC mi$5.70, ph$16.80 PB 145 006

Contents:
Heavy equipment travel
Crane operation
Sling operations
Reeving
Hand rigging
Lashing
Winch operations
Shop operations
Weight capacity testing of motor-truck cranes

MATERIALS

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
THE EFFECT OF MOLTEN BISMUTH ON INSULATING MATERIALS, by W. S. Fleshman and C. G. Collins. 9 Feb 50, 16p. NEPA-1306-SCR-56; AD-206 722.
Order from LC mi$2.40, ph$3.30 PB 138 453

Samples of twenty-six Johns-Manville insulating materials, which included cements, bonded fibrous blocks and fire bricks, were tested for possible reaction with molten bismuth. The tests consisted essentially of pouring molten bismuth at 1832°F (1000°C) over insulation maintained both at room temperature and at 1832°F (1000°C), although some tests were made in which the insulation was heated together with the bismuth for periods up to three hours. In general, the results indicated that little or no reaction, particularly of an explosive nature, occurred when the molten bismuth came into contact with the unheated materials, and that none of the materials would withstand contact with the bismuth when both were at 1832°F (1000°C) for more than a few hours. Greatest resistance to bismuth attack was shown by three types of asbestos millboards.

Virginia Agricultural Experiment Station, Blacksburg.
COMBINED INTRA- AND INTER-BLOCK ANALYSIS FOR FACTORIALS IN INCOMPLETE BLOCK DESIGNS, by R. E. Walpole, R. A. Bradley and C. Y. Kramer. Technical rept. no. 2 on The Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Mar 58, 145p. 26 refs. AD-157 825.
Order from LC mi$7.20, ph$22.80 PB 138 572

A combined intra- and inter-block analysis was obtained for factorials in balanced incomplete block designs, group divisible designs, and Latin Square type of partially balanced, incomplete block designs. For the class of Latin Square sub-type L_3 designs, both the intra-block and combined intra- and inter-block analyses were considered. Estimators for the factorial effects were obtained along with their variances and covariances. Sums of squares in terms of the factorial estimators were derived which can be used for tests of significance. These sums were independently distributed as x^2-variates with the appropriate number of degrees of freedom. For the special cases of 4 x 4 Latin Square sub-type L_3 designs, a complete analysis yielding the adjusted sums of squares, for the factorial effects, was possible. The appropriate sums of squares for main effects and interactions of a multi-factor factorial were obtained either as functions of the original estimators or as functions of the row and column averages of the original treatment estimators. The method of incorporating a fractional replicate of a factorial was also considered. Numerical examples were worked in detail for a group divisible design and a Latin Square sub-type L_3 design. The problem of analyzing factorials in various types of lattice designs is being investigated.

Ceramics and Refractories

Armour Research Foundation, Chicago, Ill.
RESEARCH AND DEVELOPMENT SERVICES LEADING TO THE CONTROL OF ELECTRICAL PROPERTIES OF MATERIALS FOR HIGH TEMPERATURE RADOMES, by Leon M. Atlas. Rept. for 1 July 58-30 Apr 59 on Electrical and Electronic Materials, Contract AF 33(616)5929. Oct 59, 34p. 14 refs. WADC Technical rept. 59 300.
Order from OTS $1.00 PB 161 423

Methods are described for the preparation of high purity aluminum oxide (less than 100 ppm of impurities) by the solution of 99.999% Al metal in hydrochloric acid and precipitation with ammonia. After calcining at 1400°C, this batch was fabricated into ceramics by firing in air at temperatures up to 1900°C. Loss tangents at 500°C approach that of sapphire, and the temperature variation of dielectric constant is considerably lower than for high purity commercial aluminas. Defects in alumina ceramics produced by impurities and by interactions with gaseous atmospheres have been studied by measuring the reflectance and thermoluminescence of gamma irradiated specimens.

Cincinnati U., Ohio.
THE SYSTEM TITANIUM-ZIRCONIUM-OXYGEN, by Michael Hoch, Robert L. Dean and others. Rept. for 1 Nov 56-31 Aug 59 on Solid State Research and Properties of Matter, Contract AF 33(616)3881. July 59, 83p. 37 refs. WADC Technical rept. 59-539.
Order from OTS $2.25 PB 161 435

The general shape of the 1450°C isotherm of the Ti-TiO-ZrO_2-Zr region was calculated from the surrounding binary phase diagrams. The phase boundaries were accurately determined by investigating 50 compositions using X-ray and metallographic techniques. The isotherm at 1500°C for the region TiO-TiO_2-ZrO_2 was obtained by investigating 45 compositions, using X-ray diffraction. The activities of titanium and TiO in the α + TiO + tetragonal ZrO_2 and the two $\alpha + \beta$ + tetragonal ZrO_2 regions were measured using the Knudsen effusion method. The solidus and liquidus surfaces were determined by observing samples suspended with a fine tungsten wire in a tungsten crucible, and heated in vacuum. The oxidation of titanium-zirconium alloys was also investigated. The presence of zirconium in titanium, and vice versa, decreases the oxidation resistance and the alloys oxidize faster than the pure metals.

Douglas Aircraft Co., Inc., Long Beach, Calif.
INFLUENCE OF SURFACE ON CERAMIC MECHANICAL PROPERTIES, by George R. Pulliam. Rept. for June 58-June 59 on Solid State Research and Properties of Matter, Contract AF 33(616)5875. Sep 59, 36p. 13 refs. WADC Technical rept. 59-261.
Order from OTS $1.00 PB 161 309

This study was devoted to establishing the importance of gaseous and liquid environments, electromagnetic irradiation, and non-stoichiometry on the deformation and fracture processes in ceramic materials. The surface condition of the material and its chemical environment have been found to have a large effect on these processes. The small ductility of magnesium oxide is reduced by air and basic solutions. Acid solutions produce ductility in previously brittle magnesium oxide. Exclusion of air by a protective coating or a protective atmosphere preserves the ductility. Photochemical reactions essentially stop the creep of silver chloride. A more quantitative evaluation of these effects should be conducted to permit the establishment of the mechanisms operating. (Author)

Minerals Research Lab., U. of Calif., Berkeley.
INTERNAL STRESSES IN MODEL CERAMIC SYSTEMS II. A. X-RAY STRAIN MEASUREMENT TECHNIQUES FOR CERAMIC BODIES. B. EXTENDING THE RANGE OF REPLICATION TECHNIQUES, by Leonard N. Grossman, Richard M. Fulrath and Robert B. Langston. Technical progress rept. no. 2 on Contract AF 49(638)04. 1 Oct 59, 36p. 14 refs. Series no. 119, issue no. 2; AFOSR-TN-59-1181.
Order from LC mi$3.00, ph$6.30 PB 145 018

X-ray diffractometer techniques for measuring triaxial and biaxial strain in ceramic bodies are described. Results using Al_2O_3 and ThO_2 crystal phases with various glasses in the Na_2O-B_2O_3-SiO_2 system are presented. It is shown that internal stresses due to expansion coefficient mismatches occur in these systems and that their magnitudes often exceed the bulk strength of the body. A progress report is included on obtaining the microstructures of model ceramic systems used in the investigation of internal stresses in ceramics.

Ohio State U. Research Foundation, Columbus.
EXPLORATORY STUDY OF NICKEL-MAGNESIA CERMETS, by Earle T. Montgomery and Paul E. Rempes, Jr. Rept. on Contract AF 33(616)3. Apr 53, 11p. 1 ref. WADC Technical rept. 53-164; AD-14 010.
Order from LC mi$2.40, ph$3.30 PB 145 333

Test bars were prepared by combining finely ground commercially fused MgO with 38.8 and 71.6 wt-% of Ni at high pressures and sintering. Descriptions are presented of the body preparation, sintering, and testing procedures. Results indicated that: (1) the firing shrinkage and the oxidation resistance increased with the longer milling time, (2) the porosity of most of the bars was under 1.0%, (3) modulus-of-rupture strength at room temperature was fair, and (4) thermal shock resistance of the specimens was adequate. It was concluded that combinations of Ni and MgO for use as solid body cermets are less promising than other oxide-base cermets now available.

Utah U., Salt Lake City.
CERAMIC STUDIES SUMMARY TECHNICAL REPORT, by P. Gibbs, G. S. Baker and others. Rept. for June 58-Apr 59 on Ceramic and Cermet Materials, Contract AF 33(616)5876. Aug 59, 20p. 9 refs. WADC Technical rept. 59-381.
Order from OTS $0.50 PB 161 146

Progress is reviewed in the preparation of high purity and doped sintered alumina samples. A high-precision fast-recording, bending creep furnace with resolution of at least 10^{-6} strain in the outer fiber is described. Preliminary tests suggest a stick-slip behavior with jumps of about 5.10^{-5} strain in the outer fiber. Progress in an electrical study of corundum-metal interface is reviewed. Migration of silver ions from a coating is found above 200° C on application of several volts/cm. The observed conduction current rises to an asymptotic value of nearly an amp. in seconds. The rise time for this process depends upon the temperature as well as the length of time during which the specimen "rested" without any field. The value of the asymptotic current was greatest at about 350° C. (Author)

Fuels, Lubricants, and Hydraulic Fluids

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE APPLICABILITY OF LINEAR VISCOELASTIC ANALYSIS TO ROCKET GRAIN DESIGN, by E. H. Lee. Technical rept. no. 3 on Contract NOrd-17838. July 58, 24p. 7 refs. AD-200 172.
Order from LC mi$2.70, ph$4.80 PB 145 216

The significance for the stress analysis problem of rate effect in materials in the form of delayed elasticity and creep is discussed, and the present well developed methods of attack on the problem through the theory of linear viscoelasticity are mentioned. It is shown that a method of testing the applicability of this theory to a specific design problem for a specific material is available for which any convenient component containing the material can be used with a free choice of loading pattern. This eliminates the need for carefully made test specimens and uniform loading systems in assessing the influence of viscoelasticity and linearity. Such a test for a propellant grain is suggested. Once the applicability of the theory has been established, the need for carefully designed experiments to measure basic viscoelastic properties is emphasized. The accurate determination of shear and compressibility properties is essential for the understanding of the behavior under combined stresses, which characterizes most propellant grain design problems. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND APPRAISAL OF A PHOTOGRAPHIC TECHNIQUE FOR ROCKER-MOTOR-COMBUSTION STUDY, by George A. Agoston. Rept. on Contract NOa(s)-53729. 29 Jan 54, declassified. 22p. 5 refs. Rept. no. 25-1.
Order from LC mi$2.70, ph$4.80 PB 145 615

The application and merits of Lucite, fused silica, and Pyrex in transparent-motor construction is described. High-speed, colored-motion-picture photography of RFNA-ammonia flame within transparent motors has been investigated for use in combustion research. This photographic technique has proved to be useful in general flow visualization. Because of flame opacity no success was achieved in utilizing it in tracer tracking for local velocity determination. Evidence has been obtained which suggests that the bright-yellow luminosity emitted from a thin rectangular motor with Lucite flame panels originates from burning Lucite rather than from propellant constituents or reaction components. In tests with cylindrical motors the shift in luminosity from one side of the turbulence ring to the other was demonstrated when the position of the latter was changed with respect to the injector. The disappearance of diffuse luminosity at a distance from the injector in a long transparent motor was noted under acid-rich conditions. Local gas analysis and temperature measurement in the nonluminous, annular, recirculating gas zone surrounding the flaming jet issuing from a turbulence ring indicated lack of attainment of equilibrium. (Author)

Massachusetts Inst. of Tech., Cambridge.
METHODS OF TESTING MECHANICAL PROPERTIES OF PROPELLANTS, by Albert G. H. Dietz, Frederick J. McGarry, and James Dorsey. Final summary rept. for 1 Mar 50-31 May 54 on Contract DA 19-020-ORD-6. [1954] 121p. 7 refs.
Order from LC mi$6.30, ph$19.80 PB 144 990

The purpose of this research was to develop and explore various methods of testing the mechanical properties of solid rocket propellant materials. A high speed tensile testing device which provides stress-strain information from tests of a few milliseconds duration has been designed, constructed and operated. Using data and techniques from an extensive static testing program on plasticized polymethyl methacrylate, a considerable amount of mathematical analysis work has been done. The purpose of this was to present conveniently and predict accurately the stress-strain-time relations describing viscoelastic behavior. A high frequency sonic, through transmission, device was designed and built to investigate one type of non-destructive test procedure for propellant materials. Operating in the 1/2-5 megacycle region at very low energy levels, it makes possible the determination of the velocity of transmission and apparent energy absorption characteristics of propellant materials.

Midwest Research Inst., Kansas City, Mo.
MODIFICATION OF SHELL FOUR-BALL WEAR TESTER FOR 800°F OPERATION AND DEVELOPMENT OF A LUBRICANT EVALUATION TECHNIQUE, by Vernice Hopkins. Rept. for Apr 57-Dec 58 on Aviation Lubricants, Contract AF 33(616)5205. June 59, 68p. 4 refs. WADC Technical rept. 59-48; AD-215 447.
Order from LC mi$3.90, ph$10.80 PB 145 451

The modifications made to adapt the Shell four-ball wear tester for 800°F operation have been outlined. Detailed discussions of the design changes, the frictional torque measuring setup, lubricant circulating system, and the application of additional controls and instrumentation are presented. The evaluation of the performance of the modified wear tester is described. Operating test procedures for a conventional test and the alterations required for lubricants solid at room temperature and for lubricants circulating through the ballpot assembly are included. Testing experiences

are discussed, especially for high temperature tests. A method for evaluating lubricants is outlined. (Author)

Naval Research Lab., Washington, D. C.
IGNITION OF HYDROCARBON VAPORS BY CONTINUOUS DC ARCS, by F. J. Woods, K. G. Williams, and H. W. Carhart. Interim rept. 30 Dec 59, 18p. 12 refs. NRL rept. 5423.
Order from OTS $0.50 PB 161 068

Studies of the ignition of flammable vapors by dc arcs drawn between stationary metal-plate electrodes and retracting spherical electrodes have shown that quenching effects of the electrodes play a dominant role in the ignition process. This dominance decreases as the spherical electrodes are made smaller and as the rate of separation is increased. With electrodes which are separated at rates less than the propagation velocity of the incipient flame kernel in the direction of electrode movement, the arc must be extended to a distance comparable to the quenching distance of the electrode system for spark ignitions. This quenching distance can be determined experimentally and expressed in terms of dimensional parameters for given electrode geometries. The electrical requirements for maintaining arcs to the required separation were found to depend on the material of the electrodes and the electrical characteristics of the current supply. (Author)

Naval Research Lab., Washington, D. C.
SHIPBOARD STUDIES OF FUEL-VAPOR IGNITION BY RADIO-FREQUENCY ARCS, by F. J. Woods, K. G. Williams and H. W. Carhart. Interim rept. 25 Jan 60, 16p. 3 refs. NRL rept. 5443.
Order from LC mi$2.40, ph$3.30 PB 143 950

Shipboard studies of radio frequency arcs developed on parked aircraft aboard the CVA 42 have shown that arcs of 0.4 ampere or more drawn from locations with an open-circuit potential greater than 120 volts can ignite flammable concentrations of fuel vapor. Such arcs were observed under conditions which were considered normal for purposes of fueling. Measurements of arc voltage and current are reported for various locations of the aircraft and transmitters. Suggestions are made for reducing the possibility of accidental fires. (Author)

Naval [Weapons Plant] Washington, D. C.
INVESTIGATION OF FLUIDS FOR USE IN HYDRAULIC TYPE RECOIL AND RECOIL-COUNTER-RECOIL MECHANISMS, AND IN HYDRAULIC TYPE BUFFERS, by M. R. Dyer. 12 Dec 58, 108p. 8 refs. Technical rept. no. NGF-T-20-57; NAVORD rept. 511; AD-209 272.
Order from LC mi$5.70, ph$16.80 PB 144 675

Experience in service revealed that some fluids currently used in hydraulic type recoil and recoil-counterrecoil mechanisms and in hydraulic type buffers have unsatisfactory low temperature properties and that corrosion occurs within this equipment. An investigation was therefore conducted on twenty different fluids, ten different packings, and three different metals to evaluate the compatibility of these materials for use in this equipment. The fluids were of four classes: (1) Glycerin-water Mixtures, (2) Petroleum Base Oils, (3) Hydrolubes, and (4) Water-Soluble Ucon Fluid. Included among these fluids were several currently used in Naval Ordnance. The packings were of three classes: (1) Rubber, (2) Leather, and (3) Flax. The metals used were Carbon Steel, Alloy Steel, and Phosphor Bronze.

Naval [Weapons Plant] Washington, D. C.
USE OF COLLOIDAL GRAPHITE (IN POLY-ALKYLENE GLYCOL) AS AN ALL-WEATHER LUBRICANT ON THE 3"/50 CAL. GUN SURFACES, SUCH AS, BARRELS, COUNTER-RECOIL-SPRING GUIDES AND HOUSING GUIDES; TEST AND EVALUATION OF, by Robert C. Duncan. 19 Sep 56, 17p. Technical rept. no. NGF-T-29-56; NAVORD rept. no. 5178.
Order from LC mi$2.40, ph$3.30 PB 138 344

Tests indicate that the counter recoil time of the 3"50 gun is less while using colloidal graphite (in Polyalkylene Glycol) than while the currently recommended cold weather lubricant mixture is used.

Ordnance Fuels and Lubricants Research Lab., Southwest Research Inst., San Antonio, Tex.
CONTINUED DEVELOPMENT OF CRC L-38 TECHNIQUE, by William P. Teich. Rept. on Contract DA 23-072-ORD-1144. Sep 58, 88p. 4 refs. AD-211 625.
Order from LC mi$4.80, ph$13.80 PB 138 266

A series of sixteen tests were conducted to investigate the effect on oil oxidation and bearing weight loss of the following: (1) an increase in the oil gallery temperature, (2) a higher engine speed and consequently a higher connecting rod bearing rubbing velocity, and (3) a reduced lubricating oil output from the engine driven oil pump. The results of these tests indicated that a slight increase in bearing weight loss occurs as the result of an increase in the oil gallery temperature, an increase in engine speed within the limits of these tests will not significantly alter the bearing weight loss, and the oil pump output between the limits of 1.81 gal/min and 3.0 gal/min has no significant effect upon test severity. With the knowledge that it is urgent that a CLR engine procedure be available as soon as possible to replace the current CRC L-4 procedure, it is recommended that studies be undertaken to eliminate the excessive camshaft thrust washer wear, determine the effects of introducing various amounts of air into the crankcase, and determine the desirability of using the new type low volume external oil heater. (Author)

Rock Island Arsenal Lab., Ill.
MILLIPORE FILTER TECHNIQUE FOR ANALYSIS OF CONTAMINATION IN MISSILE HYDRAULIC FLUID, by H. S. Muffley. 30 June 59, 17p. 1 ref. Rept. no. 59-1773.
Order from LC mi$2.40, ph$3.30 PB 145 113

The servo valves found in the guidance system of missiles are extremely sensitive to solid particle contamination extending to particles of microscopic size. Forty-one samples of missile hydraulic fluids including new, used, and reprocessed oils, were filtered through a millipore filter. Four areas of the millipore filter were photographed at 100X. The size range and distribution of the solid particles were established for the areas photographed. Total counts for the entire filtering area were then calculated. The millipore filter technique provides a fairly reliable estimate of the level of contamination of a missile fluid, however, the validity of the results is dependent upon the control of the many variables encountered. (Author)

Southwest Research Inst., San Antonio, Tex.
AIRCRAFT GEAR LUBRICATION. A LITERATURE SURVEY, by A. Hundere and B. B. Baber, Jr. Rept. on Contract AF 33(616)498. Oct 53, 100p. 206 refs. AD-20 156.
Order from LC mi$5.40, ph$15.30 PB 145 691

A summary is presented of the information that was developed from a literature survey on gear lubrication applicable for aviation use. The published information on the effect of lubricant factors, design features, and operating variables on gear tooth scuffing and pitting is summarized. Available information on test techniques and test methods is included. The articles pertinent to aircraft gear lubrication and gear lubricants are listed chronologically with abstracts in the appendix.

Thiokol Chemical Corp., Trenton, N. J.
A STUDY OF THE CORROSIVE EFFECTS OF THE COMBUSTION PRODUCTS OF BORON CONTAINING FUELS ON SELECTED HIGH TEMPERATURE MATERIALS, by Frank J. Loprest and Steven J. Tunkel. Rept. for July 56-May 58 on Aviation Fuels, Contract AF 33(616)3713. Sep 59, 331p. 21 refs. WADC Technical rept. 57-542.
Order from OTS $5.00 PB 161 421

A method is presented for treating in a quantitative manner the corrosion data obtained, as is a rating of all the alloys tested. The data show that for all alloys there exists a critical temperature (Tc) in the range 1600 to 2000°F above which the corrosion rate increases very rapidly with increasing temperature, and above which serious pitting, and even destruction, occurs within 150 hours. The rate of corrosion below Tc has been determined. A characteristic value, A, representing this rate has been listed for many alloys and tentatively related to the elemental composition. The effect of velocity of combustion products on the corrosion process has been discussed. Mechanisms of the process are presented. Finally, data on the cleaning of deposited boric oxide by saturated steam are included. (Author)

Leather and Textiles

Little, Arthur D., Inc., Cambridge, Mass.
CANDIDATE MATERIALS FOR HIGH TEMPERATURE FABRICS. Rept. for July 58-Feb 59 on Air Force Textile Materials, Contract AF 33(616)5880. Sep 59, 166p. 49 refs. WADC Technical rept. 59-155.
Order from OTS $3.00 PB 161 411

This program involved an evaluation of existing data relative to the development and use of high-temperature fabrics for re-entry parachutes. Anticipated environmental and aerodynamic factors of re-entry from satellite orbits were used as a basis for the selection of candidate materials. Among these factors were heating and deceleration rates, surface temperatures, erosion and corrosion rates, strength-to-weight properties at elevated temperatures, porosity, and flexibility. All evaluated, including metals, ceramics glasses, inorganic and organic polymers, and single crystal systems (whiskers). Although there was very little data on the behavior of fine filaments at the expected environmental conditions, we were able to select commercially available materials that could be used in a high-temperature parachute cloth with a minimum of development work. We also defined the type of data necessary to the development of more sophisticated fabrics that would have greater reliability and an extended service temperature. (Author)

Material Lab., New York Naval Shipyard, Brooklyn.
EVALUATION OF NON-DESTRUCTIVE TEST METHODS FOR LAMINATED FIBER GLASS PLASTIC MATERIALS, by J. A. Reilly and M. Goldberg. Final rept. 8 Sep 59, 19p. 5 refs. Lab. Project 5761-1.
Order from LC mi$2.40, ph$3.30 PB 144 928

Due to the increasing use of glass laminated plastic products, simple and rapid non-destructive test methods are required to determine the presence of internal structural defects such as voids, resin-rich areas, and delaminations. Several methods, based on the development of visually observable flaw patterns as a result of variations in thermal conductivity through the item tested, were evaluated. A method based on the use of thermo-sensitive decals in conjunction with an infrared heat source was selected as potentially suitable, within defined limits.

Photographic Materials

Technical Operations, Inc., Burlington, Mass.
CHEMISTRY OF PHOTOGRAPHIC DEVELOPMENT, by James E. LuValle and Gershon M. Goldberg. Final rept. on Contract AF 18(600)371. 31 Aug 58, 34p. 21 refs. TOI 58-30; AFOSR-TR-58-112; AD-201 772.
Order from LC mi$3.00, ph$6.30 PB 138 214

The over-all aims and accomplishments have been briefly discussed with reference to the pertinent technical notes. Recommendations have been given as to the areas in which further work appears to be necessary. Abstracts of all technical notes released by this project or by related projects which grew out of it

have been given in the Appendix. This report covers 6 years of contract work and encompasses numerous findings in the field.

Plastics

Army Prosthetics Research Lab., Washington, D. C.
REVISED CALIBRATION CURVE FOR DETERMINATION OF STAIN RESISTANCE OF VINYL MATERIALS, by James T. Hill and William Wiedmann. 3 Feb 59, 3p. 2 refs. Technical rept. no. 5903; AD-211 236.
Order from LC mi$1.80, ph$1.80 PB 144 725

In previous work calibration curves were presented for use in determining stain resistance of vinyl materials using a color difference meter. These curves were obtained using two tiles for standards. A blue tile was used with the stained samples and a white tile for the unstained samples. To simplify this procedure we decided to calibrate the color difference meter using one tile which would result in a single calibration curve. This report discusses this investigation.

Hughes Aircraft Co., Culver City, Calif.
RESEARCH ON HIGH TEMPERATURE POLYMERS, by J. B. Rust, C. L. Segal and H. H. Takimoto. Technical rept. no. 2, 1 Sep 58-1 Mar 59 on Contract Nonr-2540(00). [1959] 53p. 55 refs. AD-217 196
Order from LC mi$3.60, ph$9.30 PB 144 891

A study was made of the synthesis of polymer intermediates of the type $[(CH_3)_3SiO]_n Ti(OC_3H_7)_{4-n}$, where n was 2 or 4. A chemical analysis and an IR spectra analysis were conducted on the products. The postulated structure of the Ti ester intermediates was verified. The reaction of ethyl orthosilicate with trimethylacetoxysilane to form intermediates analogous to the Ti esters produced low yields of the Si ester when sodium ethylate catalyst was used. A linear polymer, a poly(triorganosiloxy)titanosiloxane, with a weight average molecular weight of 42, 300 was obtained by the use of sodium ethylate as a catalyst. Some indication was given that part of the trimethylsiloxy side groups were cleaved during the reaction or during processing of the polymers. Poly(triorganosiloxy)titanoxanes were prepared and the products were identified; there was some indication of cleavage of trimethylsiloxy groups. Polymers containing Si and Al, poly(triorganosiloxy)aluminoxanes were prepared. A linear polymer was found to have a weight average molecular weight of 42, 500. (See also PB 140 992)

Material Lab., New York Naval Shipyard, Brooklyn.
METHODS FOR DETERMINING THE SHEAR MODULUS OF GLASS REINFORCED PLASTIC LAMINATES, by P. M. Goldfarb. Final rept. 31 Aug 59, 21p. 8 refs. Lab. Project 3995-1.
Order from LC mi$2.70, ph$4.80 PB 145 037

Tests were conducted on a 1/4 inch style 181 glass cloth reinforced polyester laminate employing spans of 1 in. to 5 in. length. The beam bending method is more rapid and requires a much smaller specimen than the panel shear method.

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
INVESTIGATION OF THREE FIBER-RESIN DEPOSITORS PHASE II, by M. E. Phelps and L. N. Schultz. June 59, 60p. 4 refs. Rept. no. P-399-2.
Order from LC mi$3.60, ph$9.30 PB 144 742

Three fiber-resin depositors were obtained for comparison and evaluation. Molded items and laminates to determine physical strengths were prepared. Each depositor was evaluated with regard to various operational features. Areas of usefulness of the depositors to the Navy were considered somewhat limited. (Author)

Midwest Research Inst., Kansas City, Mo.
FABRICATION AND DEVELOPMENT OF COMPOSITE PLASTIC PLATES, by Howard W. Christie and Daniel A. Netzel. Quarterly progress rept. no. 3, phase II [Final], 16 Jan-15 Apr 59, on Contract NOas 58-563-c. 5 June 59, 62p. 3 refs.
Order from LC mi$3.90, ph$10.80 PB 144 890

Short cure cycles for the polymerization of diethylene glycol bis(allyl carbonate) have been achieved. The allyl resins do not appear promising for production of temperature resistant composites. Fabrication of allyl composites proved to be extremely difficult. Cracking of the allyl layer occurred during polymerization. High internal stresses developed by shrinkage of the resin during cure and the low strength of the partially cured resin produced the failure. Upon exposure to elevated temperatures the composites failed with cracking of the allyl layer. Epoxide resins have proved promising for the temperature resistant layer of the composites. The low shrinkage of the epoxide resins upon polymerization greatly reduces internal stressing. A curved composite of an anhydride cured epoxy resin has been fabricated. The color stability of the epoxide resins at temperatures above 300°F is poor. Most of the discoloration is produced by oxidation of the exposed surface. (See also PB 139 584)

Naval Ordnance Test Station, China Lake, Calif.
PRELIMINARY INVESTIGATION OF THE RELATIVE EFFECTS OF VARIOUS CURING FACTORS ON THE COMPRESSIVE STRENGTH OF AN ASBESTOS-FILLED MOLDED PHENOLIC RESIN, by J. S. Simpson and H. B. Porter. 12 Dec 58, 19p. NOTS TP-2149; NAVORD rept. 6441; AD-211 000.
Order from LC mi$2.40, ph$3.30 PB 144 869

A preliminary series of tests was conducted on a molded asbestos-filled phenolic resin to determine the relative effects of several curing factors on the compressive strength of the fully-cured resin. A secondary objective was to determine the feasibility of substituting gamma radiation for heat in the post cure stage.

Physical Sciences Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
THE EFFECTS OF IONIZING RADIATION UPON TRANSPARENT MATERIALS, by Gregory Arutunian and Fred L. Seppi. 26 Oct 59, 38p. (4 color photographs will not reproduce) Rept. no. RR-1.
Order from LC mi$3.00, ph$6.30 PB 145 013

Commercial-grade glass, polystyrene, plexiglas, allyl carbonate, and polyvinyl acetate were exposed to x-rays ranging in energy from 50 KVP to 150 KVP for differing lengths of time. As a result of radiation, materials containing doubly bound oxygen atoms exhibited the greatest coloration and exhibited a greater loss in transmittance in the blue region of the visible spectrum than in the red. Polystyrene, an oxygen-free aromatic hydrocarbon, was least affected by x-rays and, on the basis of retention of optical transmission, can be considered for vehicular optical viewing systems exposed to intense gamma-radiation or x-rays.

Rubber and Elastomers

Institute of Rubber Research, U. of Akron, Ohio.
STRESS RELAXATION AND THE STRUCTURE OF HIGH TEMPERATURE ELASTOMERS, by Maurice Morton, V. R. Allen, and R. D. Gates. Technical rept. no. 3, 1 Dec 58-28 Feb 59, on Contract Nonr-2573(00). [1959] 28p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 144 960

A theoretical study has been made of the effect of a "recombination" (crosslinking) reaction on the relation between sol formation and network breakdown during degradation in bulk or in a swollen condition. Experimental work on sulfur vulcanizates of natural rubber has actually shown that the sol vs. degradation relations for the above two cases are very divergent. From a similar investigation of peroxide vulcanizates of natural rubber, it was found that there is no apparent "recombination" during swollen degradation. (See also PB 143 458)

International Latex Corp., Dover, Del.
DEVELOPMENT OF ELASTOMERS WITH IMPROVED PROPERTIES IN THE ABSENCE OF CARBON BLACK REINFORCEMENT, by Verle A. Miller, Edwin B. Gienger, Jr. and others. Comprehensive progress rept. no. 3, 1 July 55-31 Jan 56, on Contract DA 44-109-qm-1778. [1956] 81p. AD-92 245.
Order from LC mi$4.80, ph$13.80 PB 145 440

Under an earlier contract the development of butadiene/acrylonitrile/methacrylic acid terpolymers was described. Dipped films of these terpolymers exhibited gum tensile strengths as high as 4000-6000 psi. combined with high oil resistance equivalent to that of the low strength Buna N rubbers. This contract covers two work phases: I. Compounding and evaluation studies with the above terpolymers directed toward applying these advances to mill compounded stocks. II. The preparation and evaluation of other functional group-containing polymers directed toward an attempt to improve the strength and tear resistance of unreinforced synthetic rubbers by utilization of reversible secondary bonding forces or chemical reaction between various polar groups of the polymer chains. (See also PB 142 062)

Wood and Paper

Marine Lab., U. of Miami, Coral Gables, Fla.
MARINE BORER INVESTIGATIONS. Annual rept. for Jan-Dec 57 on Contract NOy-81879. Feb 58, 37p. 9 refs. Rept. 58-1; AD-158 567.
Order from LC mi$3.00, ph$6.30 PB 137 904

The ultimate objective of the program is to develop an efficient, dependable wood preservative treatment for protection of wood against attack by marine borers. Wood which has been pressure-impregnated with coal tar creosote exhibits adequate resistance to marine borer attack in temperate regions. In some tropical and sub-tropical coastal areas however, creosoted piling and timber is relatively short-lived, presumably because the higher water temperature accelerates leaching of the preservative, and because some forms of boring organisms peculiar to these regions are relatively resistant to the toxic action of creosote, even when it is present in the wood in maximum concentrations. Inasmuch as creosote has been shown to be an effective marine wood preservative for many applications, one channel of the research program has been directed toward improvement of the preservative ability of creosote by systematic modification of its constitution. However, because the complex composition of creosote might limit the degree of success which can be attained by such an approach, an equal effort has been devoted to development of preservatives unrelated to creosote. Results of the overall preservative development program may be categorized as follows: (1) Accelerated evaluation of modified creosotes. (2) Modification of the accelerated leaching-exposure test. (3) Investigation of the mechanism of creosote diffusion within wood. (4) Screening of experimental preservative materials. (5) Studies on copper-based preservative treatments.

Material Lab., New York Naval Shipyard, Brooklyn.
INVESTIGATION OF THE STANDARD ASTM MECHANICAL AND PHYSICAL PROPERTIES OF EKKI, LOPHIRA PROCERA, A. CHEV. IN THE GREEN AND AIR DRY CONDITION OF MOISTURE, by C. P. Cologer. Progress rept. no. 5 (Final) on Lab. Proj. 5740-7. 17 June 59, 26p. 18 refs. AD-226 708.
Order from LC mi$2.70, ph$4.80 PB 144 677

The standard ASTM mechanical and physical properties of ekki, Lophira procera, in the green and air-dry moisture conditions were investigated. Test indicated that ekki is generally below greenheart in its mechanical strength, although it is similar to greenheart in specific gravity. Ekki is equivalent to green heart in side hardness, shear parallel to grain, cleavage and superior in end hardness. The mechanical properties of ekki are superior to white oak, and

are in accord with the difference in their relative specific gravities. The order of merit for the mechanical strength of the 3 species is greenheart, ekki, and white oak. The volumetric shrinkage of ekki compares favorably with greenheart. Ekki appeared to have a greater tendency to warp on seasoning than greenheart. The computed weights per cubic foot at 50% moisture content disclosed that ekki and greenheart would have approximately the same weight, and that both would be significantly heavier than white oak.

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, ANGELIQUE (DICORYNIA GUIANENSIS) by R. F. England. Aug 59, 5p. 7 refs. Progress rept. no. E-412-3.
Order from LC mi$1.80, ph$1.80 PB 145 111

The laminating properties of angelique (a tropical South American hardwood) were investigated using three commercial adhesives. Curing conditions of 150-153°F for 6 hours (glueline temperature) produced satisfactory results with each of the adhesives tested. (Author)

MATHEMATICS

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ARITHMETIZATION OF METAMATHEMATICS IN A GENERAL SETTING, by Solomon Feferman. Technical rept. no. 1 on Contract DA 04-200-ORD-997. 25 Aug 59, 112p. 33 refs. OOR rept. 2379.1-M.
Order from LC mi$6.00, ph$18.30 PB 145 073

The method of arithmetization, as developed by Gödel (Monatshefte f. Math. u. Physik, v. 38 (1931) p. 173-198), exploits the possibility of defining within a formal theory $\mathcal{T}$, or in arithmetical theories closely related to $\mathcal{T}$, various syntactical and logical notions concerning $\mathcal{T}$. In broad terms, the applications of the method can be classified as being extensional if essentially only numerically correct definitions are needed, or intensional if the definitions must more fully express the notions involved, so that various of the general properties of these notions can be formally derived.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
SOME STOCHASTIC PROCESSES WITH APPLICATIONS TO COUNTER MODELS, by Ronald Pyke. Technical rept. no. 44 on Contract N6onr-25140. 18 Dec 58, 38p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 144 939

A family of stochastic processes with applications in physics as well as in economic risk-theory is described. Following the work of Takacs [Acta. Math. Ac. Sci. Hung., vol. 5 (1954) pp. 203-236] the one-dimensional characteristic functions of the processes, as well as their covariance functions, are determined. The notions of counts, state A, and state B, are defined. In two special cases the expected number of counts and the expected time in state A are studied in more detail. In one case, a system of partial differential equations is given for a quantity which can be used to determine both the probability of being in state A and the expected number of counts. In a second case, approximations to the expected number of counts may be obtained by the method of steepest descents. Examples are given. (Author)

California U., Berkeley.
THE CLOSED GRAPH THEOREM AND THE KREIN-SMULIAN THEOREM, by J. L. Kelley. Technical rept. no. 20 on Contract Nonr-222(37). Jan 58, 28p. 6 refs. AD-153 817.
Order from LC mi$2.70, ph$4.80 PB 137 913

The purpose of the investigation reported here was to describe the class of locally convex Hausdorff spaces F for which a closed graph theorem holds for all possible spaces E (a more precise statement is given later). It will be shown that such spaces F are precisely those which satisfy a weakened form of the requirement that the class $\mathcal{C}$ of all convex circled subsets of F be complete relative to the Hausdorff uniformity. We will call F hyper-complete if $\mathcal{C}$ is complete; a complete metric space is automatically hyper-complete.

California U., Berkeley.
THE PARTITION FUNCTION FOR CERTAIN SIMPLE LIE ALGEBRAS, by Jan Tarski. Technical rept. no. 7 on Contract AF 49(638)79. Aug 58, 21p. 3 refs. AFOSR-TN-58-657; AD-162 188.
Order from LC mi$2.70, ph$4.80 PB 137 580

Explicit expressions are found for the partition function for the following Lie algebras: A_2, B_2, G_2, and A_3.

Carnegie Inst. of Tech., Pittsburgh, Pa.
AXIALLY SYMMETRIC SOLUTIONS OF ELLIPTIC DIFFERENTIAL EQUATIONS, by Richard C. MacCamy and Albert E. Heins. Technical rept. no. 24 on Contract AF 49(638)227. Nov 58, 37p. 15 refs. AFOSR-TN-58-922; AD-204 558.
Order from LC mi$3.00, ph$6.30 PB 137 775

An investigation is made of the representation of solutions of the axially-symmetric elliptic equations. The representations are derived by exploiting the connection between such equations and singular initial value problems for hyperbolic equations. The result is a correspondence between solutions of the elliptic equations and functions of a complex variable. Certain boundary-value problems for the elliptic equations are solved explicitly or semi-explicitly with the aid of these representations. (Author)

Chicago U., Ill.
GROUP EXTENSIONS BY PRIMARY ABELIAN GROUPS, by Saunders Mac Lane. Rept. on Contract AF 18(600)1383. May 59, 27p. 7 refs. AFOSR-TN-59-457; AD-215 262.
Order from LC mi$2.70, ph$4.80 PB 144 935

The effective calculation of the functor Ext(A, G) is considered which is defined as the group of all Abelian group extensions of the Abelian group G by the Abelian group A. For finitely generated A, the functor is known: (1) it is additive in A, (2) Ext(Z, G) = 0 when A = Z is the infinite cyclic group and (3) for A the finite cyclic group Z/mZ of order m, Ext(Z/mZ, G) = G/mG. The case when A is a torsion group is considered. The assumption is made that A is a p-primary group T. i. e., a group in which every element has order a power of the prine p. (Author)

Chicago U., Ill.
NON-UNIQUENESS IN CAUCHY'S PROBLEM, by A. Plis. Technical note no. 5 on Research on the Hilbert Transform and Related Topics, Contract AF 49(638)451. Aug 59, 10p. 3 refs. AFOSR-TN-59-1034.
Order from LC mi$1.80, ph$1.80 PB 145 070

Colorado U., Boulder.
SEQUENCES GENERATED BY ITERATION, by W. J. Thron. Rept. on Contract AF 49(638)100. [1958] 20p. 3 refs. AFOSR-TN-59-938; AD-226 018.
Order from LC mi$2.40, ph$3.30 PB 145 442

The rapidity of convergence is investigated for sequences generated by functions of the class H and of certain subclasses. The difference is considered between sequences generated by different functions and sequences generated by the same function with different initial elements. This results in obtaining, for sufficiently restricted g, all terms that are not affected by the value of the initial element of the sequence.

Colorado U., Boulder.
A TWO-PARAMETER FAMILY OF BEST TWIN CONVERGENCE REGIONS FOR CONTINUED FRACTIONS, by L. J. Lange and W. J. Thron. Rept. on Contract AF 49(638)100. [1959] 35p. 8 refs. AFOSR-TN-59-1301.
Order from LC mi$3.00, ph$6.30 PB 144 777

In this paper we shall study the continued fraction

$$1 + \frac{a_1}{1} + \frac{a_2}{1} + \cdots$$

whose elements a_n satisfy the conditions

$$a_{2n-1} = c_{2n-1}^2, \quad |c_{2n-1} \pm ia| \geq \rho$$

$$a_{2n} = c_{2n}^2, \quad |c_{2n} \pm i(1+a)| \geq \rho$$

where a is a complex number and a and ρ satisfy the inequality $|a| < \rho < |1+a|$.

Columbia U., School of Engineering, New York.
TABOO GENERATING FUNCTIONS AND OTHER TOPICS IN MARKOV CHAINS, by Peter Frank. Technical rept. no. 2 (N) on Contract Nonr-266(55). 26 Feb 59, 73p. 11 refs. AD-211 635.
Order from LC mi$4.50, ph$12.30 PB 144 810

Combinatorial properties and limit properties of Markov chains are studied. The assumption is made that the Markov chain is always one with discrete time, a countable number of states, and stationary transition probabilities. A complete answer is given to the problem of expressing the function $_Tp_{ij}(z)$ (the generating function of the probability $_Tp_{ij}^{(n)}$) in terms of the functions of the class $p_{kl}(z)$ when the taboo set of states T is finite. The limit condition is considered for $\lim_{z \to 1} {}_1p_{11}(z) = 2$, which expresses the fact that the state i is recurrent. The notion of alternation of a Markov chain and the notion of a subchain are considered. If weights $[W_i]$ with $W_i > 0$ are given, the problem is considered for finding whether an indecomposable recurrent Markov chain exists which has these numbers as stationary weights. Two uniform theorems are established which state that a property is true of all states if it is true for one state.

Columbia U., New York.
MULTIVARIATE DISTRIBUTIONS WITH GIVEN MARGINS, by E. J. Gumbel. Technical rept. T-12A on Contract DA 30-069-ORD-1061. 1 July 58, 54p. 6 refs. CU-12-58-ORD-1061-IE; OOR rept. 1716.6; AD-200 607.
Order from LC mi$3.60, ph$9.30 PB 144 804

We have developed a general system of multivariate distributions for given marginal distributions under the assumption that the marginal distributions possess at least two moments, and, that the multivariate probability function has at least two derivatives. This system includes a new bivariate normal distribution, where the regression curves are not linear and the curves of equal probability are not ellipses. It was believed that the correlation always varies between ±1. However within the general system the coefficient of correlation varies only from -1/3 to +1/3. The two limits are reached for the bivariate uniform distribution. For a certain bivariate exponential distribution the correlation has only one fixed value. The usual properties of the coefficient of correlation hold for the bivariate normal distribution for which it was designed. But they do not hold for the general case of multivariate distribution. Assume we know that the marginal distributions are normal and obtain a correlation r = .30 based on a large number of observations. The usual conclusion that the correlation is weak is based on the unwarranted hypothesis that the bivariate distribution is of the Bravais-Pearson type. If the bivariate distribution belongs to the system developed here, the correlation is about 95 per cent of a possible maximum, i.e., very high. (Author)

Cornell U., Ithaca, N. Y.
GENERALIZATIONS OF A THEOREM OF WALD ON MONOTONE SEQUENCES, by Ralph Agnew Palmer. Rept. no. 54 on Contract AF 18(600)685. Aug 56, 19p. 1 ref. AFOSR-TN-56-355; AD-95 441.
Order from LC mi$2.40, ph$3.30 PB 137 678

Duke U., Durham, N. C.
AN APPROXIMATE SOLUTION TO AN IMPROPER BOUNDARY VALUE PROBLEM, by Jim Douglas, Jr. and T. M. Gallie, Jr. Rept. on Contract AF 18(600)1341. Aug 58, 17p. 14 refs. AFOSR-TN-58-776; AD-201 924.
Order from LC mi$2.40, ph$3.30 PB 138 174

Hadamard called those boundary value problems whose solutions do not depend continuously on the boundary data "improperly posed." In this paper we give a new solution of an improperly posed problem first solved by Kreisel (Proc. of the Royal Society A, vol. 195 (1959) p. 160-183). His method of solution is to seek smoothed solutions of an integral equation; our method is to seek a normal family of solutions of the corresponding differential equation.

Harvard U., Cambridge, Mass.
THE BILINEAR RELATION ON OPEN RIEMANN SURFACES, by Robert D. M. Accola. Rept. on Contract AF 18(600)1461. Oct 59, 37p. 9 refs. AFOSR-TN-59-951.
Order from LC mi$3.00, ph$6.30 PB 144 871

Harvard U., Cambridge, Mass.
SOLUTION OF THE DIRICHLET PROBLEM FOR THE ELLIPSE BY INTERPOLATING HARMONIC POLYNOMIALS, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Oct 58, 7p. 5 refs. AFOSR-TN-58-1001; AD-206 144.
Order from LC mi$1.80, ph$1.80 PB 137 779

Recently J. H. Curtis has raised anew the question of interpolation by harmonic polynomials, and points out the analogy to interpolation by polynomials in the complex variable. He conjectures that satisfactory points of interpolation may be (for instance) equally spaced on the boundary of D with respect to the conjugate of Green's function for the complement of D. The object of the present note is to confirm this conjecture for the case that D is the interior of an ellipse, by computation of the polynomials involved.

Hebrew U. (Israel).
LOCAL DIFFERENTIAL ALGEBRA, by Abraham Robinson. Technical note no. 4 on Contract AF 61(052)187. May 59, 62p. 4 refs. AFOSR-TN-59-817; AD-220 589.
Order from LC mi$3.90, ph$10.80 PB 145 311

A consistency condition is obtained for a system of algebraic differential equations with given initial values. Theories are developed for ideals, polynomial ideals, and corresponding varieties. The starting point is a differential ring whose elements, at a given point, are represented by a homomorphic mapping into an ordinary ring.

Institute for Advanced Study, Princeton, N. J.
DIFFERENCE METHODS FOR PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS, by Milton Lees. Rept. on Contract AF 49(638)253. Sep 59, 28p. 16 refs. AFOSR-[TN]-59-1039.
Order from LC mi$2.70, ph$4.80 PB 145 304

The purpose of this paper is to introduce and apply a general technique for analyzing stability and convergence of the principal difference schemes currently in use for approximating solutions of parabolic differential equations. In addition to linear parabolic equations with non-constant coefficients, the method will be applied to certain non-linear equations.

Institute for Advanced Study, Princeton, N. J.
INTEGRATION OF THE GOURSAT PROBLEM BY DIFFERENCE METHODS, by Milton Lees. Rept. on Contract AF 49(638)253. Oct 59, 19p. 6 refs. AFOSR-TN-59-1109.
Order from LC mi$2.40, ph$3.30 PB 145 318

In this paper we employ finite difference methods to solve the Goursat problem for linear and quasi-linear hyperbolic equations in characteristic form. In addition to existence and uniqueness theorems, we derive several approximation theorems. The results are based on an integral inequality for the solutions of the Goursat problem which is similar to the well-known energy inequality for hyperbolic equations. (Author)

Institute for Advanced Study, Princeton, N. J.
ON UNIVALENT FUNCTIONS WITH REAL COEFFICIENTS, by James A. Jenkins. Rept. on Contract DA 36-034-ORD-2453. Dec 58, 20p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 138 578

The object of the present paper is to treat the class of univalent functions with real coefficients using the usual normalization in a unified manner through the medium of the General Coefficient Theorem [3;4, p. 51]. In this way we obtain substantially more complete results than have been obtained before. Among others we obtain the exact domain covered by the image of the unit circle under every such function, the region of values of such functions at a point in the unit circle and new bounds involving the derivative of these functions.

Institute for Advanced Study, Princeton, N. J.
UNIQUE CONTINUATION FOR PARABOLIC DIFFERENTIAL EQUATIONS AND INEQUALITIES, by M. Lees and M. H. Protter. Rept. on Contract AF 49(638)253 and National Science Foundation Grant G-5863. Oct 59, 22p. 8 refs. AFOSR-TN-59-1110.
Order from LC mi$2.70, ph$4.80 PB 145 317

In this paper certain unique continuation theorems are proved for parabolic equations and inequalities. Essentially, these continuation theorems have the following form. If a solution of a parabolic equation (or inequality) exists in a region and vanishes in a subregion, then it vanishes in the original region. As a consequence of one of the continuation theorems, the uniqueness of the first mixed, initial-boundary value problem for "negative time" is proved. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
A METHOD FOR EVALUATING CERTAIN LATTICE SUMS, by A. A. Maradudin and G. H. Weiss. Rept. on Contracts AF 18(600)1015 and 1315). Sep 58, 8p. 6 refs. Technical note BN-148; AFOSR-TN-58-927; AD-204 737.
Order from LC mi$1.80, ph$1.80 PB 137 776

A method for transforming slowly convergent lattice sums into very rapidly convergent sums with the aid of asymptotic expansions is presented, and the method is applied to the evaluation of a class of sums evaluation of a class of sums evaluated previously by Benson and Schreiber by purely numerical methods. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON CERTAIN REFLECTION PRINCIPLES, by E. P. Miles, Jr. Rept. on Contract AF 49(638)81. July 58, 12p. 10 refs. Technical note BN-146; AFOSR-TN-58-702; AD-162 236.
Order from LC mi$2.40, ph$3.30 PB 137 506

A reflection principle was recently established by A. Huber (Communications on Pure and Applied Mathematics 9:471-478, 1956) for functions polyharmonic of order p, applicable when the function and its first p-1 derivatives with respect to x_1 vanish on the hyperplane of reflection $x_1 = 0$. Huber's theorem includes as special cases the classical principle of H. A. Schwarz for harmonic functions and the corresponding results of H. Poritsky (Trans. Am. Math. Soc. 59:248-279, 1946) and R. J. Duffin (Duke Math. J. 22:313-324, 1955) for biharmonics. Assuming that a polyharmonic function of order p, meeting the above conditions on its derivatives, has an analytic continuation across this hyperplane, a locally valid expansion for the function is obtained in terms of its Cauchy data on the hyperplane. From this expansion an alternate reflection principle of limited range is obtained which is shown to be reducible to the Schwarz, Duffin, and Huber principles for $p = 1, 2, 3$, respectively, within their common range of validity. Results for the iterated Laplace equation are used which closely parallel those recently discussed by the author. A brief description is also presented of a corresponding heuristic approach to the reflection principle for the Helmholtz equation treated recently by Diaz and Ludford [Annali di Mathematica Pura ed Applicata, Serie IV, Tomo XXXIX (1955) pp 87-95].

Institute of Mathematical Sciences, New York U., N. Y.
EXTENSIONS OF THE KHINCHINE-WISSER THEOREM, by Harold N. Shapiro. Rept. on Contract Nonr-285(38). Dec 58, 43p. IMM-NYU 253.
Order from LC mi$3.30, ph$7.80 PB 144 854

Wisser provided a much simplified proof of Khinchine's theorem, and at the same time dropped the assumption of stationarity. In this note various extensions of Wisser's result are obtained, which focus on providing subsequences, of given infinite sequences, on which the probability of any finite intersection is bounded from below in a "natural way".

Institute of Mathematical Sciences, New York U., N. Y.
A MULTIPLYING FACTOR METHOD FOR THE SOLUTION OF WIENER-HOPF INTEGRAL EQUATIONS, by B. Noble and A. S. Peters. Rept. on Contracts AF 19(604)5238 and Nonr-285(46). July 59, 7p. 1 ref. Research rept. no. EM-137; AFCRC-TN-59-391; AD-226 646.
Order from LC mi$1.80, ph$1.80 PB 145 066

Institute of Mathematical Sciences, New York U., N. Y.
NOTE ON THE CENTRAL LIMIT THEOREM, by Harold N. Shapiro. Rept. on Contract Nonr-285(38). Feb 59, 13p. IMM-NYU-254.
Order from LC mi$2.40, ph$3.30 PB 144 703

Institute of Statistics, U. of North Carolina, Chapel Hill.
STEP-DOWN PROCEDURE IN MULTIVARIATE ANALYSIS, by J. Roy. Rept. on Contract AF 18(600)83. Dec 57, 18p. 7 refs. Mimeograph series no. 187; AFOSR-TN-58-33; AD-148 072.
Order from LC mi$2.40, ph$3.30 PB 137 711

The step-down procedure is applied to the multivariate analysis of variance and the comparison of variance-covariance matrices in order to derive new tests of significance and simultaneous confidence-bounds on a number of deviation-parameters. The step-down procedure is not invariant under a permutation of the variates and should be used only when the variates can be arranged on a priori grounds. Some advantages of the step-down procedure are that (1) the procedure uses widely known statistics like the variance-ratio; (2) the test is carried out in successive stages and in significance is established at a certain stage, one can stop at that stage; (3) it leads to simultaneous confidence-bounds on certain meaningful parametric functions.

Laboratory of Statistical Research, U. of Washington, Seattle.
ON CONTINUITY OF TRANSITION FUNCTIONS, by R. M. Blumenthal. Technical rept. no. 29 on Contract Nonr-477(11). 21 Oct 57, 11p. 3 refs. AD-148 390.
Order from LC mi$2.40, ph$3.30 PB 137 713

The continuity of transition functions $P(T, x, A)$ of a time-homogeneous Markov process with state-space X is discussed from the standpoint of placing less restrictive properties on the function than was done by J. L. Doob (Stochastic Processes, New York, 1953) and D. G. Kendall (Trans. Amer. Math. Soc. 78:529-540, 1955) when they assumed that for each x in X, $P(t, x, [x]) \to 1$ as $t \to 0$. The following properties are always assumed: (1) for each $t > 0$ and x in X, $P(t, x, \cdot)$ is a measure on $\underline{F}$ with $P(t, x, X) \leq 1$; (2) for each $t > 0$ and A in $\underline{F}$, $P(t, \cdot, A)$ is $\underline{F}$-measurable; and (3) for each $s > 0$, $t > 0$, x in X, A in $\underline{F}$, $P(t+s, x, A) = \int P(t, y, A)(s, x, dy)$. These additional properties are also assumed at various stages in the discussion: (1) for each A in $\underline{F}$, $P(t, x, A)$ defines a function on $(0, \infty) \times X$ which is measurable in (t, x) with respect to

the product Borel field of the Lebesgue measurable subsets of $(0,\infty)$ and $\underline{F}$; and (2) with x fixed, for each A in $\underline{F}$, $\lim_{t\to 0} P(t, x, A)$ exists. F is a Borel filed of subsets of X.

Lloså, R. San Juan.
SEMI-ANALYTICAL FUNCTIONS IN CONVEX REGIONS. Rept. on Contract AF 61(514)1254. [1956] 363p. 65p. AFOSR-TR-59-60; AD-216 625.
Order from LC mi$11.10, ph$56.10 PB 145 097

Contents:
Introduction: Convex functions of a variable and convex plan sets: continuity of convex functions; derivations of converse functions
Chap. 1. Domains and fundamental functions: convex stars and circularly convex domains; the fundamental domains; the fundamental functions
Chap. 2. Fundamental sequences: convex rectified; Faber's minorant and Watson' sequence
Chap. 3. Semi-analyticity and differentiation: auxiliary theorems; semianalytical classes; formal properties of the asymptotical expansions
Chap. 4. Determination of a function by its asymptotical expansion disregarding the bounds sequence: strong-semianalytical functions; decomposition in sum of semianalytical functions; the optimal asymptotic approximation
Chap. 4. Application to summation of divergent series: summation of power divergent series; summation of numerical divergent series

Louisiana State U. [Baton Rouge].
CONTINUOUS HOMOMORPHIC IMAGES OF REAL CLANS WITH ZERO, by Haskell Cohen and I. S. Krule. Rept. on Contract AF 18(603)89. 5 June 58, 6p. 4 refs. AFOSR-TN-58-433; AD-158 237.
Order from LC mi$1.80, ph$1.80 PB 157 437

Maryland U., College Park.
OPERATORS AND THEIR FREDHOLM DOMAIN, by John W. Brace. Rept. on Contract AF 18(603)78. Sep 58, 24p. 19 refs. AFOSR-TN-58-851; AD-203 492.
Order from LC mi$2.70, ph$4.80 PB 138 049

This paper is concerned with the operator $I-\lambda T$, λ a complex number, I the identity mapping, and T a closed linear operator taking a Banach space X into itself. For a given y in X, the goal is to solve the equation $x-\lambda T(x)=y$ for x. The set of complex numbers called the generalized Fredholm domain for T is presented along with appropriate generalizations of the definition of the Fredholm radius. Making use of the Fredholm domain of type I, a very general class of operators having the spectral properties of compact operators is given. In analogy to the Fredholm method for integral equations, a method is given which is applicable in the Fredholm domain of type I. Though this method presupposes information about the eigen values, it may be used in reverse to determine such information.

Michigan U. [Research Inst.] Ann Arbor.
INHERENT ERRORS IN MATRICES WITH STATISTICAL APPLICATIONS, by Joseph Bryce Tysver. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 58, 102p. 74 refs. 2144-213-T; AD-154 973.
Order from LC mi$5.70, ph$16.80 PB 138 467

The class of inherent errors evaluated in this study includes errors due to observation and measurement and does not include computational errors introduced by roundoff. The matrix operations are limited to the solution of linear systems. Additional development is made of the two usual methods of stating the effects of inherent errors: bounds and probability distributions. Second order increments are considered, new expressions for bounds are introduced, and distributional considerations are used in matrix operations for which such treatment is not presently available. An additional method of evaluation involves the determination of maximum values for the errors in the results of matrix operations. Application is made to the statistical problems of linear regression and analysis of variance for one-factor experiments.

Naval Ordnance Test Station, China Lake, Calif.
STURM-LIOUVILLE SYSTEMS WITH GENERALIZED BOUNDARY CONDITIONS, by L. C. Barrett and C. J. Thorne. 5 Aug 59, 27p. 3 refs. NOTS TP 2206; NAVORD rept. 6517; AD-225 490.
Order from LC mi$2.70, ph$4.80 PB 144 855

Theorems listing conditions and proofs are given for mathematical assumptions made in a previous report. Separation theorems locating the characteristics numbers of one-layer problems within intervals are given. (Author)

Naval Weapons Lab., Dahlgren, Va.
ON GENERALIZED GRID SCHEMES AND FINITE DIFFERENCES, by E. W. Schwiderski. 4 Nov 59, 47p. 7 refs. NWL rept. no. 1672.
Order from LC mi$3.30, ph$7.80 PB 144 946

This report introduces the "principle of complete interpretation of initial or boundary conditions" for the integration of partial differential equations which uses the geometry of prescribed domains of operation and the integral at the boundary. Rectangular grid schemes are generalized. The definition of ordinary finite differences is reformulated into new generalized differences. Laplace's equation is illustrated, and applications of generalized differences are cited. (Author)

[Office of Scientific Research and Development].
TABLES OF TRIGONOMETRIC FUNCTIONS TO FIVE SIGNIFICANT FIGURES, AND FOR EVERY TENTH OF A MIL. Sep 43, 330p. 2 refs. AMP rept. no. 24.1.
Order from LC mi$11.10, ph$50.10 PB 145 122

Pennsylvania U., Philadelphia.
HOMOMORPHISMS OF TRANSFORMATION GROUPS, by Robert Ellis and W. H. Gottschalk. Rept. on Contract AF 18(600)1116. 30 Nov 58, 22p. 4 refs. AFOSR-TN-58-874; AD-203 914.
Order from LC mi$2.70, ph$4.80 PB 138 147

Results of the study show that a transformation group with compact phase space and non-compact phase group gives rise to a compact topological group called its structure group. Let (X, T) be a transformation group with compact phase space X and with arbitrary phase group T. There exists least invariant closed equivalence relations S_d and S_e in X such that T is distal on X/S_d and T is equicontinuous on X/S_e. If (X, T) is locally almost periodic, then the 4 relations of S_d and S_e with the proximal and regionally proximal relations coincide. Such transformation groups are partially classifiable according to their structure groups.

P[erkin-]E[lmer] Corp., Norwalk, Conn.
A SINGULAR DIFFERENTIAL BOUNDARY PROBLEM, by David A. Shotwell. Rept. on Contract AF 33(616)5649. 30 Apr 59, 39p. 5 refs. WADC Technical rept. 59-319.
Order from OTS $1.00 PB 161 416

The purpose of this paper is to derive an expansion theorem, valid under suitable restrictions, for a function f(t) which is integrable on $(-\infty, \infty)$.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
PROPERTIES OF SECOND-ORDER CORRELATION FUNCTIONS, by J. Y. Hayase. Thesis. Rept. on Contract DA 36-039-sc-64637. 17 May 57, 68p. 47 refs. Technical rept. 330; AD-201 535.
Order from LC mi$3.90, ph$10.80 PB 145 267

The idea of correlation functions is extended to higher-order correlation functions. A definition of n^{th}-order correlation functions is given, and the general nature of these functions is considered. The emphasis is placed on the case n = 2. A survey of the ideas of stochastic process is given, and it is shown how it serves as a model for messages in a communication system. The second-order autocorrelation functions of periodic, aperiodic, and random functions are computed and plotted. Properties of second-order autocorrelation functions concerning continuity, behavior at the origin, phase effects of harmonics, and so forth, are considered. For periodic and aperiodic functions, the relation between the first- and second-order autocorrelation functions is given. The Fourier transform of second-order autocorrelation functions is investigated and a physical interpretation of this transform is given. Second-order crosscorrelation techniques are used to determine the location of random noise sources. (Author)

Stanford U., Calif.
CONSTRAINT QUALIFICATIONS IN MAXIMIZATION PROBLEMS, by Kenneth J. Arrow, Leonid Hurwicz, and Hirofumi Uzawa. Technical rept. no. 64 on Contract N6onr-25133. 22 Dec 58, 14p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 144 938

Stanford U., Calif.
AN INTEGER LINEAR PROGRAMMING MODEL FOR MACHINE SCHEDULING, by Harvey M. Wagner. Technical rept. no. 66 on Contract N6onr-251(33). 24 Dec 58, 19p. 13 refs.
Order from LC mi$2.40, ph$3.30 PB 144 932

Stanford U., Calif.
STABILITY OF THE GRADIENT PROCESS IN n-PERSON GAMES, by Kenneth J. Arrow and Leonid Hurwicz. Technical rept. no. 67 on Contract N6onr-25133. 29 Dec 58, 18p. 3 refs.
Order from LC mi$2.40, ph$3.30 PB 144 940

Syracuse U., N. Y.
DISCRETE POTENTIAL THEORY AND BOUNDARIES, by J. L. Doob. Research rept. no. 19 on Contract AF 48(638)265. Sep 58, 38p. 12 refs. AFOSR-TN-58-884; AD-204 102.
Order from LC mi$3.00, ph$6.30 PB 138 126

This report outlines the potential theory based on discrete parameter Markov processes and applies it to obtain the Martin exit and entrance boundaries in the chains (countable state space) case. (Author)

Syracuse U., N. Y.
ON SEMI-GROUPS OF POSITIVE MATRICES II, by W. B. Jurkat. Research rept. 21 on Contract AF 49(638)265. Sep 58, 18p. 13 refs. AFOSR-TN-58-931; AD-205 096.
Order from LC mi$2.40, ph$3.30 PB 138 127

Kolmogorov's differential equations of first and higher order are investigated from the viewpoint of semi-groups of positive matrices. (Author) (See also PB 139 320)

University Coll., Cork (Eire).
RESEARCH ON PROPERTIES OF THE COEFFICIENTS IN FOURIER SERIES WITH GAPS, by P. B. Kennedy. Technical (final) rept. on Contract AF 61(514)1399. 15 June 59, 7p. 9 refs. AFOSR-TR-59-115.
Order from LC mi$1.80, ph$1.80 PB 145 278

Size of coefficients in lacunary Fourier series of functions with certain continuity properties; some questions of convergence of such series; applications in regular-function theory.

Uppsala U. (Sweden).
STUDIES IN PERTURBATION THEORY. II. GENERALIZATION OF THE BRILLOUIN-WIGNER FORMALISM. III. SOLUTION OF THE SCHRÖDINGER EQUATION UNDER A VARIATION OF A PARAMETER, by Per-Olov Löwdin. Technical note no. 28 on Contract AF 61(514)1200. 15 June 59, 21p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 145 191

Part II. The solution of the Schrödinger equation by means of the variation principle and a discrete basis

leads to a certain secular equation. In a previous paper it was shown that, if this equation is handled by a partitioning technique, a generalization of the Schrödinger-Brillouin formula is obtained. The procedure contains an inverse matrix, and it is shown here that, if in the expression for the wave function this matrix is approximated to the M^{sh} order, the corresponding matrix in the expectation value for the energy is approximated to order $(2M+1)$. This gives a simple derivation and generalization of the Brillouin-Wigner theorem. The connection between the variation principle and perturbation theory is further discussed. Part III. The solution of the Schrödinger equation by means of the variation principle and a discrete but not necessarily orthonormal basis is studied in the case when the Hamiltonian $T1 = T1(\alpha)$ is a function of a parameter α. The coefficients in the power series expansions in α of the wave function and the energy are explicitly determined in the form of expectation values, and the connection with the conventional Schrödinger theory is discussed. (Author)

Virginia U., Charlottesville.
SEMI-COMPACT MAPPINGS, by Paul McDougle. Technical note no. 5 on Topology and Mathematical Analysis, Contract AF 49(638)72. July 58, 10p. 5 refs. AFOSR-TN-58-768; AD-201 923.
Order from LC mi$1.80, ph$1.80 PB 138 175

The semi-compact mapping property is introduced here for the purpose of relating certain properties that have been of importance in the study of decomposition spaces. Also, since certain equivalences have been established among space property invariants, mapping properties, and decomposition properties it has seemed feasible to introduce a system of spaces and mappings which characterize many decomposition space problems while obviating the decomposition construction. Particular attention is given the case where point inverses are connected and have bicompact boundaries.

Virginia U., Charlottesville.
STATIONARY POINTS FOR FINITE TRANSFORMATION GROUPS, by John Greever. Technical note no. 6 on Topology and Mathematical Analysis, Contract AF 49(638)72. Aug 58, 16p. 9 refs. AFOSR-TN-58-797; AD-202 230.
Order from LC mi$2.40, ph$3.30 PB 138 171

Let X be a finite-dimensional compact Hausdorff space and let G be a group of transformations of X into itself. A corollary to the Lefschetz Fixed Point Theorem asserts that F_G is non-empty when G is cyclic and X is triangulable and homologically trivial over R. From a theorem of P. A. Smith it follows that F_G is non-empty when X is homologically trivial over Z_p and G is of order p^{α}. It is the purpose of this paper to set forth results of this nature for groups of more arbitrary orders than those dealt with by the Lefschetz and Smith Theorems

Washington U., Seattle.
A COMPARISON OF SOME ANALYTIC METHODS OF ROTATION IN FACTOR ANALYSIS, by Edward F. Gocka. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). Feb 59, 169p. 29 refs.
Order from LC mi$7.80, ph$25.80 PB 144 824

The present study does not compare all analytic methods; it is restricted to a comparison of three analytic methods which are regarded as representative of the major trends in current analytic procedures. The results from the analytic procedures are compared with those obtained from known graphical procedures. Properties such as factorial invariance, which are quite adequately demonstrated for the graphical results, are used to evaluate the analytic results. The matrices to be rotated are selected so as to adequately sample the range of all possible positive manifold factor patterns for small matrices which have a complete and determinate simple structure.

Washington U., Seattle.
ON A CLASS OF PARTIALLY ORDERED SETS, by E. Michael. Technical rept. no. 5 on Contract Nonr-477(21). Mar 59, 5p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 145 211

In this note we consider a class of partially ordered sets, called partially well-ordered, and it is shown that they have some simple, desirable properties. As the name suggests, a simply ordered set is well-ordered if and only if it is partially well-ordered. Moreover, it is shown that any subset, finite cartesian product or image under an order-preserving map of partially well-ordered sets is partially well-ordered.

Wayne State U., Detroit, Mich.
STATISTICAL TECHNIQUES IN LIFE TESTING. CHAPTER II. TESTING OF HYPOTHESES, by Benjamin Epstein. Technical rept. no. 3 on Contract Nonr-2163(00). 1 Oct 58, 148p. 5 refs.
Order from LC mi$7.20, ph$22.80 PB 145 341

In the following we shall assume that the underlying p. d. f. of the life-time X is described by

$$f(x;\theta) = \frac{1}{\theta} e^{-x/\theta}, \quad x > 0, \ \theta > 0.$$

Our object is to test various hypotheses regarding the mean life θ on the basis of censored, truncated, or sequential procedures. (See also PB 134 345)

Computing Devices

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE AUTOMATIC DETECTION OF SCALING ERRORS IN AN ORDVAC-TYPE ARITHMETICAL ORGAN, by George W. Reitwiesner. Jan 56, 21p. 7 refs. Memo. rept. no. 966.
Order from LC mi$2.70, ph$4.80 PB 144 653

In preparing programming for the solution of problems by fixed radix calculating machines, programmers must scale the arithmetic to satisfy certain number-size restrictions which exist inherently in the functioning of the machines. In complicated problems this may not always be possible, and considerations of machine solution time may prohibit resort to programmed floating radix operation. A very definite advantage accrues when circuits are incorporated into the machine to recognize unanticipated violations of these restrictions and to effect appropriate alarm action when they occur. The ORDVAC contains no such circuits. All schemes considered heretofore for the addition of such circuits have appeared to require a significant quantity of equipment of distinctive design and function.

Computer Control Co., Inc., Wellesley, Mass.
FEASIBILITY STUDY FOR A KEYBOARD TYPE SELECTOR PLUGBOARD AND PLUGBOARD CHECKER, by Robert E. Michaud. Technical rept. no. 173 on Contract AF 30(602)1728. 20 June 58, 76p. 3 refs. RADC-TN-58-149; AD-148 752.
Order from LC mi$4.50, ph$12.30 PB 137 513

A study has been conducted to determine the feasibility of replacing a plugboard method of connecting logical elements by an automatic method, using a paper tape or a keyboard. Two possible means of implementation were considered: The telephone crossbar and the magnetic transfluxor with associated electronic circuits. The Transfluxor was adjudged to be superior, and a demonstration unit constructed to illustrate the logical design and circuit techniques involved. (Author)

Melpar, Inc., Falls Church, Va.
VOICE DATA PROCESSING SYSTEM, by L. P. Schoene, Jr. Scientific rept. no. 1 on Contract AF 19(604)5579. 15 Oct 59, 121p. AFCRC-TN-59-791.
Order from LC mi$6.30, ph$19.80 PB 144 797

The system programming, the results of a feasibility study, and the design and development of transistorized plug-in modules for a digital Voice Data Processing System are presented. This system, being fabricated to support the development by AFCRC of a speech bandwidth compression technique, is a special purpose computer operating from a 400 kilocycles-per-second clock. Several operational modes are provided to enable use of the Voice Data Processing System as a data accumulating and sorting device and then as a complete communication system simulator. The mathematical design analysis and the description of the operational evaluation tests for one of the circuit modules are included as appendices. (Author)

Michigan U. [Research Inst.] Ann Arbor.
THE LOGIC OF FIXED AND GROWING AUTOMATA by Arthur W. Burks. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 58, 39p. 14 refs. 2144-231-T.
Order from LC mi$3.00, ph$6.30 PB 144 660

Computers may be classified in various ways: discrete versus continuous, synchronous versus asynchronous, deterministic versus probabilistic, fixed versus growing. When the word "automaton" is used in this paper without qualification, it will be to refer to discrete, synchronous, deterministic computers. In Sections 2 through 5 fixed automata are discussed, and, in Section 6, growing automata. Several languages for describing automata and methods for transforming expressions from one language to another are presented, and some general theorems concerning automata are stated and proved. Language and theory are, of course, intimately related: to state theorems about automata one must specify the class of automata under consideration, which can be accomplished by specifying the languages adequate to describe them. Automata languages have considerable practical importance for the process of logical design. (Author)

National Research Labs., Ottawa (Canada).
COMBINED ANALOG-DIGITAL SIMULATION OF ENGINEERING PROBLEMS, by F. W. Pruden. Oct 59, 17p. 7 refs. Mechanical engineering rept. MK-6.
Order from LC mi$2.40, ph$3.30 PB 144 887

A simple, but realistic dynamic system is considered, and the relative advantages of analog and digital methods of solution are investigated. For solution accuracy limited to 3 to 4 decimal digits the analog method is cheaper. However for certain mathematical operations such as long-term integration and generation of complicated functions, digital computer accuracy may be necessary. The coupling of analog and digital machines is discussed, and the relevant sampled-data theory is introduced. The stability of such combined systems in calculations is considered. Finally some examples of combined calculations are given. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INVESTIGATION OF HIGH-FREQUENCY TRANSISTOR LOGIC CIRCUIT FOR DIGITAL APPLICATION, by Thomas Wong. 1 Aug 59, 104p. 18 refs. NOTS-TP-2319; NAVORD rept. 6588.
Order from LC mi$5.70, ph$16.80 PB 145 166

A discussion on the design of a logic module employing junction transistors is given. This package is designed as a standard module for logical operation in a digital computer, and employs "NOR" logic in place of the usual "AND", "OR", and "NOT" functions. In addition, the principle of threshold operation for the "NOR" circuit is introduced; this characteristic increases the versatility of the logical operation. The worst-case design philosophy was employed in the design technique. The circuit analysis of this module includes the various input and output loading conditions. A small-signal equivalent circuit for saturation operation is also presented. (Author)

Springfield Armory, Mass.
CORRECTIONS FOR POTENTIOMETER LOADING IN ANALOG COMPUTER COEFFICIENT POTENTIOMETERS, for E. H. Jakubowski. 6 Mar 59, 34p. Rept. SA-TR20-2807; AD-226 675.
Order from LC mi$3.00, ph$6.30 PB 144 941

A set of tables containing correction factors, which must be added to a potentiometer to compensate for

loading due to an input resistor of finite value, is presented. Procedure is described, and calculations given. (Author)

University of Southern California, Los Angeles.
THE ROLE OF HUMANS IN COMPLEX COMPUTER SYSTEMS: A DESCRIPTION OF THE STUDY, by Glenn L. Bryan, Joseph W. Rigney and others. Technical rept. no. 24 on Contract Nonr-228(02). Jan 59, 62p. 4 refs.
Order from LC mi$3.90, ph$10.80 PB 145 022

This report describes the background, rationale, and procedures employed to study personnel problems connected with programming and maintaining general purpose digital computers. Fifty computer locations were visited. Interview, observational, and questionnaire data were collected. Brief descriptions of the various data-collection techniques are presented. The substantive findings will be presented in the next three technical reports of this series. (Author)

University of Southern Calif., Los Angeles.
THE ROLE OF HUMANS IN COMPLEX COMPUTER SYSTEMS: MAINTENANCE, by Glenn L. Bryan, Joseph W. Rigney and others. Technical rept. no. 26 on Contract Nonr-228(02). Jan 59, 102p. 8 refs.
Order from LC mi$5.70, ph$16.80 PB 145 020

This investigation was designed (1) to observe and describe maintenance requirements and practices for digital computer systems now in use, (2) to examine the methods for screening, training, and evaluating computer technicians, and (3) to obtain up-to-date information on the organization and supervision of computer maintenance work. Visits were made to 50 representative computing centers in the United States. on-site information was collected by means of observation, questionnaires, and interviews. The results presented provide a state-of-the-art summary regarding human factors problems in computer maintenance; they also serve to define computer personnel problems where future data are most needed.

University of Southern California, Los Angeles.
THE ROLE OF HUMANS IN COMPLEX COMPUTER SYSTEMS: PROGRAMMING, by Glenn L. Bryan, Joseph W. Rigney and others. Technical rept. no. 25 on Contract Nonr-228(02). Jan 59, 81p. 4 refs.
Order from LC mi$4.80, ph$13.80 PB 145 021

This report describes the results of research undertaken to develop and organize information about the role of humans in programming digital computers. It discusses programming practices and problems and pays special attention to the selection, training, and utilization of programmers. Information was collected by visiting 50 computers centers engaged in business, scientific, and military data-processing. Interviews, questionnaires, and direct observation were among the techniques used. Programming was found to be a process requiring the best talents of many different people. It appears that what is needed most for successful programming is a broad enough approach on the part of planners to encompass the diverse problems that are inevitable, but that so often are overlooked when programming is undertaken by a new group. A list of 50 summary statements is presented in the concluding section of the report. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
ON THE CONCEPTS OF A PROBLEM AND PROBLEM-SOLVING, by Richard Bellman and Paul Brock. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 26p. 12 refs. Rept. no. 2144-352-R.
Order from LC mi$2.70, ph$4.80 PB 145 108

This report discusses the concepts of a problem and problem-solving from the view point of concepts and limits of large-scale computers as a mathematical tool for the solution of major problem areas in modern technology. Typical problem areas include military ones such as combat surveillance and air defense. (Author)

MECHANICS

Ballistic Research Labs., Aberdeen Proving Ground, Md.
LAWS FOR LARGE ELASTIC RESPONSE AND PERMANENT DEFORMATION OF MODEL STRUCTURES SUBJECTED TO BLAST LOADING, by W. E. Baker, W. O. Ewing, Jr. and J. W. Hanna. Dec 58, 56p. 10 refs. Rept. no. 1060.
Order from OTS $1.75 PB 161 446

A model law is developed for scaling of response to blast loading of structures which undergo large elastic and plastic deformations. In the derivation of the model law, strain-rate and gravity effects are assumed negligible. The geometrical scaling of response predicted by the law is verified by a series of experiments on small cantilever beams. (Author)

Bolt Beranek and Newman, Inc., Cambridge, Mass.
DAMPING OF FLEXURAL VIBRATIONS BY ALTERNATE VISCO-ELASTIC AND ELASTIC LAYERS, by Eric E. Ungar, Donald Ross, and Edward M. Kerwin, Jr. Rept. for Dec 58-July 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. Nov 59, 45p. 10 refs. WADC Technical rept. 59-509.
Order from OTS $1.25 PB 161 425

A general analysis of damping due to N equal tapes is presented; the effect of using non-equal tapes is investigated for double tape applications. Suitable dimensionless parameters are used where possible in order to maintain generality. Previous work dealing with the damping of flexural vibrations by application of single "damping tapes" consisting of metal foils and dissipative adhesives is summarized and extended to multiple tapes. It is shown that additional tapes provide a considerable increase in damping at low frequencies, but only a very small increase at high frequencies. It is found that multiple tapes and single tapes incorporating an equivalent amount of metal provide nearly the same damping, a fact which results in great design flexibility. Experimental and theoretically predicted results are shown to be in reasonabl/ good agreement. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE CONTACT PROBLEM FOR VISCOELASTIC BODIES, by E. H. Lee and J. R. M. Radok. Technical rept. no. 47 on Contract Nonr-562(10). Jan 59, 31p. 13 refs. C11-47.
Order from LC mi$3.00, ph$6.30 PB 144 863

The contact problem in viscoelasticity is one in which different types of boundary conditions are prescribed depending on whether boundary points inside or outside the region of contact are considered. Since, in general, the contact region varies with time, this leads to a problem which cannot be treated directly by application of the Laplace transform, which has formed the basis for most published viscoelastic stress distribution solutions. It is shown that the solution of the viscoelastic counterpart of the Hertz problem in elasticity can be deduced from the elastic solution by the method of functional equations. A particular example is presented, and the marked effect of viscoelastic behavior on the pressure distribution in the contact region is illustrated.

Brown U. Div. of Engineering, Providence, R. I.
A DIFFERENTIAL STRESS-STRAIN RELATION FOR THE HEXAGONAL CLOSE-PACKED ARRAY OF ELASTIC SPHERES, by J. Duffy. Technical rept. no. 3 on Contracts Nonr-562(14) and Nonr-266(09). Oct 57, 15p. 5 refs. 562(14)/3; AD-145 022.
Order from LC mi$2.40, ph$3.30 PB 137 548

A differential stress-strain relation is derived for a medium composed of a hexagonal close-packed array of elastic spheres in contact. The stress-strain relation is based on the theory of elastic bodies in contact, and includes the effects of both normal and tangential components of contact forces. Results are presented for an experiment performed as a test of the differential stress-strain relation. (Author)

[Defense Atomic Support Agency] Washington, D. C.
RESPONSE OF A FIXED ENDED RIGID FRAME TO TRANSIENT LOADING, by R. C. DeHart. 1 Nov 57, 40p. 3 refs. AFSWP-613; AD-151 333.
Order from LC mi$3.00, ph$6.30 PB 145 400

The response of a fixed ended rigid frame subjected to time dependent forces is determined. The Lagrange equation of motion, written in terms of the generalized coordinates for each of several normal modes, is used. The analysis shows that if the column mass is large and the time dependent concentrated load is applied at the column top, a rigid frame containing columns with fixed ends has a quite different bending moment response than an identical rigid frame containing pinned rather than fixed ends. For the case in which the dynamic load is uniformly distributed along a column, there is essentially no difference between the response of the frame with fixed ended columns and the response of the frame with pin ended columns. Changing the column ends from a pinned to a fixed condition does not materially change the time dependent deflections of the frame.

Illinois U., Urbana.
VIBRATIONS OF PRISMATIC BARS INCLUDING ROTATORY INERTIA AND SHEAR CORRECTIONS, by J. G. Sutherland and L. E. Goodman. Technical rept. on Contract N6ori-71, T.O. 6. 15 Apr 51, 28p. 16 refs. ATI-122 886.
Order from LC mi$2.70, ph$4.80 PB 138 124

The natural frequencies of beams, as predicted by the classical Bernoulli-Euler theory, are known to be slightly higher than those obtained in carefully controlled experiments. The difference between theory and experiment is almost completely removed, however, if consideration is given to the influence of rotatory inertia and shear deformation. This was first done by Timoshenko. Others who have contributed to an understanding of the importance of these effects include Jacobsen, Mindlin, Kruszewski, Fife and Wilbur, and E. Reissner.

Institute of Flight Structures, Columbia U., New York.
SHEAR BUCKLING OF BARS, by G. Herrmann and A. E. Armenakas. Technical note no. 3 on Contract AF 49(638)430. Oct 59, 14p. 1 ref. CU-7-59-AF-430-CE; AFOSR-TN-59-1016; AD-228 828.
Order from LC mi$2.40, ph$3.30 PB 144 762

It is shown that a perfectly straight bar, subjected to a state of uniform shear stresses will buckle, in a manner similar to a column under compression, if the shear stress exceeds a certain critical value. The buckling equations are obtained by the Newtonian approach, and also by the application of the principle of minimum potential energy. In order to provide additional insight into this buckling mechanism, a simple model is introduced and analysed. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
ON FINITE DEFORMATIONS OF AN ELASTIC ISOTROPIC MATERIAL, by Fritz John. Rept. on Contract AF 49(638)161. Oct 58, 69p. 6 refs. IMM-NYU-250; AFOSR-TN-58-955; AD-205 348.
Order from LC mi$3.90, ph$10.80 PB 138 255

This report contains some results on finite deformations of an ideal elastic material. The first chapter deals with a purely geometric question, which is quite independent of the physical properties of materials. Chapter II gives an exposition of the classical equations for ideal elastic isotropic materials. The relations

$$q_{ik} = \frac{\partial U(p)}{\partial p_{ik}}$$

between p and q which take the place of the stress strain relations are analyzed in more detail in Chapter III. In Chapter IV we consider changes in potential energy resulting from changes in the transforma-

tion x' = f(x). Chapters V and VI derive the equations for bending of thin plates using Lagrange coordinates.

Martin Co., Baltimore, Md.
COMBINED EFFECTS OF AXIAL LOAD, THERMAL STRESS, AND CREEP IN FLAT PLATES, by P. C. Huang and C. J. Van Der Maas. Rept. for 1 Nov 56-31 Aug 57 on Structures Research at Elevated Temperature, Contract AF 33(616)3617. Mar 58, 145p. 3 refs. WADC Technical rept. 57-442.
Order from OTS $2.75 PB 161 087

This report presents methods for calculating the stresses and strains in unevenly heated flat plates. The methods are limited to the analysis of loadings in the plane of the plate and to temperature and strain distributions which are one-dimensional. The effects of plasticity, creep, and stability have been considered. Several experiments using 2024-T4 bare aluminum plates are reported in detail. It is concluded that the analytical methods have been verified by the experimental data. (Author)

Martin Co., Baltimore, Md.
COMBINED EFFECTS OF AXIAL LOAD, THERMAL STRESS, AND CREEP IN FLAT PLATES. LARGE DEFLECTION ANALYSIS OF BUCKLED PLATES UNDER THERMAL EFFECTS, by P. C. Huang and C. J. Van Der Maas. Rept. for 1 Oct 58-15 Jan 59 on Structures Research at Elevated Temperature, Contract AF 33(616)3617. Feb 59, 30p. WADC Technical rept. 57-442, supplement 1.
Order from OTS $0.75 PB 161 087-S-1

This report presents a method for calculating the post-buckling deflections, stresses, and strains in simply-supported flat plates which are evenly or unevenly heated. The analysis method is limited to uniaxial elastic-loads in the plane of plate and to one-dimensional temperature distribution. The method is applied to particular examples to demonstrate its use for calculating critical buckling loads and post-buckling behavior of plates subjected to the following temperature distributions: uniform, hot at the center varying linearly to cool at the edges, and cool in the center varying linearly to hot at the edges. The deflections and stresses resulting from these conditions are compared. An experimental verification for the method was sought using compression-buckling data from three tests. It was found that the theoretical data correlate satisfactorily with the experimental data. (Author)

Minnesota U., Minneapolis.
STEADY STATE RESPONSE OF A SIMPLE SYSTEM WITH A HYSTERETIC SPRING, by Edward R. Rang. Rept. for 1 June-31 Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. July 59, 22p. 10 refs. WADC Technical rept. 59-121; AD-227 099.
Order from OTS $0.75 PB 161 091

The response of a simple spring-mass system is studied. The spring characteristics are chosen to simulate hysteresis loops found for systems in which the damping is due to the energy dissipation of materials or fabricated joints. Procedures for approximate calculation are outlined and an example is given. (Author)

Naval Research Lab., Washington, D. C.
MECHANICAL IMPEDANCE AS A TOOL FOR SHOCK OR VIBRATION ANALYSIS, by R. O. Belsheim and J. W. Young, Jr. Interim rept. 15 Feb 60, 31p. 78 refs. NRL rept. 5409.
Order from OTS $1.00 PB 161 022

This report introduces mechanical impedance to those already familiar with classical vibration theory. The impedance term is defined and discussed in detail. The analog between mechanical and electrical systems is noted and electrical circuit theorems which are especially applicable to mechanical systems are presented. In order to provide an introduction to the impedance concept, several simple mass-spring-dashpot systems are analyzed to obtain their impedance and the results are presented graphically. Since most structures are too complicated to yield to an analytical determination of impedance, methods for experimentally measuring mechanical impedance are discussed. Applications of impedance techniques for the general analysis of some shock and vibration problems are discussed. Material throughout the report is referenced and a fairly complete bibliography is included for those who would like more detailed information. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
NON-HOMOGENEOUS ELASTICITY, by Michael A. Sadowsky and Martin A. Goldberg. Rept. on Contract AF 49(638)202. Nov 58, 107p. 1 ref. AFOSR-TR-58-156; AD-162 280.
Order from LC mi$5.70, ph$16.80 PB 137 778

The report contains: table of notations; relations between coefficients of elasticity; orientational introduction; the problem of non-homogeneous elasticity in its general insoluble formulation; the principle of selective specializations leading to soluble cases; the generalized forms of the potential and bipotential equations; results for μ = const. and non-homogeneous elastic body in which the stress function equation in plane strain or plane stress remains $\Delta^4 \phi = 0$ or acquires additional linear terms with constant coefficients.

Watertown Arsenal Labs., Mass.
BUCKLING OF SHALLOW SPHERICAL SHELLS, by John F. Mescall. Nov 59, 23p. 13 refs. Technical rept. no. TR-836.32/1.
Order from LC mi$2.70, ph$4.80 PB 144 800

The buckling of a shallow spherical shell under uniform external pressure is investigated by application of the condition that the second variation of the total potential energy of the shell vanish. An approximate numerical estimate of the buckling pressure is obtained by means of a Rayleigh-Ritz procedure. (Author)

Aerodynamics and Pneumatics

AER, Inc., Pasadena, Calif.
THEORETICAL STUDY OF THE INFLUENCE OF BLEED AREA ON AERODYNAMIC GROUND-INTERFERENCE PHENOMENA, by T. Kubota. Rept. on Contract N123(60530)14510A. 31 Mar 59, 98p. 9 refs. Technical rept. 115 (114-9-1); NOTS-TP 2324; NAVORD rept. 6592.
Order from LC mi$5.40, ph$15.30 PB 144 985

A theoretical analysis is carried out to determine the effects of bleed area on the ground interference of high-speed test sleds. At subsonic speeds a method is presented for estimating the bleed area effect of a lifting surface in an infinitely deep channel. For slender bodies an estimation of the bleed area effect is obtained by considering the two-dimensional flow in a transverse plane. At transonic speeds the transonic slender wing theory is extended to the case of ground interference, and the problem is reduced to that of finding a two-demensional incompressible flow in a transverse plane and an axisymmetric transonic flow around an equivalent body of revolution. Finally, at supersonic speeds the ground interference effects on slender bodies of revolution are analyzed by the method of Laplace transformation. (Author)

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
AN EXPLORATORY INVESTIGATION OF SOME AERODYNAMIC HEATING EFFECTS ON FLUTTER, by Sidney I. Gravitz. Rept. on Contract AF 49(638)219 Sep 58, 94p. 34 refs. ASRL Technical note 74-1; AFOSR-TN-58-972; AD-205 600.
Order from LC mi$5.40, ph$15.30 PB 138 125

An experimental and theoretical investigation is made of the effects of rapid change in Mach number on the flutter characteristics of supersonic wings; and the feasibility of utilizing a heated model in a low stagnation temperature wind tunnel to observe aerodynamic heating effects is studied.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
MEASUREMENT OF PRESSURE DISTRIBUTIONS ON AN OSCILLATING WEDGE IN SUPERSONIC FLOW, by John R. Martuccelli. Rept. on Contract NOas-58-313-d. Oct 58, 43p. 7 refs. Technical rept. 71-2; NAVAER-5151; AD-210 874.
Order from LC mi$3.30, ph$7.80 PB 144 950

A series of pressure distributions over a wedge oscillating in pitch in a two-dimensional supersonic flow are presented for two Mach numbers, two surface angles, and three amplitudes of oscillation. In general the pressure amplitudes lie on or slightly above those predicted by linearized theory, while the phase angles are much lower than the theoretical values. A theoretical investigation, confirmed by a limited amount of experimental evidence, is also presented to show that flow discontinuities may be causing significant errors in the pressure measurements. (Author)

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME BIBLIOGRAPHY. PART II. VOLUME 3, CONFIGURATIONS, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 81p. 297 refs. WADC Technical rept. 55-99; Pt. 2, vol. 3; AD-74 499.
Order from LC mi$4.80, ph$13.80 PB 145 065

Contents:
Types of construction
Exposed components
- Airfoils (wings, fins and stabilizers, control surfaces)
- Fuselage
- Nose cone
- Radomes
- Canopies and astro-domes

Cooling (and heating) systems for exposed components
- Convection cooling
- Transpiration (sweat) and film cooling
- Ablation (melting surface) cooling

Joints
- Welds
- Riveted joints
- Brazed joints
- Adhesive bonded joints
- Surface to surface joints

Airesearch Mfg. Co., Phoenix, Ariz.
AERODYNAMIC CRITERIA FOR OPTIMUM DESIGN OF MIXED-FLOW IMPELLERS: EXPERIMENTAL RESULTS FOR IMPELLERS I AND IB, by J. L. Dussourd, N. Van Le, and D. E. Lewis. Rept. on Research on Mixed-Flow Compressors for Small Turbomachinery Application, Contract AF 33(616)2940. July 58, 152p. 13 refs. Rept. no. GT-5944-R; WADC Technical note 58-88.
Order from LC mi$7.50, ph$24.30 PB 144 669

This technical note reports the experimental results obtained on the performance of two mixed-flow impellers, designated as I and IB. These impellers are two of a series designed to provide information in formulating criteria for the aerodynamic designs of such compressors. Impellers I and IB represent compressor components aimed at a 5:1 pressure ratio and approximately 400 lb per min flow capacity. They are identical in meridonal shape, have identical inlet and exit conditions, have "medium-loaded" blades, and differ only in their respective blade shapes. The blade shape is such that the loading distribution is different, Impeller IB having a more highly loaded inducer. Each impeller, coupled with a vaneless diffuser, was tested extensively. Recorded test information includes over-all compressor calibration, impeller inlet survey data of total and static pressure, exit survey data of yaw angle, total pressures and temperatures at several peripheral positions, and shroud static pressures. The results indicate that little performance difference is detectable between the two impellers under all operating conditions. A discussion is presented of the performance results at conditions of subsonic, transonic, and supersonic flow relative to the inducer. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
INSTRUMENTATION FOR THE 5-IN. HYPERSONIC WIND TUNNEL AT FOREST GROVE STATION, by C. T. Holliday. Rept. on Contract NOrd-7386.
1 Oct 49, 50p. CM-576.
Order from LC mi$3.30, ph$7.80 PB 145 446

The requirements for satisfactory instrumentation of the blow-down type of wind tunnel differ somewhat from the requirements of the more conventional type of wind tunnel that is designed for continuous operation. Since static temperatures and pressures are very high and the time of supersonic flow is short the wind tunnel must be operated safely and automatically, and all data recording instruments must be automatic in operation and have a sufficiently high frequency response to accurately record all significant information. This report describes briefly the instrumentation of the five-inch hypersonic wind tunnel at the Forest Grove Station (near Silver Spring, Maryland) of the Applied Physics Laboratory, The Johns Hopkins University.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ENGINEERING DESIGN OF A WAVE SUPERHEATER FACILITY FOR HYPERSONIC RESEARCH AND DEVELOPMENT, by J. E. Carpenter. Rept. on Contract AF 18(603)141. Feb 59, 332p. 11 refs. Rept. no. AD-1118-A-2; AFOSR-TN-59-108; AD-210 224.
Order from LC mi$11.10, ph$51.60 PB 145 085

The engineering problems associated with the development of the 9000°R. Wave Superheater are presented in considerable detail. Included are the approaches that were pursued to attain a sound solution and the reasons for selecting the final engineering configurations. The major portion of the report is concerned with equipment selection and the background of engineering information required to perform the selection. Several Appendices are included which report in detail the results of various analytical and experimental studies. Specifications for the major items of purchased equipment are also included. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
MODIFICATIONS OF THE BASIC SHOCK TUBE TO IMPROVE ITS PERFORMANCE, by Anthony L. Russo and A. Hertzberg. Rept. on Contract AF 18(603)10.
Aug 58, 50p. 11 refs. Rept. no. AD-1052-A-7; AFOSR-TN-58-716; AD-162 251.
Order from LC mi$3.30, ph$7.80 PB 144 524

Basic modifications are considered which would improve the performance of shock tubes in producing higher shock strengths and extend the use of hydrogen in generating strong shock waves in air. These modifications are the double-diaphragm driver with monatomic buffer gases and an area contraction at the diaphragm station. The results of this investigation indicate that the use of a shock tube with an area contraction and the proper monatomic buffer gas will permit the generation of strong shock waves, using cold hydrogen as a driver gas, with overall pressure ratios comparable to those required for combustion drivers. It is also shown that, by using a buffer gas with the proper atomic weight, the downstream diaphragm pressure ratio may be controlled to minimize the mass of the downstream diaphragm.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
STUDIES OF CHEMICAL NONEQUILIBRIUM IN HYPERSONIC NOZZLE FLOWS, by J. Gordon Hall and Anthony L. Russo. Rept. on Contract AF 18(603)141. Nov 59, 62p. 20 refs. Rept. no. AD-1118-A-6; AFOSR-TN-59-1090.
Order from LC mi$3.90, ph$10.80 PB 144 945

Analyses have been made of chemical nonequilibrium effects in pseudo-one-dimensional nozzle flows where the working fluid is a mixture of a dissociating species and inert diluent. Numerical examples computed on a high-speed digital machine are given for the critical flow of pure oxygen at a reservoir temperature of 5900°K over a wide range of reservoir pressures. From the examples discussed it appears that high reservoir pressures are essential to avoid significant nonequilibrium effects in hypersonic wind tunnel test flows of air and in rocket nozzle flows employing hydrogen-like propellants. For the rocket nozzle, the net effect of nonequilibrium is to make the specific impulse for infinite expansion ratio only weakly dependent on chamber pressure for a given chamber temperature.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
CALCULATION OF THE CROSS-STREAM WAVE LENGTH OF THE THREE-DIMENSIONAL TRANSITION PATTERN IN THE BOUNDARY LAYER ALONG A FLAT PLATE, by John R. Weske. Rept. on Contract AF 18(600)893. Nov 58, 30p. 10 refs. Technical note BN-150; AFOSR-TN-58-864; AD-203 671.
Order from LC mi$2.70, ph$4.80 PB 137 785

Observed three-dimensional transition motions in the boundary layer showing a pronounced pattern recurring periodically across the stream are analyzed under the assumption that secondary vorticity is a controlling factor and that viscous effects are of minor consequence. An optimum cross-stream wave length was computed which is numerically in agreement with experimental observations. The results of the computation point to the emergence of composite periodic vortex configurations. (Author)

Institute for System Research U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING ON AN AIR VEHICLE: A REVIEW OF THE LITERATURE [PART 23] by M. Z. Krzywoblocki. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689.
Dec 59, 345p. 2183 refs. WADC Technical note 56-360, Part 23; AD-161 021.
Order from OTS $5.00 PB 161 442

The work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The present segment of the work includes material reviewed by the author in the period July-Sep 57. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly; others are listed without comment. (Author) (See also PB 161 140)

Institute of Engineering Research, U. of California, Berkeley.
SLIP FLOW OVER A SHORT FLAT PLATE, by J. A. Laurmann. Doctoral thesis. Technical rept. on Contract Nonr-222(45). 26 Dec 57, 37p. 9 refs. HE-150-152; Series no. 20, issue no. 116; AD-155 324.
Order from LC mi$3.00, ph$6.30 PB 138 005

Solutions of the compressible flow Navier-Stokes equations have been obtained for the problem of slip flow over a short flat plate at zero angle of attack by linearization for small values of the ratio of the plate length to the mean free path of the gas. A closed form solution was found possible in the incompressible case; in the compressible case a general discussion has been given in terms of splitting of the solution into transverse and longitudinal waves. It was found that the effect of viscous terms of order higher than boundary layer theory extends over distances at the leading and trailing edges of the order of $\sqrt{\nu}$, and thus in many practical cases of interest are negligible. (Author)

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
THE DISSOCIATION OF A PURE DIATOMIC GAS IN A LAMINAR BOUNDARY LAYER ON AN ADIABATIC FLAT PLATE, by Gianni Jarre. Technical note 10 on Contract AF 61(514)1124.
Sep 58. 22p. 4 refs. AFOSR-TN-58-944; AD-205 082.
Order from LC mi$2.70, ph$4.80 PB 138 057

The present paper deals with the problem of the dissociation, produced by the friction heating, in a pure diatomic gas in a laminar boundary layer on an adiabatic flat plate at hypersonic Mach numbers. Two different and simplified methods are applied and give almost the same numerical laws describing the temperature-decay at the wall at the approaching of the chemical equilibrium state. Two numerical examples show that the considered case of dissociation is a very slow process. (Author)

Massachusetts Inst. of Tech., Cambridge.
GAS DYNAMICS OF FREE MOLECULE FLOW, by Alar Toomre. Rept. on Contract AF 49(638)207.
Mar 58, 41p. 10 refs. Fluid Dynamics Research Group rept. no. 58-2; AFOSR Technical note no. 58-787; AD-202 114.
Order from LC mi$3.30, ph$7.80 PB 144 982

The influence of a solid object upon the velocity distribution of gas atoms in free molecule flow is studied. A concept of shadow flow makes it possible to consider two distinct velocity categories, and in principle facilitates the calculation of the velocity distribution function at any point in space. The interaction with the surface is considered in detail. The cosine dependence of diffuse reflection, in particular, is shown to be useful. (Author)

National Research Labs., Ottawa (Canada).
HALF-MODEL MEASUREMENTS OF LONGITUDINAL FORCE AND MOMENT CHARACTERISTICS OF AGARD MODEL 'B' AT SUBSONIC AND SUPERSONIC SPEEDS, by J. G. Laberge. Dec 59, 30p. 5 refs. Aeronautical rept. LR-267.
Order from LC mi$2.70, ph$4.80 PB 144 884

This report presents longitudinal force and moment characteristics of AGARD model 'B' as measured on a half model in the N. A. E. 30-inch x 16-inch high speed wind tunnel, over a Mach number range from 0.375 to 2.03. (Author)

Naval Ordnance Test Station, China Lake, Calif.
PRESSURE AND WAVE DRAG COEFFICIENTS FOR HEMISPHERES, HEMISPHERE-CONES AND HEMISPHERE-OGIVES, by Jerome R. Katz.
21 Mar 58, 23p. 13 refs. NOTS-1947; NAVORD rept. 5849; AD-159 801.
Order from LC mi$2.70, ph$4.80 PB 144 989

Experimental pressure and wave drag coefficients for hemispheres, hemisphere-cones, and hemisphere-ogives were compiled and compared with modified Newtonian theory for a wide range of Mach numbers. (Author)

Naval Weapons Lab., Dahlgren, Va.
TRANSONIC FLOWS PAST BLUNT BODIES OF REVOLUTION WITH DETACHED SHOCK WAVES, by E. W. Schwiderski. 2 Dec 59, 63p. 16 refs. NWL Rept. no. 1673.
Order from LC mi$3.90, ph$10.80 PB 145 153

An investigation of the intrinsic analytic properties of the quasi-linear mixed flow yields a flow model which contradicts the common well-known flow pattern in some fundamental points. Basically new concepts are formed which consider the whole transonic flow as an entirety. Based on the new flow model a numerical method is developed which constructs regular analytic transonic flow elements as an entirety. The method is founded upon generalized grid schemes and finite differences which were introduced in NWL Report No. 1672. The principal ideas of this method will be used for the construction of the final solution to the shock wave problem in a future report. The described method is programmed for NORC. The complete program and numerous samples of transonic flow elements will be given in another NWL Report. In this report only one example is discussed in detail.

Rensselaer Polytechnic Inst., Troy, N. Y.
SIMPLE SHEAR FLOW PAST A FLAT PLATE IN AN INCOMPRESSIBLE FLUID OF SMALL VISCOSITY, by Ting Yi Li. Rept. on Contract AF 18(600)1591. July 58, 47p. 15 refs. TR AE 5813; AFOSR-TN-[58]-718; AD-162 253.
Order from LC mi$3.30, ph$7.80 PB 137 905

We shall consider the simple shear flow past a flat plate in an incompressible fluid of small viscosity. This problem has been discussed in a number of recent articles by the present writer. However, in these articles the present writer did not expand his viewpoints fully mainly because of the limitation of these articles' length, and consequently there exist a number of obscure points which call for further discussion. In the present report, therefore, the author shall attempt to bring forth a more complete account of his solution.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
A TECHNIQUE FOR EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER FROM A SURFACE IN SUPERSONIC FLOW AT LARGE SURFACE-TO-FREE-STREAM TEMPERATURE RATIOS, by W. S. Bradfield, A. R. Hanson and others. Rept. on Contract AF 18(603)16. June 58, 31p. 5 refs. Research rept. no. 150; AFOSR-TR-58-64; AD-158 252.
Order from LC mi$3.00, ph$6.30 PB 144 952

A description is given of an experimental technique for studying heat transfer at high temperatures. The direction of heat flux is from the surface to the boundary layer. Preliminary values of local convective and radiative heat transfer are reported. Some data are given on the deterioration of graphite surfaces coated with silicon nitride and silicon carbide. (Author)

Technische Hochschule, Munich (West Germany).
RIEMANN'S PROBLEM FOR A LAVAL-NOZZLE, I. HYDRAULIC APPROXIMATION, by Rudolf Schätz. Technical note no. 9 on Contract AF 61(514)1080. 12 Aug 59, 23p. 5 refs. AFOSR-TN-59-709.
Order from LC mi$2.70, ph$4.80 PB 145 296

This report discusses hydraulic approximation of RIEMANN's problem, i.e., the determination of flow arising from discontinuous initial pressure distribution, for LAVAL nozzles, presenting a detailed analysis of numerical features of difference methods employed. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

Air Force Cambridge Research Center, Bedford, Mass.
A RELATIVISTIC TREATMENT OF STRONG SHOCK WAVES IN A CLASSICAL GAS, by Arnold W. Guess. Dec 59, 40p. 12 refs. GRD Research Notes no. 27; AFCRC-TN-59-642.
Order from OTS $1.00 PB 161 430

The relativistic Rankine-Hugoniot conditions of Taub are extended to include radiation pressure and energy density. The equations are specialized to the case of a classical gas in front of the shock (neglect of pressure and internal energy compared to rest mass energy density) and found to give strong shocks. Solutions are obtained separately for the cases of a pure material gas and a pure radiation gas behind the shock.

Experimental Towing Tank, Stevens Inst. of Tech., Hoboken, N. J.
AN EXPERIMENTAL STUDY OF THE EFFECT OF EXTREME VARIATIONS IN PROPORTIONS AND FORM ON SHIP MODEL BEHAVIOR IN WAVES, by Edward Numata and Edward V. Lewis. Rept. on Contract Nonr-263(10). Dec 57, 55p. 10 refs. Rept. no. 643; AD-154 980.
Order from LC mi$3.60, ph$9.30 PB 138 220

Results are presented of tests in regular and irregular waves of five models varying widely in form and proportions. Comparisions are given both among these models and with models tested in connection with other projects. It is shown that a low displacement-length ratio is a distinct advantage for reducing amplitudes of motions and, hence, for increasing speed at sea provided freeboard is adequate. The good sea performance of certain small craft with high displacement-length ratios appears to result mainly from ample free-board and, to a lesser extent, their V-form sections. It is shown that a good estimate of comparative performance of models of different form and proportions in irregular head seas can be obtained by suitable non-dimensional plots of motion amplitudes in regular waves of various lengths.

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
MODIFICATION AND FLOW CALIBRATION OF TEST SECTION OF HIGH-SPEED WATER TUNNEL, by Robert W. Kermeen. Summary rept. on Task 4, Contract NOrd-16200. Dec 58, 7p. 3 refs. Rept. no. E-73-10; AD-210 194.
Order from LC mi$1.80, ph$1.80 PB 145 273

The test section of the High-Speed Water Tunnel (Trans. ASME, vo/, 70, no. 5, p. 437-457, July 48) was modified in preparation for experiments on the force and cavitation characteristics of torpedo fins and control surfaces mounted on a reflection plane. The modification involved installing a reflection plane in the 14-inch diameter working section of the tunnel. The reflection plane is described and the results of flow calibrations of the tunnel test section with the reflection plane installed are given. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON THE ORIGIN AND MECHANISM OF VORTEX MOTION AT THE INLET OF INTAKES PLACED NEAR A FLAT SURFACE, by J. R. Weske. Rept. on Contract AF 18(600)893. Nov 58, 27p. 4 refs. Technical note BN-152; AFOSR-TN-58-863; AD-203 672.
Order from LC mi$2.70, ph$4.80 PB 137 784

Occurrence of vortex motion at the inlet of intakes is traced to the effect of the free flow upon the motion

in the boundary layer along the plate and to the generations of secondary vorticity. The flow is investigated experimentally and by preliminary theoretical analysis. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
A SOLUTION OF THE EQUATIONS OF STATISTICAL MECHANICS, by Robert M. Lewis. Rept. on Contract AF 49(638)341. Nov 59, 23p. 5 refs. Research rept. HT-3; AFOSR-TN-59-1216.
Order from LC mi$2.70, ph$4.80 PB 144 970

The solution of the initial value problem for Bogoliubov's functional differential equation of non-equilibrium statistical mechanics is obtained. This solution is then expanded in an infinite power series in the density which has the advantage that the calculation of the leading terms requires the solution of s-body problems only for small values of s. A derivation of the equilibrium equation by reduction from the non-equilibrium equation is included. (Author)

Iowa Inst. of Hydraulic Research, Iowa City.
THE ADDED MASSES OF PROLATE SPHEROIDS ACCELERATING UNDER A FREE SURFACE, by M. R. Bottaccini. Rept. on Contract Nonr-1611(01). Jan 59, 54p. 17 refs.
Order from LC mi$3.60, ph$9.30 PB 144 680

In this study we shall concern ourselves with the resistance of a fluid (treated as inviscid) to the acceleration of a wholly submerged body moving in the presence of a free surface. Specifically it is our aim to obtain usable expressions for those hydrodynamic force and moment components which tend to vanish whenever the acceleration of the submerged solid goes to zero.

James Forrestal Research Center, Princeton, N. J.
DETERMINATION OF TURBULENCE CHARACTERISTICS OF SOLID PARTICLES IN A TWO-PHASE STREAM BY OPTICAL AUTO-CORRELATION, by S. L. Soo, C. L. Tien, and V. Kadambi. Rept. on Project Squid, Contract Nonr-1858(25). Oct 58, 17p. 5 refs. Technical rept. PR-84-P.
Order from LC mi$2.40, ph$3.30 PB 145 723

Application of optical auto-correlation techniques enables determination of Lagrangian correlation, scale and intensity of turbulent motion of solid particles in a two-phase stream. This method allows measurement of both longitudinal and transverse correlations. (Author)

Technion Research and Development Foundation, Ltd. (Israel).
RESEARCH ON CROSS-STRESSES IN THE FLOW OF LIQUIDS, by Markus Reiner. Technical rept. for 1 Oct 57-30 Sep 58 on Contract AF 61(052)10. [1959] 27p. 12 refs. AFOSR-TN-59-37; AD-209 209.
Order from LC mi$2.70, ph$4.80 PB 145 168

Part I. An instrument is described which works as a centripetal vacuum pump. It consists of two circular metal plates, one stationary, the other rotating opposite it. The stator has an opening in the centre. The rotor can be freely displaced along the axis of rotation. By centripetal pumping action it is kept floating on an air cushion of thickness D. The relation between D and the speed of rotation was determined for different weights of the rotor to be supported. The results are interpreted on the basis of Maxwell's theory of the elastico-viscosity of air. Part II. An instrument is described which works as a centripetal pressure pump with incompressible liquids. (Author)

METALLURGY

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF A METHOD TO IMPROVE CASTINGS BY PRESS FORGING, by Andrew H. Murphy and Lyle L. Clark. Rept. for June 55-Dec 56 on Contract AF 33(600)30159. Mar 57, 217p. 12 refs. AD-140 817.
Order from LC mi$9.60, ph$33.30 PB 145 245

The effect of various press-forging and heat-treating conditions on the mechanical properties of Al, Mg, and Ti alloy castings was investigated. Optimum forging conditions (percent deformation, forging temperature, and heat-treatment prior to or after forging) were determined for a series of cast test bars of Al alloys 220 and 356, Mg alloy AZ92, and Ti-6Al-4V. The feasibility of utilizing a die block of cast Be-Cu alloy was demonstrated by press forging (to finished size and shape) 100 aircraft elevator control levers from Mg alloy castings; negligible die wear was observed. The improvement in the properties obtained by press forming Al 356 castings can be duplicated by increasing the normal aging time for this material. Mg AZ92 castings showed a marked improvement in physical properties when press forged with a 20% deformation. The increase in the strength of Al 220 press forged castings was proportional to the forging deformation. Ti-6Al-4V castings showed a very slight improvement in strength when subjected to press forging. The improvement imparted to production press-forged castings can be predicted by press forging cast test bars of the same alloy. (Portions of this report are illegible)

Massachusetts Inst. of Tech., Cambridge.
ON THE AGING BEHAVIOR OF THE ALLOY Ti-6Al-4V, by J. M. Dupouy, M. B. Bever, and B. L. Averbach. Technical rept. no. 2 on Physical Metallurgy of Titanium Alloys, Contract Nonr-1841(02). 31 Mar 59, 23p. 15 refs.
Order from LC mi$2.20, ph$4.80 PB 144 956

The effects of aging in the temperature range 800-1100°F (427-593°C) on the mechanical properties of the alloy Ti-6Al-4V were investigated. The amount of beta phase was measured as a function of aging time using an x-ray technique which employed a scintillation counter and a pulse-height analyzer.

Northwestern Technological Inst., Evanston, Ill.
AN ACOUSTICAL STUDY OF LOW-TEMPERATURE AGE-HARDENING AFTER REVERSION IN Al - 6 at.% Ag, by Herbert Herman and Morris E. Fine. 3 Dec 58, 19p. 25 refs. AFOSR-TN-58-1025; AD-162 292.
Order from LC mi$2.40, ph$3.30 PB 137 941

A study was conducted to determine the kinetics of re-aging after reversion in single crystals and to determine the mechanism of growth of Guinier-Preston zones. Two Al-6 at-% Ag single crystals, about 1.3 by 0.05 in. in size, were grown using a modified Bridgeman technique from ingots. The specimens were homogenized for 1 mo in a 550° C salt bath. For solution treatment, the specimen was contained in a sealed and weighted pyrex ampule evacuated to 10^{-6} mm of Hg which was suspended by a wire in a vertical furnace. For the quench, the wire was cut, allowing the ampule to drop into 25° water. Aging to the fully hardened state was attained by a 42-hr treatment at 100°C. Reversion was accomplished by heating for 15 min at 220°C. Plots were made for the fractional change of the resonant frequency from the initial reading to time t for re-aging after reversion at 50°, 70°, and 100°C. The re-aging reactions at 70° and 100°C were completed while the 50°C re-aging curve was 60% complete after 160 hr. Young's modulus decreased during concentration of Ag atoms into zones, the rate decreasing with increasing aging time. Zone formation occurred while the specimens were being warmed to the re-aging temperature. The decrease in modulus for the completed re-aging reactor was 2 of 3%. The total change from 1/2 hr to completion was less for direct aging than for re-aging after revision. Curves obtained for a crystal re-aged for 2 hr at 70°C and dropped to 50°C were extrapolated to 2.5 hr and indicated a 10±2 Kcal/mol activation energy.

Watertown Arsenal Labs., Mass.
CHROMIUM PLATING ON TITANIUM ALLOYS, by Charles Levy. Nov 59, 22p. 12 refs. WAL TR 405/1.
Order from LC mi$2.70, ph$4.80 PB 144 877

Methods for plating on titanium, reported in the literature, have been investigated and evaluated. Average adhesion values ranged from 572 to 5785 psi for the various methods. Acid immersion zinc deposits which offer promise of conditioning titanium surfaces for electroplating were developed in laboratory experimentation. More research is needed to achieve adhesion of chromium plate to titanium comparable to that obtained on steel, which is of the order of 40,000 psi.

Wisconsin U., Madison.
SUMMARY DATA TABULATION OF 300 MB FLOW CHARACTERISTICS FOR THE NORTHERN HEMISPHERE, by James F. Lahey, Reid A. Bryson and others. Final rept., Pt. 2, on Contract AF 19(604)2278. Sep 59, 139p. 1 ref. AFCRC-TR-59-270.
Order from LC mi$6.90, ph$21.30 PB 144 796

This tabulation contains, in addition to the types of data presented in the atlas, listings of 300 mb densities and the number of days for which U, V, and UV data were available at each grid intersection.

Case Inst. of Tech. [Cleveland, Ohio]
AN INVESTIGATION OF SPECIAL TREATMENT FOR DEVELOPING HIGH TOUGHNESS IN ULTRA HIGH-STRENGTH STEELS, by C. W. Marshall, G. W. Form and R. F. Hehemann. Final rept. on Contract DA 33-019-505-ORD-8. Nov 58, 56p. 9 refs. WAL no. 310/214; AD-211 011.
Order from LC mi$3.60, ph$9.30 PB 144 878

A new hardening technique involves deformation of the austenitic structure (without recrystallization) prior to the martensitic transformation to yield pronounced improvements in strength and toughness of high-strength steels. The principal variables investigated were working temperature and amount and mode of deformation prior to quenching. Rolling of 4350 steel at 1000°F caused a significant increase in strength but lowered ductility and notch impact toughness. Deformation of austenite prior to quenching did not invariably lead to improvement in mechanical properties.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SUPPLYING OF CAST TEST BARS FOR HIGH TEMPERATURE LEAN ALLOY STUDY, by J. Salvaggi. Final rept. for 19 Jan 53-30 Dec 56 on Contract NObsr-61335. [1957] 20p. 2 refs. Rept. no. KA-875-M-14; AD-144 946.
Order from LC mi$2.40, ph$3.30 PB 137 940

An investigation of the high-temperature behavior of modified chromium-nickel stainless steels in cast form has been conducted. A base analysis corresponding to a 17 Cr- 12 Ni- 2.5 Mo- 0.25 C stainless steel was modified by small additions of titanium, boron, and tungsten. The shell mold process was used to produce all cast test bars. Hot strength properties developed by the cast boron bearing compositions at 1350 and 1500°F compared favorably with those obtained for wrought material of similar compositions tested previously. These hot strength properties are in the same range as those of many of the super alloys containing appreciable quantities of strategic elements.

James Forrestal Research Center, Princeton, N. J.
SELF-DIFFUSION OF IRON IN NICKEL AND COBALT FERRITES, by R. H. Condit, M. J. Brabers and C. E. Birchenall. Rept. on Contract AF 18(600)967. July 58, 10p. 5 refs. Metallurgy rept. no. 18; AFOSR-TN-58-565; AD-158 383.
Order from LC mi$1.80, ph$1.80 PB 137 435

The self-diffusion of radioactive iron has been measured in nickel and cobalt ferrites in the temperature range between 844° and 1190°C. The rate of diffusion in the nickel ferrite is lower by about an order of magnitude than the diffusion in magnetite, and the rate in cobalt ferrite is about two orders of magnitude lower than the diffusion in magnetite. Iron diffusion in nickel ferrite appears to decrease with decreasing iron content. (Author)

National Bureau of Standards, Washington, D. C.
A STUDY OF 17-7 PH STAINLESS STEEL, by Nesbit L. Carwile and Samuel J. Rosenberg. Rept. for Jan 57-Dec 58 on Metallic Materials, Contract AF 33(616)57-7. June 59, 44p. WADC Technical rept. 58-653; AD-216 528.
Order from OTS $1.25 PB 161 089

A study was made of the mechanical properties and microstructures of 17-7 PH stainless steel as affected by heat treatment. Although optimum room temperature mechanical properties were obtained by a treatment slightly different from the TH 950 and TH 1050 treatments recommended by the manufacturer, the best tensile and stress-rupture properties at elevated temperatures (600° and 800°F) were obtained with the TH 950 treatment. When this steel in either the TH 950 or TH 1050 condition was subjected to prolonged exposure at 800°F, either with or without stress, a definite embrittlement resulted. The material may be restored to approximately its original properties by re-aging. Although extensive metallographic and X-ray examinations were made to ascertain the mechanism of aging and the precipitation-hardening compound, no definite conclusions were reached. The microstructure of this steel is extremely complex and could be a fertile field for study. (Author)

Naval Research Lab., Washington, D. C.
SOME OBSERVATIONS ON LOCALIZED BUCKLING OF CENTRALLY NOTCHED SHEET-STEEL SPECIMENS, by W. L. Bingham. Interim rept. 22 Dec 59, 8p. 1 ref. NRL rept. 5412.
Order from LC mi$1.80, ph$1.80 PB 143 015

Bending strains above a transverse slit in variously sized specimens of constant thickness have been used to indicate the presence of buckling. Buckling was found to occur only in the widest plate tested (48 inches); this is an observation in accordance with present elastic theory. Values of the transverse strains measured at positions ahead of the slit indicate the presence of a stress-relieving mechanism. This may be either a buckling deflection or a localized strain of the Luder-band type. (Author)

Rutgers State U., New Brunswick, N. J.
INHIBITION OF HYDROGEN EMBRITTLEMENT DURING PICKLING, by Leonard Dauerman. Quarterly progress rept. no. 13, 1 Jan-31 Mar 59, on Contract DA 30-069-ORD-1680. [1959] 38p.
Order from LC mi$3.00, ph$6.30 PB 145 503

Phenomena at Metal-Acid Solution Interfaces. Hydrogen diffusion. Possible Roles of Hexamine, and DHQ. (See also PB 144 392)

Watertown Arsenal Labs., Mass.
SUBSIZE CHARPY CORRELATION WITH STANDARD CHARPY, by Charles H. Curll. Dec 59, 26p. 3 refs. Technical rept. no. WAL TR 112/95.
Order from LC mi$2.70, ph$4.80 PB 144 923

The test data tend to verify a previously established nonlinear correlation between selected subsizes above the transition range and further indicate a linear correlation between the energy required to fracture standard-size and subsize V notch Charpy specimens at the normal acceptance testing temperature of -40°C.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
A STUDY OF THE RELATIONSHIP BETWEEN NOTCHED AND UNNOTCHED SPECIMENS OF 2024 ALUMINUM ALLOY IN THE LOW-CYCLE FATIGUE REGIME, by Richard D'Amato and Robert De Boer. Rept. for 1 Mar 58-31 Dec 59 on Structural Design Criteria, Contract AF 33(616)3310. May 59, 80p. 6 refs. WADC Technical note 59-2.
Order from OTS $2.00 PB 161 405

An experimental fatigue investigation was conducted in the range of life between 1 and 10000 cycles to failure using notched and unnotched specimens of 2024 aluminum alloy. The notched specimens with theoretical elastic stress concentration factors of 2.0 and 4.0 were cycled between limits of deformation across the notch and the unnotched specimens were cycled between limits of elongation measured over a gage length of 3/4 inch. It was found that a linear relationship existed between range of deformation and cycles to failure when these variables were plotted on log-log coordinates and that the slope was the same for all three specimen configurations. In addition, when the strain-cycling data from each notch type was normalized to the failure strain, the data from all specimen configurations were found to lie within a relatively narrow band. The present investigation also indicated that the results of fatigue tests on notched specimens tested between limits of strain may be converted to stress-cycling results (S-N diagrams) by means of a stress-strain curve. (Author)

[Aeronautical Materials Lab.] Naval Air Material Center, Philadelphia, Pa.
ENDURANCE TESTS OF ALUMINUM AND MAGNESIUM CASTING ALLOYS CONTAINING VARIOUS DEGREES OF DISPERSED DISCONTINUITIES. Rept. on Endurance Tests of Aluminum Alloy AL-355 Containing Various Degrees of Porosity, Proj. TED NAM AE 4132. 14 Dec 54, 10p. 4 refs. Rept. no. AML NAM AE 4132, Pt. 2.
Order from LC mi$1.80, ph$1.80 PB 138 242

Fatigue strengths for porosity degrees Numbers 1 through 4 for aluminum casting alloy AL-355 in the solution treated and aged (T6) condition were determined. Based on the rising order of porosity and the fatigue strength taken as the stress corresponding to the fatigue life at 10,000,000 cycles, it was found that as porosity increased, the fatigue strength decreased from a maximum of 12,000 psi for degree Number 1 to a minimum of 9,000 psi for degree Number 4. Porosity degrees are illustrated by radiographic reproductions.

California U., Berkeley.
THE EFFECT OF HIGH TEMPERATURE RECOVERY ON THE CREEP OF POLYCRYSTALLINE ALUMINUM IN THE DISLOCATION CLIMB REGION OF TEMPERATURES, by W. D. Ludemann, L. A. Shepard, and J. E. Dorn. Rept. for 31 Jan 58-31 Jan 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3860. Dec 59, 34p. 32 refs. WADC Technical rept. 59-131.
Order from OTS $1.00 PB 161 422

Recovery of the creep resistance of 99.99% pure aluminum was studied at temperatures of 540°, 573°, 600°, and 611°K. Polycrystalline specimens crept under a stress of 950 psi to a strain of 5.5% were allowed to recover for periods of from one minute to sixteen days under a residual stress of 4.4 psi. Increased creep rates upon reapplication of the 950 psi stress evidenced softening of the material. The activation energy for the recovery process was found to be 64,000 cal/mole. Metallographic studies of the specimens showed relief of local elastic strains by coalescence of dislocations into sub-grain boundaries upon recovery, and sub-boundary migration. Indications of minor grain growth were also found. The activation energy of 64,000 cal/mole indicates that recovery of creep resistance was due primarily to the sweeping out of dislocations within the grains by the migration of sub-boundaries. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE WELDING OF TITANIUM AND TITANIUM ALLOYS, by G. E. Faulkner and C. B. Voldrich. Rept. on Contract AF 18(600)1375. 31 Dec 59, 69p. 38 refs. DMIC Rept. 122.
Order from OTS $1.75 PB 151 079

Information available to the Defense Metals Information Center on the welding of titanium and titanium alloys is summarized in this report. Welding is used to fabricate titanium and titanium-alloy components for air-frames, jet engines, missiles, and chemical equipment. Among the most important considerations in adapting titanium and its alloys to welded components is to use proper welding procedures and to select alloys that have the required weld-joint properties. The chemical and metallurgical characteristics that affect the selection of welding processes and alloys are discussed. Also, information is presented on surface preparation, welding procedures, and quality control. In addition, detailed data on the mechanical properties of welded joints in the commercial grades of titanium and titanium alloys and how these properties are affected by heat treatment and elevated temperatures are presented. (Author)

Manufacturing Labs., Inc., Cambridge, Mass.
INVESTIGATION OF THE STRENGTH AND DUCTILITY RELATIONSHIPS IN TITANIUM-ALUMINUM ALLOYS BETWEEN 6 AND 15% ALUMINUM FOR APPLICATION AT ELEVATED TEMPERATURES, by B. S. Lement, G. T. Hahn, and K. Kreder. Rept. for 28 May 58-14 May 59 on Contract AF 33(616)5948. Nov 58, 74p. 13 refs. WADC Technical rept. 59-342.
Order from OTS $1.75 PB 161 424

An investigation of the strength and ductility relationships in a series of Ti-Al alloys varying from 6 to 15% aluminum was carried out. The activation energy for the embrittlement reaction in a Ti-8Al alloy was found to be about 34,000 cal/mol, which is compatible with present knowledge of diffusion of aluminum or interstitial elements. More complete evidence was obtained that striations represent sub-boundaries that form as a result of the beta-alpha transformation and at which micro-segregation occurs. Striations can be eliminated by cold working and recrystallizing, or by quenching and recrystallizing. Rapid quenching results in a martensitic structure which exhibits high resistance to embrittlement on subsequent aging at 750°F in a Ti-8Al alloy. In the embrittled condition fracture takes place by trans-granular cleavage. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EFFECT OF HEAT TREATMENT ON THE METALLURGICAL AND MECHANICAL PROPERTIES OF 7AL-3MO TITANIUM ALLOY, by Paul L. Hendricks. Rept. for 18 Sep 57-13 Jan 59 on Metallic Materials, Contract AF 33(600)35886. Nov 59, 109p. WADC Technical rept. 59-263.
Order from OTS $2.50 PB 161 363

Metallurgical and mechanical properties of 7Al-3Mo titanium alloy were determined on a production size heat. The investigation included heat treatment, the determination of tensile properties, stress rupture, creep stability, compressive yield, modulus, and impact strength. The conditions under which testing was accomplished varied from room temperature up to 1000°F. (Author)

Metals Research Lab., Brown U., Providence, R.I.
INFLUENCE OF THERMAL HISTORY ON PREFERRED ORIENTATIONS IN THE RECRYSTALLIZATION OF TECHNICALLY PURE ALUMINUM, by R. E. Green, Jr., B. G. Liebmann and H. Yoshida. Rept. on Contract AF 49(638)479. 15 Nov 58, 11p. 10 refs. AFOSR-TN-58-1014; AD-162 279.
Order from LC mi$2.40, ph$3.30 PB 137 931

The influence of the state of impurities (dissolved or precipitated) on the generation of preferred orientations in recrystallization of strained aluminum single crystals, has been investigated. The crystal contained 99.79% Al, 0.09% Fe, 0.09% Si and 0.03% Zn, only the iron not being well within its solid solubility limit. It is indicated that iron in supersaturated solid solution prevents the generation of preferred orientations while it has no effect of this kind when precipitated.

Nonferrous (except light) Metals

Climax Molybdenum Co. of Michigan, Detroit.
DEVELOPMENT OF MOLYBDENUM-BASE ALLOYS. PART I. HIGH STRENGTHS AND HIGH RECRYSTALLIZATION TEMPERATURES IN WROUGHT MOLYBDENUM-BASE ALLOY BAR STOCK. PART II. MOLYBDENUM-BASE ALLOY SHEET MATERIALS, by M. Semchyshen, Gordon D. McArdle, and Robert Q. Barr. Rept. for Jan-Dec 58 on Metallic Materials, Contract AF 33(616)5447. Oct 59, 138p. 6 refs. WADC Technical rept. 59-280.
Order from OTS $2.75 PB 161 413

Some significant advances have been made in the development of Molybdenum-base alloys. Of several investigated, one exhibited an ultimate tensile strength at room temperature of 155600 psi and 101300 psi at 1800°F. Another showed a one hour recrystallization temperature in excess of 3200°F. A third alloy had a 100 hour rupture strength of 32700 psi at 2400°F. These represent the strongest known metallic materials for service at 1800°F to 2400°F. Nominally 1/16" thick sheet was fabricated from some of the alloys. While this sheet exhibited recrystallization temperatures comparable to those of wrought bar stock of the same composition, the tensile strengths and uniform elongations were lower for the sheet material. Annealing temperatures sufficient to recrystallize the cone of the alloy sheets were inadequate to recrystallize the extreme surface layers. This "case effect" is attributed to contamination of the surface during rolling and annealing. Bendability of the sheet alloys was substantially increased by milling off these outer layers. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE PROPERTIES OF BORON, by D. N. Williams. 4 Jan 60, 9p. 19 refs. DMIC memo. 41.
Order from OTS $0.50 PB 161 191

The element boron has properties that have given rise to speculation on its possible use as a structural material. However, considerable careful work in reduction and purification of boron has produced nothing encouraging. The purest material available today shatters at low impact, has no ductility, and such poor thermal-shock resistance that it breaks up on cooling slowly from the temperature at which it was produced to room temperature. This memorandum is written to collect as much authentic information as is available and to disseminate this to researchers who may be interested in the future potential and present limitations of boron.

National Bureau of Standards, Washington, D. C.
PREPARATION OF HIGH PURITY W, Mo, Ta, Cb, AND Zr, by Geo. A. Moore and L. L. Wyman. Rept. for Feb 58-Feb 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)58-11. Oct 59, 15p. WADC Technical rept. 59-314.
Order from OTS $0.50 PB 161 365

This project has been undertaken to prepare refractory metals of the highest possible purity in massive forms suitable for spectrochemical standards and for other essential applications. Experiments were made leading toward the preparation of purified volatile halides, taking advantage of fractional distillation and ion exchange reactions. An apparatus for the formation of refractory metal rods by the thermal decomposition of purified halides was completed. A large zone melting unit for the final purification of these rods was approaching completion at the end of the project year. In this unit electric bombardment heating is provided for the most refractory metals and an RF heating unit is provided for zone melting larger quantities of the less refractory metals. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THE SPECTRAL EMISSIVITY AND OPTICAL PROPERTIES OF TUNGSTEN, by Robert Dean Larrabee. Rept. on Contract DA 36-039-sc-64637. 21 May 57, 85p. 36 refs. Technical rept. 328; AD-156 602.
Order from LC mi$4.80, ph$13.80 PB 144 929

An experiment designed to measure the spectral emissivity of tungsten at incandescent temperatures has been initiated. A direct comparison method is utilized in which the radiant intensity from a tungsten source is compared with the radiant intensity from an approximative black body, and the spectral emissivity is computed from the basic relation $E_{\lambda T} = S/B$, where $E_{\lambda T}$ is the spectral emissivity at temperature T and wavelength λ, S is the radiant intensity of the tungsten source, and B is the radiant intensity of the approximative black body. It is shown that the spectral emissivity of tungsten is caused by the classical electromagnetic reflection and refraction of black-body light incident upon the metal-vacuum interface from inside the metal. Equations for the spectral emissivity of tungsten as a function of the direction of polarization and the angle of viewing the tungsten surface are developed in terms of the optical constants of tungsten. The optical constants of tungsten are computed by comparing these equations with the experimental data. An attempt is made to explain the main features of these data in terms of a combination of the Lorentz elastically bound electron theory of insulators and the Drude-Zener-Kronig free-electron theory of metals. (Author)

Structural Metallurgy and Corrosion

Battelle Memorial Inst., Columbus, Ohio
CAUSES OF CRACKING IN HIGH-STRENGTH WELD METALS, by A. J. Jacobs. R. P. Sopher and P. J. Rieppel. Rept. on Contract AF 33(038)12619. Aug 54, 35p. 5 refs. WADC Technical rept. 52-322, Pt. 3; AD-65 474.
Order from LC mi$3.00, ph$6.30 PB 145 332

Hot-tension and weld-metal cracking studies were conducted on SAE 43XX-type steels and other selected steels. Results from these studies showed a correlation, inasmuch as an increase in carbon, sulfur, and phosphorus tended to lower hot ductility and promote hot-crack susceptibility, and a misch metal addition seemed to have the opposite effects. (Author)

Case Inst. of Tech., Cleveland, Ohio.
THE PRESSURE DERIVATIVES OF THE ELASTIC CONSTANTS OF COPPER, SILVER AND GOLD, TO 10,000 BARS, by E. B. Daniels and Charles S. Smith. Technical rept. no. 1 on Contract Nonr-

1141(05). Jan 58, 35p. 30 refs. AD-219 023.
Order from LC mi$3.00, ph$6.30 PB 137 957

The pressure derivatives of the elastic constants of the homologous series of metals copper, silver and gold, were measured over the pressure range from 0 to 10,000 bars, using a modified ultrasonic pulse echo method. Means were devised to measure the change of elastic constant with pressure as directly as possible. The values found for the pressure derivatives of the elastic constants of copper, silver and gold are reported. The notation, $C = C_{44}$, $C' = (C_{11} - C_{12})/2$ and $B_S = (C_{11} + 2C_{12})_S/3$ was used. The data for each metal, of the three elastic constants and their pressure derivatives, were interpreted in terms of conventional theory. The theoretical contributions of long-range interactions were subtracted off and the remainder attributed to short range nearest neighbor interaction. The analysis indicates that these must be non-central, many-body interactions in order to account for the shear constants and their pressure derivatives. The many-body character of the interactions is of rapidly increasing importance in the sequence, copper, silver and gold.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
COMPOSITION FOR RAPID AND SIMULTANEOUS DERUSTING, DEGREASING AND RUST-PROOFING OF FERROUS SURFACES AT AMBIENT TEMPERATURES, by M. H. Swann. 8 Jan 58, 11p. CCL #40; AD-155 258.
Order from LC mi$2.40, ph$3.30 PB 145 043

The amount of Fe required to take into H_3PO_4 solution to prevent flash rusting was determined. At 5% Fe-phosphate content, the effect was first noticed. The effect increased as the concentration increased until at 15% excessive amounts of loose powdery deposits were left on the metal surfaces. The salts tested as additives included ferric and ferrous phosphates, ferric and ferrous oxalates, ferric and ammonium citrates, ferric sulfate, zinc oxalate, maganese phosphate, zinc phosphate, and combinations of the Na, K, and ammonium salts of oxalates and phosphates. In the presence of excess phosphoric acid as needed to remove rust, only ferric oxalate or combinations of ferric salts and alkali oxalates were protective. The effect of temperature, the weight of ferrous oxalate coating deposited, and the effect of time and temperature on coating weights were studied. A formula was developed that can be supplied in concentrated form for dilution with H_2O to facilitate shipping and storing; the formula exhibited an accelerated rate of rust removal. The formula is composed of ethylene glycol monobutyl ether in a water-soluble, acid-stable, nonionic surface-active agent used in aqueous medium containing H_3PO_4 and ferric oxalate.

Columbia U., New York.
INVESTIGATION OF THE ROLES OF ABSOLUTE GRAIN SIZE AND NUMBER OF GRAINS IN THE CROSS-SECTION AS FACTORS CONTROLLING FLOW AND FRACTURE STRESSES AT LOW TEMPERATURE, by James Wade Hill. Rept. on Contract AF 18(600)898. 28 Feb 58, 18p. 9 refs. AFOSR-TN-58-682; AD-162 215.
Order from LC mi$2.40, ph$3.30 PB 138 107

By variation of specimen size and grain size in a subgrain-free structure it is observed that absolute grain size and not the number of grains in the cross-section is the controlling factor in determining flow and fracture stress at low temperatures when all other factors are constant. (Author)

Hammond Metallurgical Lab., Yale U., New Haven, Conn.
THE MECHANISM OF INTERGRANULAR RUPTURE OF COPPER AND ALUMINUM AT HIGH TEMPERATURES, by W. D. Robertson and Raymond C. Boettner. Final rept. on Contracts DA 19-059-507-ORD-2597 and DA 19-059-ORD-1906. Jan 59, 120p. 60 refs. [AD-210 501].
Order from LC mi$6.00, ph$18.30 PB 145 175

Void-crack formation in creep was studied by means of density measurements and metallography in single crystals, bicrystals and polycrystals of copper of varying purity and polycrystalline aluminum of commercial purity as a function of stress, temperature and time. The importance of void-crack formation in analyses of creep curves and in the mechanism of penetration of liquid metals into solid nickels is discussed.

Massachusetts Inst. of Tech., Cambridge.
STUDY OF CRYSTAL STRUCTURES OF COMPLEX METALLIC PHASES, by David P. Shoemaker. Final rept. for 1 July 52-31 Aug 58 on Contract DA 19-020-ORD-1859. 1 Nov 58, 83p. 19 refs. OOR rept. 461.4 Met; AD-209 926.
Order from LC mi$4.80, ph$13.80 PB 145 178

Contents:
I. The crystal structure of the R phase, Mo-Co-Cr
II. X-ray diffraction studies of the δ phase, Mo-Ni
III. The crystal structure of the P phase, Mo-Ni-Cr
IV. Bonding in the transition-group intermetallic phases

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500° F, by M. J. Sinnott. Progress rept. no. 14, 15 Aug-15 Sep [49] on Project NEPA. 15 Sep 49, 10p. [NEPA-1159-MIC-14] ATI-184 781.
Order from LC mi$1.80, ph$1.80 PB 137 450

The Geiger temperature indicating and recording unit (GETIR) has been successfully coupled to a motor-generator set to control the temperature of an induction-heated furnace. Life tests on a graphite induction furnace with no protection for the graphite show a life of approximately sixty hours at a temperature of 3300° F. A graphite induction furnace to operate with a protective atmosphere has been constructed and is currently being put into operation. Creep tests on a test sample of a carbide submitted by NACA were attempted, but oxidation and fluxing of the sample invalidated the test, which was run for forty-eight hours at 1800°F. at a load of 4000 pounds per square inch. Creep tests on BeO samples are currently being attempted. Stability tests on ThO_2-Y_2O_3 heater rods have been started to determine the life of these units. (Author) (See also PB 138 461)

Midwest Research Inst., Kansas City, Mo.
RESEARCH ON THE MECHANISMS OF FATIGUE, by J. C. Grosskreutz and Fred R. Rollins. Rept. for Mar 58-Mar 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5065. Sep 59, 71p. 56 refs. WADC Technical rept. 59-192.
Order from OTS $2.00 PB 161 412

Small angle X-ray scattering from fatigued copper and aluminum reveals that the formation of misoriented subgrains is the most pronounced structural change occurring and that this formation is essentially completed within the first 10% of the fatigue life. It is demonstrated that high temperature annealing does not remove this polygonized structure, but does promote some growth and consolidation of the subgrains. The effect of annealing on fatigue life is discussed. No evidence has been found for the formation of voids in the volume of the samples during cyclic stressing. This result strongly favors the hypothesis that cracks originate at the surface. Electron micrographs have shown the existence of deep intrusions on the surface of copper samples run to fatigue. Energy dissipation during fatigue has been measured and found to follow the classic stages of fatigue. Reasons are discussed for discarding these stages in favor of a simple picture of crack initiation and crack propagation. A comprehensive state of the art survey is included. (Author)

Midwest Research Inst., Kansas City, Mo.
STUDY OF METHODS FOR NONDESTRUCTIVE MEASUREMENT OF RESIDUAL STRESS, by Fred R. Rollins. Rept. for 1 July 58-30 Sep 59 on Solid State Research and Properties of Matter, Contract AF 33(616)5932. Dec 59, 48p. 56 refs. WADC Technical rept. 59-561.
Order from OTS $1.25 PB 161 436

A rather thorough search for new techniques of measuring residual stresses has been conducted. This search has included a study of various physical phenomena which exhibit some stress dependent relationship. Of the many phenomena studied, ultrasonics was chosen for further experimental investigation. It has been definitely established that residual stresses in metals can cause double refraction of a polarized shear wave. A technique, based on the double refraction of shear waves, for measuring the average stress through certain specimens is described and sources of error are discussed. The interaction of two ultrasonic waves in metals has been investigated also. (Author)

Naval Boiler and Turbine Lab., Philadelphia, Pa.
CORROSION OF AN IRON-CHROMIUM-ALUMINUM ALLOY BY SYNTHETIC FUEL OIL ASH, by J. F. Kelly. Evaluation rept. 26 Aug 57, 15p. NBTL Test R-232; AD-147 472.
Order from LC mi$2.40, ph$3.30 PB 144 918

Tests were conducted on a Fe:Cr:Al alloy (25 Cr:4.6 Al: balFe). In synthetic fuel oil ash corrodants of high vanadium and of high sodium contents it had better resistance than type 310 alloy. Tests were conducted at 1700° for a maximum of 20 hours.

Physical Sciences Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
A STUDY OF METALLIC CORROSION BY X-RAY DIFFRACTION, by Otto Renius and Gerald P. Connell. Rept. on Contract DA 20-089-ORD-39246. Dec 59, 38p. 10 refs. Rept. no. RR-4.
Order from LC mi$3.00, ph$6.30 PB 145 011

Several metallic specimens, subjected to controlled corrosion, were studied by x-ray diffraction to determine the crystal structure of the base metal and the corrosion products. Diffraction patterns for various corroded and uncorroded, stressed and unstressed metals were obtained. The relationship between diffraction peak-to-background intensity ratios and the extent of corrosion was investigated. (Author)

Rock Island Arsenal Lab., Ill.
IN SITU CONVERSION OF OPERATING HYDRAULIC OILS TO PRESERVATIVE OILS, by R. L. LeMar. 26 Oct 59, 19p. Rept. no. 59-2773.
Order from LC mi$2.40, ph$3.30 PB 145 114

Fourteen commercial, inhibitor, additive concentrates were evaluated in four samples of used, operating hydraulic oil. A number of these concentrates were found to convert such an oil to an inhibited oil with preservative properties comparable to MIL-L-21260 oil. These additive concentrates were also miscible with the oil at room temperature and so could be added directly to the oil in the machine tool hydraulic system and mixed therein, by exercising the machine tool. Viscosity and flash point effects of the additive concentrates were also considered. A list of quality control tests for future selection of concentrates is included. (Author)

Rock Island Arsenal Lab., Ill.
PROCESS QUALITY CONTROL FOR CORROSION PREVENTIVE OILS AND COMPOUNDS, by Robert E. Johnson. 21 Oct 59, 24p. Rept. no. 59-2721; AD-228 438.
Order from LC mi$2.70, ph$4.80 PB 144 735

A quality control program was initiated and maintained in an attempt to insure the quality of preservative materials utilized in the storage of Ordnance materiel. The results obtained indicate that such a program is feasible and will provide valuable information if the personnel concerned are conscientious in the maintenance of necessary records. A satisfactory procedure was established to check periodically the preservative oils and fingerprint remover compounds. The use of a short fingerprint removal test considerably reduced the testing time. Additional work is necessary to establish a satisfactory procedure for the periodic check of solvent cutback and petrolatum type materials. Actual savings realized

from this program cannot be readily determined. However, periodic testing revealed deficiencies which were immediately corrected. A considerable amount of Ordnance materiel would have been preserved with deficient preservatives had it not been for this program. (Author)

Watertown Arsenal Labs., Mass.
ELEVATED TEMPERATURE CHARACTERISTICS OF THREE AGE HARDENED AND INTERNALLY OXIDIZED TITANIUM-COPPER-CERIUM ALLOYS, by Joseph M. Dhosi. Master's thesis. Dec 59, 57p. 16 refs. Technical rept. no. WAL TR-405.2/5.
Order from LC mi$3.60, ph$9.30 PB 144 922

The effects of solid solution strengthening by zirconium and tantalum on the precipitation hardening response of Ti-2.0Cu-0.4Ce were determined. Elevated temperature characteristics after aging and after internal oxidation were compared and it was found that the beneficial effects of each treatment are not additive. Internal oxidation was observed to improve the temperature stability of the base alloy.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Air Force Cambridge Research Center, Bedford, Mass.
NATURAL AEROSOLS AND NUCLEAR DEBRIS STUDIES, by M. I. Kalkstein, P. J. Drevinsky and others. Progress rept. no. 2 on Contract AT(49-7)1431. Nov 59, 44p. 17 refs. GRD Research Notes no. 24; AFCRC-TN-59-627.
Order from OTS $1.25 PB 161 368

Some additional results of research on radioactive and inactive aerosols in the troposphere and stratosphere are presented. Results of studies of stratospheric particulate aerosols and of the size distribution of fission products in the lower atmosphere are discussed. Techniques of particulate aerosol collection and analysis are described. Results for barium-140 and strontium-90 in individual precipitation samples are presented together with preliminary meteorological interpretation. Some results for gamma-ray activities in precipitation and soil samples are discussed. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RADIATION CHEMISTRY AND RELATED PHENOMENA. PART I. MECHANISMS OF RADIATION CHEMISTRY. PART II. RADIATION CHEMISTRY OF SATURATED ALIPHATIC HYDROCARBONS. PART III. RADIATION CHEMISTRY AS A PRECURSOR TO RADIATION EFFECTS ANALYSES, by Gordon G. Wepfer, Lowell A. King and William L. R. Rice. Rept. for Apr-June 59 on Materials Analysis and Evaluation Techniques. Nov 59, 91p. 12 refs. WADC Technical rept. 59-296.
Order from OTS $2.25 PB 161 414

It is known that when high-energy radiation passes through matter, energy is transferred to the target by ionization and excitation processes. Subsequently, any number of processes can and do occur, depending on the ionization density. Part I of this report is a summary of the mechanisms which can take place leading to the observed effects in radiation chemistry studies. The discussion is limited somewhat by a lack of knowledge of the extent to which the various secondary processes take place in a given system. It is possible, however, to discuss things which have been observed and the conditions under which certain processes are known to take place, processes which should be considered in studying any new system. Part II is a review of the radiation chemistry of pure saturated aliphatic hydrocarbons. Discussions and experimental observations found in the literature have been condensed and are presented. Part III is concerned with gross property changes resulting from interaction of radiation with materials. Programs to date in the radiation effects area are discussed. The relative success or failure of these various research efforts is indicated. An attempt is made to show the need for correlation of fundamental changes observed through radiation chemistry, and macroscopic changes observed in radiation effects studies. (Author)

Palmer Physical Lab., Princeton U., N. J.
STRANGE PARTICLE PRODUCTION IN COMPLEX NUCLEI, by Albert Eugene Werbrouck. Technical rept. no. 22 by Cosmic Ray and Elementary Particles Group on Contract Nonr-1858(06). 20 Feb 59, 100p. 45 refs.
Order from LC mi$5.40, ph$15.30 PB 144 723

Strange particle production by high energy pions and protons bombarding carbon, iron, and lead nuclei in a multiplate cloud chamber was investigated. This choice of targets provided an opportunity to compare the effects of multistage processes which are sensitive to nuclear radius. The two stage process that originally motivated the experiment was the indirect production of strange particles by pions in turn produced by a nucleon incident on the same nucleus. Early indications of very low direct production of strange particles in p-p collisions led to the belief that a large fraction of the production in p-nucleus collisions was through the indirect process. The result for this fraction in lead is $\sim 2/3$. A K-pair production by protons comparable to the direct production of hyperon-K meson pairs by protons was observed.

Stanford U., Calif.
NUCLEON FORM FACTORS FROM ELECTROPRODUCTION OF PIONS, by S. Gartenhaus and C. N. Lindner. Technical rept. no. 37 on Contract AF 49(638)388. Sep 58, 19p. 15 refs. AFOSR-TN-58-819; AD-202 351.
Order from LC mi$2.40, ph$3.30 PB 137 535

The dispersion relation analysis of Fubini, Nambu, and Wataghin [Phys. Rev. 111:329; 1958] for electropion production was applied to the experiments of Panofsky and Allton [Phys. Rev. 110:1155; 1958] as an independent means for studying nucleon structure.

The results are in qualitative agreement with those from elastic scattering experiments. Some of the limitations inherent in the form factor measurements by this process are also discussed. (Author)

Uppsala U. (Sweden).
NATURE OF THE TWO-ELECTRON CHEMICAL BOND I. THE HOMOPOLAR CASE, by Harrison Shull. Technical note no. 26 on Contract AF 61(514)1200. 5 June 59, 40p. 12 refs.
Order fr[illegible]C mi$3.00, ph$6.30 PB 145 190

By using the artifice of dividing space into two parts by means of a plane perpendicular to the internuclear axis and passing through its midpoint, it is shown that there is possible a division of a two-configuration two-electron wave function into two orthogonal parts each of which has optimum properties associated with the plane intuitively corresponding to the names "ionic" and "atomic". The division of the density distributions for the Wang, Weinbaum, and Rosen functions into ionic, atomic, and ionic-atomic cross-term parts is considered, and it is shown that the former two parts are roughly non-bonding, where as it is the latter part which contributes most to the density between the nuclei in the binding region. The term covalent seems best applied to the cross-term. The method is capable of extension to the heteropolar bond.

Elementary Particles

California U., Berkeley.
ELECTROMAGNETIC STRUCTURE OF THE NUCLEON, by Adam M. Bincer. Rept. on Contract AF 49(638)327. Nov 59, 35p. 17 refs. AFOSR-TN-59-1217.
Order from LC mi$3.00, ph$6.30 PB 145 041

Dispersion relations are proved for the electromagnetic and mesonic nucleon vertex functions considered as a function of the nucleon mass. The results are used to express the isotopic scalar and the isotopic vector electromagnetic form factors of the nucleon in terms of pion electroproduction (or photoproduction) and pion-nucleon scattering amplitudes in the $J = \frac{1}{2}$, $T = \frac{1}{2}$ state. (Author)

California U., Berkeley.
LOW-ENERGY π-MESONS IN THE COSMIC RADIATION, by Mircea Fotino. Technical rept. no. 41 on Cosmic Rays, Contract Nonr-222(40). 2 Feb 59, 47p. 39 refs.
Order from LC mi$3.30, ph$7.80 PB 144 899

The intensity of π-mesons in the atmosphere is investigated in the energy region $E_{kin} \lesssim 50$ Mev. at sea level and mountain altitudes. Positive π-mesons coming to rest in an absorber-scintillator are identified by the characteristic π-μ decay. They are detected electronically and recorded photographically. The value 1.45 ± 0.09 is adopted for the negative-to-positive ratio at small energies. The omnidirectional intensities J_{π^+} of slow positive π-mesons at sea level (91 m.), Echo Lake, Colorado (3260 m.), and Mt. Evans, Colorado (4310 m.) are found to be 0.0094 ± 0.0024, 0.098 ± 0.005 and 0.240 ± 0.011 $g^{-1}d^{-1}$ respectively. The altitude dependence of $J_{\pi^\pm}$, $J_{\mu^\pm}$ and $J_{\pi^\pm}/J_{\mu^\pm}$ is given and the attenuation length of slow π-mesons in the atmosphere found to be $L_a^\pi \approx 120\text{-}130 g/cm^2$ in this altitude interval. A discussion covering most of the available results along the same line is presented. (Author)

California U., Berkeley.
SPECTRAL REPRESENTATIONS IN PERTURBATION THEORY. III. THE SCATTERING AMPLITUDE WITH TWO COMPLEX INVARIANTS, by Jan Tarski. Rept. on Contract AF 49(638)327. [1958] 53p. 14 refs. AFOSR-TN-59-1071.
Order from LC mi$3.60, ph$9.30 PB 145 322

The partial Feynman amplitude corresponding to a particular fourth order diagram is examined as a function of energy and momentum transfer with both of these variables complex. The region of regularity of this function is found, and the types of singularities at the remaining points are determined. An approach which requires only elementary calculations is developed. The condition for the validity of Mandelstam's representation in the fourth order is obtained. Spectral representations for exchange scattering processes at fixed momentum transfer are discussed as another application of the principal results. (Author)

Convair, Fort Worth, Tex.
APPLICATION OF WIENER-HOPF METHOD TO TRANSPORT THEORY, by N. Edmonson. Rept. on Contract AF 33(600)32054. 8 Sep 58, 60p. 8 refs. MR-N-202; NARF-58-34T.
Order from LC mi$3.60, ph$9.30 PB 145 347

Milne's equation is derived as an example of an equation of the Wiener-Hopf type. The basic mathematical theory of the Wiener-Hopf method is developed and a number of physical problems solvable by the Wiener-Hopf method are presented. A discussion of the application of the Wiener-Hopf method to the non-homogeneous integral equation is included. (Author)

Convair, Fort Worth, Tex.
THE TWO-REGION NEUTRON TRANSPORT EQUATION, by T. W. Summers. Rept. on Contract AF 33(600)32054. 29 Dec 58, 24p. 4 refs. MR-N-220; NARF-58-53T.
Order from LC mi$2.70, ph$4.80 PB 145 345

The two-region neutron transport equation with plane symmetry has been solved by the Wiener-Hopf method for the case in which one region contains a plane, isotropic source parallel to the interface. The results are subject to the restrictions of isotropic scattering without loss of energy and a constant total mean free path. Analytical results are presented for the total flux and the angular flux at the interface. Numerical results for the total flux at the interface are presented in the form of a parameter study. (Author)

Illinois U., Urbana.
EVALUATION OF K^-- NUCLEON SCATTERING PHASE SHIFTS ON BASIS OF PRESENT DATA, by R. D. Hill. Technical rept. no. 7 on Contract Nonr-1834(05). Mar 59, 12p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 144 893

The purpose of the following evaluation was to try to obtain an estimate of the K^- neutron elastic scattering cross-section. This is useful in planning a possible emulsion K^-- nuclear scattering analysis. Since the summer of 1958, when Dalitz carried out his evaluation of the phase-shifts, certain more complete experimental data, such as the inelastic K^--proton scattering cross-sections as a function of energy and the charge-exchange K^- proton scattering cross-sections, have become available. A re-evaluation of the phase-shifts was therefore felt to be worth-while. (Author)

Miami U., Coral Gables, Fla.
NEGATIVE PION INTERACTIONS AT 1.3 $\frac{Bev}{c}$, by M. Blau, C. F. Carter and A. Perlmutter. Rept. on Contract AF 49(638)97. 10 July 59, 36p. 15 refs. AFOSR-TN-59-788; AD-220 514.
Order from LC mi$3.00, ph$6.30 PB 145 040

A total of 340 meters of track of negative pions of momentum 1.3 $\frac{Bev}{c}$ were followed in emulsion, and pion interactions were recorded. Special emphasis is placed on inelastic scattering on free protons (single meson production). The resulting angular and momentum distributions of the emitted particles are investigated and compared with previous experiments at similar energies. An attempt is made to explain these results on the basis of an isobar decaying into a nucleon and the slower pion. In the case of reaction $\pi^- + p \rightarrow \pi^- + \pi^0 + p$, it appears that there exists an anisotropy in the isobar frame of reference, in which the slower pion is emitted predominantly backward, with respect to the isobar direction. The results are compared with the π - π coupling model. Angular and energy distributions of mesons emitted in nuclear interactions are investigated and compared with other results and Monte Carlo calculations. The meson multiplicity and energy degradation in these collisions are also discussed. Strange particles found during the investigation are analyzed. (Author)

Stanford U., Calif.
FLUX AT SEA LEVEL OF HEAVY CHARGED PARTICLES PAIR-PRODUCED IN COSMIC-RAY SHOWERS, by A. Goldberg. Technical note no. 6 on Contract AF 49(638)388. Sep 59, 10p. 13 refs. AFOSR-TN-59-964.
Order from LC mi$1.80, ph$1.80 PB 144 964

The flux at sea level of charged particles with mass 300-600 electron masses is calculated assuming the particles to be pair-produced by cosmic-ray photons. The cross section for pair production, including the effects of nuclear size, is folded into the distribution of photons predicted by shower theory. Absorption of the produced particles is also considered approximately. The results are well below the experimental upper limit set up by Keuffel and co-workers. (Author)

Instruments and Installations

Cyclotron Lab., U. of Illinois, Urbana.
MULTI-PURPOSE MAGNETIC PARTICLE ANALYZER, by Robert L. Burman and Avivi I. Yavin. Technical rept. no. 6 on Contract Nonr-1834(05). Mar 59, 28p. 10 refs.
Order from LC mi$2.70, ph$4.80 PB 144 895

A suggestion is made in this paper to apply Mileikowsky's idea of an astigmatic magnet to Enge's spectrometer.

Naval Radiological Defense Lab., San Francisco, Calif.
A SIMPLE CALIBRATION AND CHECKING FACILITY FOR FAST AND SLOW NEUTRON DETECTORS, by A. H. Redmond. 28 Jan 59, 20p. Research and development technical rept. USNRDL-TR-302.
Order from LC mi$2.40, ph$3.30 PB 145 614

A simple facility is described for checking the sensitivity of doserate instruments for fast neutron detection, and for calibration of thermal neutron detectors. About 7 million plutonium-beryllium neutrons per second give a tolerance flux density of slow neutrons from the walls of a cavity in paraffin or water. Construction drawings of the cavity are given, and for the dimensions specified the constant is given for converting any plutonium-beryllium flux of neutrons to combined thermal and epithermal flux densities, so that instruments can be calibrated in standard flux densities.

New York U. Coll. of Engineering, N. Y.
PLATEAU SLOPES AND PULSE CHARACTERISTICS OF LARGE, HIGH PRESSURE BF_3 COUNTERS, by Rosalind B. Mendell. Rept. on Contract AF 18(600)1555. July 59, 75p. 30 refs. AFOSR-TN-59-738.
Order from LC mi$4.50, ph$12.30 PB 144 936

Factors affecting the flatness of plateau of large diameter high pressure BF_3 counters were examined. It was found that with gas and counter body free from contamination, counters up to 5 cm radius and filled with BF_3 gas at 64 cm Hg had acceptably flat plateaus. Desired gas purity was obtained by generating the gas from CaF_2BF_3 complex, trapping residual impurities, and isolating and collecting BF_3 vapor that had been in equilibrium with the liquid phase at a vapor pressure of 20 cm Hg. The resolution of counters of different pressures and cathode diameter for ionizing events with a known energy spectrum was compared. Pulse amplification characteristics of the different counters were determined, and results, including the effect of electron attachment on measured values for counters of large diameter and high pressure are discussed.

Physical Sciences Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
INVESTIGATION OF OSCILLATING DOSIMETRY, by Otto Renius and Donald S. Sarna. 26 Oct 59, 21p. 5 refs. Rept. no. RR-2.
Order from LC mi$2.70, ph$4.80 PB 145 012

Quartz crystal oscillators, both wire and pressure mounted types, were subjected to X-radiation ranging from 28 KVP to 300 KVP to note the change in oscillating frequency with respect to the radiation dose received. Curves of frequency shift were plotted with respect to X-ray dosage to a megaroentgen level. Crystal dosimeters were heat treated after irradiation to return them to their initial frequency, and were then re-irradiated. AT cut quartz oscillator plates were not applicable as crystal dosimeters, however, the BT cut plates exhibited a frequency shift in proportion to the dose received. (Author)

Nuclear Engineering and Power

Ballistic Research Labs., Aberdeen Proving Ground, Md.
AIR BLAST MEASUREMENTS AROUND WATER-FILLED SIMULATED NUCLEAR REACTOR CORE VESSELS, by Wendell C. Olson and Harry Goldstein. July 59, 26p. 2 refs. Memo. rept. no. 1219; AD-226 238.
Order from OTS $1.00 PB 161 445

Measurements are presented of the air blast caused by bursting water-filled simulated nuclear reactor core vessels with internal explosive charges. The data were obtained by detonating one-pound spherical Pentolite explosive charges within the simulated cores and recording peak overpressures and positive impulses at each of several distances from 3 to 10 ft from the vessel center. The test data complement the results of previous experiments conducted by Larson and Olson in which air-filled simulated core vessels were burst by various energy sources simulating reactor runaway. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ELASTIC-PLASTIC RESPONSE OF THIN SPHERICAL SHELLS TO INTERNAL BLAST LOADING, by Wilfred E. Baker. Feb 59, 38p. 7 refs. Memo. rept. no. 1194.
Order from OTS $1.25 PB 161 444

This report presents the results of a second analytical study, supplemented by some experiments, of the response of an idealized nuclear reactor containment shell to internal transient loading which could be caused by reactor runaway. The containment shell is assumed to be a thin spherical shell, and the transient loading is assumed spherically symmetric. The theory of the elastic-plastic response of the shell is developed for a blast loading which is intense enough to cause plastic flow. Solutions are obtained for both a linear model which neglects changes in shell radius and thickness, and a more exact non-linear model which accounts for these effects. Experimental checks of the theories are described. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ELASTIC RESPONSE TO INTERNAL BLAST LOADING OF MODELS OF OUTER CONTAINMENT STRUCTURES FOR NUCLEAR REACTORS, by J. W. Hanna, W. O. Ewing, Jr. and W. E. Baker. Feb 59, 52p. 14 refs. Rept. no. 1067.
Order from OTS $1.75 PB 161 447

This report presents the results of an experimental study of the elastic response of four geometrically scaled models of nuclear reactor outer containment shells to internal blast loading. The character of response of the shells to dynamic loading is determined with the shells unsupported (suspended in air) and with the shells half-buried in the ground. Geometrical modeling of the response is verified for both support conditions. The results of a static pressure test of one vessel show that its dynamic response cannot be predicted from static considerations. (Author)

Nuclear Reactions

Texas Nuclear Corp., Austin.
NEUTRON INTERACTIONS IN LITHIUM, CARBON, NITROGEN, ALUMINUM, ARGON, MANGANESE, YTTRIUM, ZIRCONIUM, RADIOLEAD, AND BISMUTH, by Norman A. Bostrom, Ira L. Morgan and others. Rept. for 15 Mar 58-14 Mar 59 on Contract AF 33(616)5619. Feb 59, 150p. 96 refs. WADC Technical note 59-107.
Order from OTS $2.75 PB 161 406

An investigation of the interaction of neutrons in lithium, carbon, nitrogen, aluminum, argon, manganese, yttrium, zirconium, radiolead. and bismuth has been made for various neutron energies. In particular the following measurements have been made: (a) The angular distributions of the neutrons inelastically scattered from yttrium and zirconium at neutron energies of 3.67 Mev and 4.21 Mev. (b) The angular distributions of the non-elastically scattered neutrons from yttrium and zirconium when bombarded with 15.2 Mev neutrons. (c) The energy distributions of the neutrons emitted from yttrium, zirconium, and radiolead when bombarded with 4.21 Mev neutrons. (d) The energy distributions of the neutrons emitted from yttrium and zirconium when bombarded with 15.2 Mev neutrons. (e) The cross section for production of gamma rays due to neutron interaction in lithium, yttrium, zirconium, and radiolead at an incident neutron energy of 1.01 Mev. (f) The cross section for production of gamma rays due to neutron interaction in yttrium and zirconium for neutrons in the energy region from 3.46 Mev to 4.59 Mev. (g) The gamma ray spectra produced from 14.9 Mev neutron interaction in yttrium, zirconium, and radiolead. (h) The angular distributions of the gross gamma rays from lithium, yttrium, zirconium. radiolead, and bismuth for an incident neutron energy of 4.21 Mev and for yttrium and zirconium at an incident neutron energy of 3.67 Mev. (Author)

Yale U., New Haven, Conn.
EFFECTS OF ATOMIC ELECTRONS ON p-p AND n-p SCATTERING, by G. Breit. Rept. on Contract AF 18(600)771. 15 Aug 58, 6p. 4 refs. AFOSR-TN-58-730; AD-162 265.
Order from LC mi$1.80, ph$1.80 PB 137 686

Radioactivity

Convair, Fort Worth, Tex.
ANALYSIS OF THE MOMENTS METHOD EXPERIMENT, by R. L. Kloster. Rept. on Contract AF 33(600)38946. 4 Sep 59, 31p. 11 refs. NARF-59-33T; FZK-9-138; AD-226 115.
Order from LC mi$3.00, ph$6.30 PB 145 630

Monte Carlo calculations show the effects of a plane water-air boundary on both fast neutron and gamma dose rates. Multigroup diffusion theory calculation for a reactor source shows the effects of a plane water-air boundary on thermal neutron dose rate. The results of Monte Carlo and multigroup calculations are compared with experimental values. The predicted boundary effect for fast neutrons of 7.3% agrees within 16% with the measured effect of 6.3%. An estimate of the boundary effect for thermal neutrons from PoBe source is obtained from the results of multigroup diffusion theory calculations for a reactor source. The calculated boundary effect agrees within 13% with the measured values. (Author)

Convair, Fort Worth, Tex.
MECHANISMS OF RADIATION DAMAGE: A SERIES OF LECTURES. Rept. on Contract AF 33(600)32054. 15 June 59, 332p. 47 refs. MR-N-232; NARF-59-28T; AD-225 541.
Order from LC mi$11.10, ph$51.60 PB 145 474

Contents:
Reactor spectra and their role in radiation damage calculations, by J. Romanko
Atomic displacements in solids during irradiation, by C. E. Morgan
Dislocation theory and plastic flow, by J. R. Streetman
Impeded motion of dislocations; Radiation effects, by J. R. Streetman
Stresses around neutron-induced defects in metals; Plastic flow, by J. R. Streetman
Organic chemistry, by A. B. Hoefelmeyer
Polymer chemistry, by P. M. James
Radiation chemistry, by A. B. Hoefelmeyer
Radiation damage mechanisms, by P. M. James
Mechanisms of radiation damage in organo-silicone, by T. W. Albrecht
Physical aspects of high-polymer systems, by E. G. Fritz
Rheological treatment of radiation effects in elastomers, by E. G. Fritz
Anti-rads and their mechanisms, by G. K. Abel
Molecular structure and radiation stability, by G. K. Abel

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Arctic Aeromedical Lab., Ladd AFB, Alaska.
WALK-AROUND SLEEPING BAG, by Harvey A. Buskirk. Apr 59, 17p. Technical rept. 59-4; AD-227 509.
Order from LC mi$2.40, ph$3.30 PB 144 849

A modification of the standard Quartermaster Mountain Sleeping Bag is proposed, which will render it useful both for sleeping purposes and for wear as an outer garment in a survival situation. The modification facilitates the addition of insulation, thus improving its heat conservation and allied characteristics. Economy of weight and bulk is realized because this dual purpose article can be integrated with the current clothing assemblies in a manner which will permit deletion of the conventional arctic parka. (Author)

Polacoat Inc., Blue Ash, Ohio.
FEASIBILITY STUDY AND DESIGN OF A SELF-ATTENUATING LIGHT VALVE, by John F. Dreyer. Rept. on Health Hazards of Materials and Radiation, Contract AF 33(616)5469. Oct 59, 21p. 14 refs. WADC Technical rept. 59-81.
Order from OTS $0.75 PB 161 433

Investigation of the phototropic phenomenon to determine the feasibility of phototropic material as a protective, self-attenuating light valve against the energy yields of high-intensity light sources has been accomplished. Although it has been found that the practical utilization of phototropic material as a protective eye device against an atomic flash is marginal, its use as a sunglass appears to be feasible. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
A FIELD TEST OF CANAIGRE-TANNED HEAVY LEATHER IN LOW QUARTER SHOES, by Ludwig Seligsberger, Charles W. Mann, and Joseph Naghski (Hides and Leather Lab.). Oct 59, 26p. 16 refs. Footwear and Leather Series rept. no. 15.
Order from LC mi$2.70, ph$4.80 PB 144 533

The service characteristics of these shoes were studied over a period of 14 months. Details of the tanning trial and the field test are described. Only minor, if any, differences between the shoe components made from canaigre and from standard leather were noted - except for the wear resistance of the outsole. The wear resistance of the outsoles was measured by comparing losses in outsole thickness before and after wear. By this method, oil-treated canaigre soles showed a 22% greater loss than oil-treated standard soles. This difference is sufficiently small to warrant the conclusion that the leather industry could produce canaigre-tanned leather as good as heavy leather tanned in the conventional manner, if it were to direct its efforts toward that goal. The field test, therefore, may be considered as an encouraging first step toward establishing canaigre as a domestic replacement material for critical and strategic tanning imports.

Quartermaster Research and Engineering Center, Natick, Mass.
TEST OF THREADS FOR FOOTWEAR CONSTRUCTION CONSIDERING THE EFFECT OF STORAGE, by Edward B. Frederick. Oct 58, 30p. Footwear and Leather Series rept. no. 14.
Order from LC mi$2.70, ph$4.80 PB 138 411

This study was undertaken to determine the optimal thread and cord combination for stitching the uppers and bottoms of leather combat footwear in order to extend its service life. The effect of a two-year storage period, under both temperate and tropical conditions, on the stress-strain properties of selected threads and cords was investigated. The threads and cords were stored in skeins and in a wrapped-around-leather condition. Service shoes stitched with various combinations of these threads and cords were also stored. The threads and cords were laboratory tested periodically during storage and again at the end of the two year period. The shoes were visually examined periodically and, after the complete storage period, they were wear-tested. The laboratory test results showed the strength loss of the nylon threads to be negligible during storage. The shoe wear test results showed the nylon thread to be significantly more durable for upper stitching than any of the other threads tested. In the laboratory, the nylon and polyester cords were found to be about equal during the storage period. Both lost less strength than either the cotton or linen cords. As a result of the shoe wear test, the durability of all of the bottom stitching cords was indicated to be about equal. (Author) (See also PB 140 252)

PHYSICS

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TECHNICAL PAPERS FROM THE QUARTERLY REVIEW OF BUMBLEBEE ACTIVITIES, JANUARY-JUNE 1957. Rept. on Contract NOrd-7386. [1957] 48p. 15 refs. Bumblebee rept. no. 270.
Order from LC mi$3.30, ph$7.80 PB 145 094

Contents:
Material transport in a laminar propane-air flame front
Material strengths under missile load conditions
Transistor IF amplifiers
Calculation of fluid flow in a variable-area can combustor
Use of thermistors in precision thermal conductivity gas analyzer
Approximate method for calculation of ogive-cylinder aerodynamic characteristics
Design of an acceleration insensitive skin-friction balance for supersonic flight
An investigation of the fine structure of turbulent flows
Automatic recording wave analyzer for analysis of vibration data

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 3. PHYSICS (PART I). 373p.
Order from OTS $3.75 PB 161 135

Contents:
Multiple subfields of physics
Astronomy and astrophysics
Atomic and molecular
Biophysics
Electricity and magnetism
Electromagnetic waves
Electron physics
Heat and thermodynamics
Light and optics
Nuclear physics
Sound and acoustics
(See also PB 151 496)

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 4. PHYSICS (PART II) AND GEOPHYSICAL SCIENCES. 375p.
Order from OTS $3.75 PB 161 136

Contents:
Physics (Part II):
Mechanics (except solid state)
Solid state physics
Geophysical Sciences:
Cartography and geodesy
Earth physics
Geography
Geology and geophysics
Meterology
Oceanography
(See also PB 151 497)

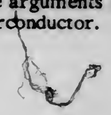
Diamond Ordnance Fuze Labs., Washington, D. C.
THE DISCONTINUOUS POTENTIAL OF AN AXIALLY SYMMETRIC CHARGE ON A SPHERE, by Chester Snow. 1 Oct 59, 39p. 2 refs. TM-59-8.
Order from LC mi$3.00, ph$6.30 PB 144 709

If a sphere is covered with a thin metallic foil which is cut along some circle, its two parts may be kept at different potentials. The limiting case where this insulating cut is infinitely thin leads to a surface potential with finite discontinuity. The potential function at all points inside and outside the sphere may be evaluated by exact formulas so the surface density of electric charge on each cap may be computed, not only when the sphere is isolated, but also when it is any height above a conducting plane. (Author)

Maryland U., College Park.
DETERMINATION OF THE SUPERCONDUCTING SKIN DEPTH FROM THE ENERGY GAP AND SUM RULE, by M. Tinkham (U. of California) and R. A. Ferrell. Rept. on Contracts Nonr-1797(00) and 222(58). Feb 59, 13p. 18 refs. Physics Dept. Technical rept. no. 131.
Order from LC mi$2.40, ph$3.30 PB 144 780

It has previously been pointed out that the oscillator strength sum rule provides a useful relation between

the energy gap in a superconductor and the strength of the supercurrent which flows in response to an applied low frequency field. A direct consequence is the effect of impurities in increasing the penetration depth. The purpose of the present note is to extend these arguments to the case of an ideal pure bulk superconductor.



Acoustics

Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RANDOM VIBRATION SIMULATION, by Neal Granick. Status rept. on Destructive Noise and Vibration. Nov 58, 18p. 12 refs. WADC Technical note 58-274; AD-203 125.
Order from LC mi$2.40, ph$3.30 PB 145 147

The status of random vibration research as it pertains to problems in simulation is reviewed critically. Areas of experimental research are suggested which eventually may determine the extent to which random vibration should be used in the laboratory. The continued use of sinusoidal vibration techniques for the simulation of noise-induced vibration appears justified on the basis of existing knowledge and economic considerations. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INTEGRATED WHITE NOISE, by Roy Leipnik. July 59, 14p. NOTS TP-2370; NAVORD rept. 7013.
Order from LC mi$2.40, ph$3.30 PB 145 127

The autocovariance of n-times finite-integrated band-limited white noise is calculated in terms of exponential-integral functions. Asymptotic results are obtained for large and small band-width limits, and error-bounds are given, with a view toward error-analysis of integrated accelerometers. (Author)

Ordnance Research Lab., Pennsylvania State U., University Park.
A THEORY OF REFLECTIONS FROM GRADUAL-TRANSITION SOUND ABSORBERS, by Norman V. Miller. Rept. no. 46 on Contract NOrd-16597. 15 Dec 58, 47p. 14 refs. AD-208 109.
Order from LC mi$3.30, ph$7.80 PB 144 963

In this report, reflections from gradual-transition linings for anechoic tanks are treated theoretically by considering the propagation of compressional waves in stratified media. Typical linings are considered in detail to determine theoretically the proportion of transition width to total lining width that produces minimum reflections. A comparison of the theoretical results with experimental data for a cone-type underwater lining indicates that the one-dimensional theory gives useful results for cone and wedge linings.

Electricity and Magnetism

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
MAGNETOHYDRODYNAMIC CHANNEL FLOW OF A PERFECT GAS FOR THE GENERATION OF ELECTRICAL POWER, by G. W. Sutton. Rept. on Contract AF 04(647)269. 8 Dec 59, 34p. 9 refs. Technical Information Series R59SD473.
Order from LC mi$3.00, ph$6.30 PB 145 184

This report considers the channel flow of an ideal compressible gas which is slightly ionized, for the purpose of generation of electrical power. Analytical expressions are derived for the flow variables for flows of constant velocity, temperature, pressure, density and area.

Carnegie Inst. of Tech., Pittsburgh, Pa.
ELECTRIC FIELD DISTRIBUTION IN AN IONIZED GAS. I, by Michel Baranger and Bernard Mozer. (Doctoral thesis). Technical rept. no. 1 on Contract Nonr-760(15). [1959] 19p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 144 897

A method for improving systematically the Holtsmark distribution is described. It is based on a cluster-type expansion and takes into account increasing orders of correlation. In this paper, it is applied to the calculation of the distribution of the high-frequency component of the electric field in an ionized gas in thermal equilibrium. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
ATMOSPHERIC WHISTLERS AND THE ELECTRON DENSITY IN THE IONOSPHERE, by F. H. Shammatt. Rept. on Contract AF 19(604)5504. 21 Oct 59, 26p. 10 refs. Rept. no. 6-30; AFCRC-TN-59-790.
Order from LC mi$2.70, ph$4.80 PB 144 968

Some of the electromagnetic energy released from lightning strokes travels a path through the ionosphere essentially parallel to the magnetic lines of the earth's magnetic field. It arrives at the ground in the opposite hemisphere as a frequency dispersed wave train with time delay increasing with decreasing frequency. This report presents a method of computing the dispersion from a knowledge of the electron density and compares observed and computed dispersions based on an assumed exponential electron density height distribution.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
IMPROVEMENTS IN DESIGN OF THE FIVE-STRING PENDULUM MAGNETOMETER, by C. H. Nowlin. Scientific rept. no. 14 on Contract AF 19(604)1084. 10 Sep 58, 34p. 4 refs. AFCRC-TN-58-554; AD-160 863.
Order from LC mi$3.00, ph$6.30 PB 137 792

Attention was given to the experimental and theoretical problems of measuring the saturation magnetic moment per gram of various magnetic materials. A five-string pendulum magnetometer is used and the sample is located in a non-homogeneous field. A description and pictures of a practical operating system (including automatic timing) are shown. Sources of possible error are pointed out, together with the methods of suppressing them, which enabled us to limit our error to a maximum of 3 per cent. Furthermore, equations are derived showing the exact effect of using simply shaped pole caps, e.g., spherical, instead of hopefully assuming that all will be well if one limits operation to a small region near the center of the pole gap. (Author)

Electronics

PLASMA: BIBLIOGRAPHY. Suppl. to Electric Discharges in Gases and on Plasma: Annotated Bibliography. 28 Jan 59 [13]p. AF 1255489, Suppl. to AF 1255488.
Order from LC mi$2.40, ph$3.30 PB 142 618

Consists of entries from Western open sources, 1955-58.

A bibliography on plasma covering the publications of the United States, England and France and which is a supplement to AF 1255488 entitled "Annoted Bibliography on Electric Discharges in Gases and on Plasma" dated Jan. 28, 1959 covering publications from Soviet open sources, 1950-1958 (technical translation 59-12981).

Air Force Cambridge Research Center, Bedford, Mass.
THE McGILL SYMPOSIUM ON MICROWAVE OPTICS JUNE 22-25, 1953. PART I. MICROWAVE OPTICS, by B. S. Karasik and F. J. Zucker. Apr 59, 142p. 156 refs. AFCRC-TR-59-118(I); AD-211 499.
Order from OTS $2.75 PB 161 450

Contents:
Lenses and reflectors
Caustics and aberrations
Fourier transforms and communication theory
Microwave optics of artificial dielectric media
Microwave interferometry and the Faraday effect

Air Force Cambridge Research Center, Bedford, Mass.
THE McGILL SYMPOSIUM ON MICROWAVE OPTICS, JUNE 22-25, 1953. PART II. DIFFRACTION AND SCATTERING, by B. S. Karasik and F. J. Zucker. Apr 59, 250p. 172 refs. AFCRC-TR-118(II); AD-211 500.
Order from OTS $3.50 PB 161 451

Contents:
Electromagnetic theory
General techniques
The geometric optics limit in diffraction theory
Asymptotic developments
Diffraction by apertures
Scattering by specific bodies
Radiation patterns of antennas
Experimental studies
(See also PB 161 450)

Hughes Aircraft Co., Culver City, Calif.
NEAR FIELD ANALYSIS OF CIRCULAR APERTURE ANTENNAS, by R. C. Hansen and L. L. Bailin. Scientific rept. no. 3508/3 on Contract AF 19(604)3508. Aug 59, 37p. 20 refs. AFCRC-TN-59-780; AD-228 778.
Order from LC mi$3.00, ph$6.30 PB 144 600

The problem of the accurate determination of the total electromagnetic field produced by a current distribution on a circular disc type aperture is examined. For comparison of the near and Fresnel region solutions, an exact Maxwellian integral is used as the starting point. Aperature and space coordinates are separated by the use of Bessel function addition theorems, allowing the field to be expressed as a sum of terms containing radial and angular integrals. The radial integrals involve only the disc (aperture) distribution and coordinates while the angular integrals involve only the elevation angle. The distance from origin appears implicitly in the series coefficients. These integrals are suitable for high speed computations and have been evaluated for a number of cases. The results are compared with the small angle and general Fresnel formula values for various observation angles, distances from the aperture, and aperture distributions. (Author)

Hughes Aircraft Labs., Culver City, Calif.
PERIODICALLY SLOTTED SURFACE WAVE STRUCTURE, by Robert W. Hougardy. Scientific rept. no. 3508/4 on Contract AF 19(604)3508. Aug 59, 31p. 11 refs. AFCRC-TN-59-781.
Order from LC mi$3.00, ph$6.30 PB 144 599

A new type of surface wave structure is considered in which the required reactive surface impedance is provided by a parallel array of air-filled waveguides with contiguous broad walls. Each guide has a narrow wall containing a series of closely-spaced, non-resonant, transverse slots. For an operating frequency at which the narrow dimension of each guide is less than one-half free-space wavelength, all propagating modes are of the surface wave type. An approximate solution for the propagation constant β of the dominant mode is obtained by employing a variational technique. Experimental results are in qualitative agreement with theory. Attempts to predict the radiation pattern of this surface wave structure meet with varied success, with best results obtained for $(\beta/k)-1<0.040$. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
THE SOLUTION OF MAXWELL'S EQUATIONS IN TERMS OF A SPINOR NOTATION. PART I. THE INITIAL VALUE PROBLEM IN TERMS OF FIELD STRENGTHS AND THE INVERSE PROBLEM, by

H. E. Moses. Rept. on Contract AF 19(604)1717. June 58, 39p. 5 refs. Research rept. no. EM-114; AFCRC-TN-58-189; AD-152 441.
Order from LC mi$3.00, ph$6.30 PB 137 566

Maxwell's equations for fields with sources in media in which the dielectric constant and permeability are unity are written in terms of a spinor notation which resembles the one used for Dirac's equation for the electron. One can introduce Green's functions and expansions in terms of complete sets of orthogonal functions, which are analagous to those used in the quantum theory of the electron, to solve Maxwell's equations in more compact form than in terms of the conventional vector notation. It is possible to express both real and complex vector potentials simply in terms of the field strengths by means of this notation. Some examples will be given. Furthermore, the new notation enables us to solve in a simple way an 'inverse radiation problem'.

Institute of Optics, U. of Rochester, N. Y.
A SIMPLE PULSED ULTRAVIOLET LIGHT SOURCE, by Richard F. Weeks. Technical note no. 15 on Contract AF 19(600)193. Sep 58, 19p. 6 refs. AFOSR-TN-58-615; AD-162 143.
Order from LC mi$2.40, ph$3.30 PB 138 219

A pulsing circuit to permit the use of a conventional low pressure "Nester" hydrogen arc as an ultraviolet stimulating source for luminescence studies is described. The pulse duration may be varied from 5 milliseconds to 30 microseconds with a repetition rate of 60 per second. There is no perceptible variation of the light form from pulse to pulse. The rise time of the pulses is 20 microseconds and the fall time, 0.3 microseconds. The pulsing circuit is assembled from conventional electronic components and contains no critical high frequency circuits. The inherent spectral range and reliability of operation of the Nester lamp are maintained and the unit may be easily switched to DC operation. The use of this source in kinetics measurements is discussed briefly.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
SELECTIVE REFLECTIVITY OF CRYSTALS IN THE NEAR INFRARED, by Dean Fiske Kimball. Rept. on Contract Nonr-248(01). 1 Oct 57, 87p. 9 refs. AD-200 149.
Order from LC mi$4.80, ph$13.80 PB 137 708

The reflectivities of six newly prepared synthetic crystals (corundum, spinel, nickel zinc ferrite, zinc ferrite, titania oxidized and titania reduced) were measured over the region 1-25 microns. The measurements were made on a modified Perkin-Elmer Model 12C single beam double pass spectrometer using unpolarized radiation and near normal incidence. All crystals exhibited selective reflection with the regions of strong reflection of zinc ferrite and nickel ferrite beginning at about 15 microns, and those of the other crystals beginning at about 11 microns. Corundum attained the highest reflectivity of any of the samples, its peak reflectivity reaching 95%. However, it appears that the titania crystals have the best chance of proving useful. The transmission of a plate of 0.0096" thickness of InSb was also measured over the region 1-25 microns. It was opaque out to 7 microns after which the transmission increased very rapidly to a maximum value of 45%. This material has found application as a short wavelength cut-off filter. (Author)

Research Technology Associates, Inc., Waltham, Mass.
STUDY OF ELECTRON AND ION BEAMS UNDER OUTER SPACE CONDITIONS, by J. Babakian. Final rept. on Contract AF 19(604)3895, 15 Aug 59, 97p. 17 refs. AFCRC-TR-59-172.
Order from LC mi$5.40, ph$15.30 PB 144 980

The research and design of an experimental high vacuum system is considered in some detail. This facility was intended for the evaluation of electron and ion beams under a variety of environmental conditions. The equipment has been built and tested. Some aspects of the formation and propagation of electron beams have been considered. Some designs of electron guns and their possible use have been discussed. In like manner ion sources and ion beams have been covered.

Rome Air Development Center, Griffiss AFB, N. Y.
AN INVESTIGATION WITH NEUTRAL DENSITY FILTERS OF THE RELATIONSHIP BETWEEN CRT SIGNAL DETECTION AND BRIGHTNESS DISCRIMINATION, by Robert L. Erdmann. Nov 59, 13p. 2 refs. RADC-TN-59-318.
Order from LC mi$2.40, ph$3.30 PB 144 776

Signal detectability on cathode ray tubes (CRT) depends primarily upon the brightness discrimination ability of the observer. Typical data on brightness discrimination indicates that this function improves continuously up to intensity values well above the maximum light output of a CRT. Yet, observations relating to voltage required for signal detection on CRT's to grid bias, which regulates light output, show a minimum value well below the bias that produces maximum light output. This report presents two previous explanations of this phenomenon and investigates the implications of one. The discussion section presents some special difficulties encountered when trying to apply brightness discrimination data to intensity modulated scopes. (Author)

Stanford U., Calif.
SYNTHESIS OF THIRD ORDER CONTRACTOR CONTROL SYSTEMS, by Irmgard Flügge-Lotz. Rept. on Contracts AF 49(638)513, NAw-6533, and AF 33(600)35030. 15 Oct 59, 32p. 14 refs. Div. of Engineering Mechanics technical rept. no. 123; AFOSR-TN-59-918.
Order from LC mi$3.00, ph$6.30 PB 145 504

The transfer function of the uncontrolled linear dynamic system has one real and two complex poles and may have zeros. The parameters of the system change with operating conditions. A feedback contactor control with linear switching function is suggested, which can be realized easily and which is efficient under different operating conditions. The design is based on the idea of coming as close as possible to "optimum" control in those cases for which the latter is known. The influence of imperfections (time delay, threshold) on the performance of the control system is discussed. (Author)

Technical Research Group, Syosset, N. Y.
SPHERICALLY SYMMETRICAL LENSES, by A. F. Kay. Rept. on Contract AF 19(604)4054. Oct 58, 37p. 14 refs. Technical rept. no. 122-1; AFCRC-TN-58-566; AD-160 878.
Order from LC mi$3.00, ph$6.30 PB 138 277

A design procedure is given for finding the index variation of a spherically (or cylindrically) symmetric lens which will produce, with some restrictions, any desired shaped beam pattern. Applications are made to a broad beam Luneberg lens, a bistatic Luneberg reflector, and a bistatic Eaton-Lippmann lens. Other examples are also worked out. The practical importance of the index singularity at the center of lenses of the Eaton-Lippmann type is treated. In Part II, the question of tolerances in refractive index in spherically and cylindrically symmetric lenses is considered. Some new properties of radially symmetric lenses are given.

Trinity Coll., Dublin (Eire).
EMISSION OF SECONDARY ELECTRONS FROM SOLID SURFACES. Annual technical status rept. ATR no. 1 for 1 Nov 58-31 Oct 59 on Contract DA 91-591-EUC-973. 6 Nov 59, 5p. AD-228 543.
Order from LC mi$1.80, ph$1.80 PB 144 920

Experimental work has been concerned with the production of ultra high vacuum in the neighborhood of 10^{-10}mm Hg necessary for the production and maintenance of clean surfaces.

Molecular Physics and Spectroscopy

Columbia U., New York.
THEORY OF SATURATION IN ELECTRON SPIN RESONANCE SPECTRA, by Michael J. Stephen and George K. Fraenkel. Technical note rept. no. 2 on Research in Electron Spin Resonance, Contract AF 49(638)520. 23 Sep 59, 44p. 24 refs. CU-2-AF-520-Chem.; AFOSR-TN-59-745.
Order from LC mi$3.30, ph$7.80 PB 144 910

A theory of saturation in electron spin resonance spectra exhibiting hyperfine splitting is presented. This theory is used to study the saturation of free-radical spectra in solution, and a variety of relaxation processes are investigated.

Emory U., Ga.
RELATIVE DOUBLE-BONDING CAPACITIES OF THE HALOGENS, by J. H. Goldstein, John A. Howe and Roselin S. Wagner. Technical rept. no. 4 on Program in Microwave Spectroscopy, Contract DA 01-009-ORD-440. 15 Dec 56, 4p. 9 refs.
Order from LC mi$1.80, ph$1.80 PB 138 327

Brief based studies are made of several series of gaseous organic halides. (See also PB 137 496)

Indiana U., Bloomington.
A STROBOSCOPIC FLASH SOURCE FOR KINETIC SPECTROSCOPY, by Jerry H. Current, Odell F. Raper, and Edward J. Blair. Rept. on Contract AF 18(603)93. 29 Aug 58, 12p. 3 refs. AFOSR-TN-58-[778]; AD-201 926.
Order from LC mi$2.40, ph$3.30 PB 138 172

A stroboscopic light source is described for observing the kinetic behavior of chemical systems by absorption spectroscopy. The light consists of a short train of flashes in an accurately timed sequence. Such a system takes advantage of the brilliance of the xenon flash source while at the same time making it possible to observe the system at a sequence of times. Accurate timing is inherent in the apparatus. (Author)

Institute of Molecular Physics, U. of Maryland, College Park.
MOBILITY OF HYDROGEN IONS (H^+, H_2^+, H_3^+) IN HYDROGEN, by Edward A. Mason and Joseph T. Vanderslice. Rept. on Contract AF 18(600)1562. 14 Nov 58, 23p. 26 refs. IMP-OSR-11; AFOSR-TN-58-1005; AD-206 148.
Order from LC mi$2.70, ph$4.80 PB 137 813

Force laws for H^+, H_2^+, and H_3^+ in H_2 are calculated from theory and from results on the scattering of low-velocity ion beams in H_2 gas. These results are then used to calculate the mobilities of the hydrogen ions in H_2 gas as a function of temperature. The mobilities of H^+ and H_2^+ decrease slightly with increasing temperature, but the mobility of H_3^+ increases strongly. The agreement with experiment indicates that the unidentified hydrogen ion whose mobility has been measured is probably H_2^+, rather than the usually assumed H_3^+. (Author)

Massachusetts Inst. of Tech., Cambridge.
SOLID-STATE AND MOLECULAR THEORY GROUP. Quarterly progress rept. no. 28 on Contract Nonr-1841(34). 15 Apr 58, 66p. 75 refs. AD-161 845.
Order from LC mi$3.90, ph$10.80 PB 138 568

A note on the spin hamiltonian
Compton scattering of X-rays from non-spherical charge distributions
X-ray atomic scattering factors
Electronic wave functions for polyatomic molecules
Dipole moment in hydrogen fluoride
Electron coupled interaction between nuclear spins in the HD molecule
Multi-center integral programs for I.B.M. 704 computer
704 programs
Energy band in iron
Energy bands in potassium
Bimolecular semiconducting compounds
Electronic structure of a two-vacancy V-center in KCl
Interaction of a hole with mobile lattice ions in KCl
Transport properties of metals (See also PB 138 444)

Mellon Inst. [of Industrial Research, U. of Pittsburgh] Pa.
INFRARED SPECTROSCOPIC EVIDENCE FOR THE ROTATION OF AMMONIA MOLECULE IN SOLID ARGON AND NITROGEN, by D. E. Milligan and R. M. Hexter. Rept. on Contract AF 49(638)542. 18 Dec 59, 16p. 6 refs. AFOSR-TN-59-1327.
Order from LC mi$2.40, ph$3.30 PB 144 908

High resolution infrared spectra [of the symmetric bending mode] of ammonia suspended at high dilution in solid argon and nitrogen have been obtained. More than a half dozen extremely sharp bands have been observed in the 950-1040 cm^{-1} region [in the spectrum of ammonia] in these materials under conditions where there should be little if any absorption due to polymeric species. The frequency separations of the bands, their temperature dependence and their extreme sharpness appear to be compatible with a model in which the ammonia molecule executes quantized rotation in these solids. (Author)

Mellon Inst. [of Industrial Research, U. of] Pittsburgh, Pa.
INTERMOLECULAR COUPLING OF VIBRATIONS IN MOLECULAR CRYSTALS, by R. M. Hexter. Rept. on Contract AF 49(638)542. 22 Oct 59, 36p. 25 refs. AFOSR-TN-59-1139.
Order from LC mi$3.00, ph$6.30 PB 144 867

The theory of Davydov of the origin of correlation field splittings is applied to the non-degenerate modes of solid methyl chloride. Intermolecular coupling constants and dipole derivatives for these modes in the solid are derived. An isotope effect on such splittings is reported for the first time in methyl iodide and is accounted for by means of Davydov's theory. The effect of intermolecular transition dipole coupling on intensities is derived and compared with implications of the dipole derivatives derived from the correlation field splittings. The possible use of other bases for correlation field splittings is discussed. (Author)

University Coll., Dublin (Eire).
OPTICAL ABSORPTION IN INORGANIC SOLIDS. Annual Technical rept. no. 1, 1 Oct 58-30 Oct 59, on Contract DA 91-591-EUC-958. 30 Oct 59, 13p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 145 019

The absorption spectra of thin films of stannous oxide, stannic oxide, tetragonal plumbous oxide, rhombic plumbous oxide and plumbic oxide have been determined from 2000 - 10,000A. The absorption spectra of thin films of beryllium oxide zirconium dioxide, tantalum pentoxide, stannous oxide, stannic oxide, plumbous oxide, arsenic trioxide, antimony trioxide and bismuth trioxide have been determined from 1200 - 2000A using a Schumann region grating spectrophotometer. Another apparatus for evaporation in vacuum and an apparatus for the measurement of absorption spectra at liquid nitrogen temperatures have been constructed during the reporting period.

Optics

Air Force Missile Development Center, Holloman AFB, N. Mex.
A STUDY OF THE REFLECTION EFFICIENCIES OF A WATER-WHITE, SILVER-BACKED GLASS MIRROR AT DIFFERENT ANGLES OF INCIDENCE, by Fred Allison and Kenneth Steele. Oct 59, 62p. AFMDC-TN-59-27.
Order from LC mi$3.90, ph$10.80 PB 144 979

The reflection efficiencies of the silver-backed, water-white glass mirror contemplated for the Holloman Solar Furnace have been determined, at various angles of incidence, by both computational and experimental methods. The results indicate practically negligible differences in the mirror efficiencies at all angles at which the solar radiation will impinge on the heliostat and the condenser mirrors of the presently designed furnace. The mirror efficiency experimentally determined approximates 92 percent of the incident angles considered. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
POWER SPECTRA EVALUATIONS FOR SELECTED AIRBORNE MICROWAVE REFRACTOMETER RECORDINGS, by F. N. Edmonds, Jr., F. X. Bostick, Jr. and J. R. Gerhardt. Rept. on Contract AF 19(604)2249. 15 Aug 58, 88p. 22 refs. Rept. no. 6-24; AFCRC-TN-58-377; AD-160 830.
Order from LC mi$4.80, ph$13.80 PB 138 256

Fifteen samples of tropospheric index of refraction fluctuations have been analyzed statistically to give a description of the fluctuation field which is then interpreted in terms of current theories for the production of these fluctuations. The samples or shots were measured with an airborne microwave refractometer over Camp Carson, Colorado, at altitudes ranging from 6500 to 20,000 feet above mean sea level. The analysis used improved equipment and techniques developed at EERL and yielded a power spectrum, an amplitude distribution plot and a running rms for each sample which are presented in Appendix I.

Millikan Lab. of Physics, Pomona Coll., Claremont, Calif.
ULTRASOFT X-RAY INTERACTION COEFFICIENTS, by Burton L. Henke and Jack C. Miller. Technical rept. no. 3 on Ultrasoft X-ray Physics, Contract AF 49(638)394. Aug 59, 84p. 8 refs. AFOSR-TN-59-895.
Order from LC mi$4.80, ph$13.80 PB 144 965

Ultrasoft x-radiations (10 to 100 A in wavelength) are highly absorbed by matter so as to be particularly useful in microanalysis. Not only are the photoelectric absorption cross-sections very large compared with those for conventional x-ray wavelengths but also the effect of radiative damping upon the scattered wave becomes significantly large. Generally, the ultrasoft x-ray interactions are considerably simpler and more easily defined than those for conventional x-radiations. Atomic scattering factors have been tabulated for O, Al and Si; refractive indices have been obtained for Al, Al_2O_3, and SiO_2; and the reflected intensities from surfaces of Al, Al_2O_3 and SiO_2 and from layered combinations of these surfaces have been tabulated as a function of both wavelength and angle of reflection. These results have been used to illustrate the potentiality of ultrasoft x-radiations for application to the microanalysis for mass, chemical and surface structure information.

Naval Ordnance Test Station, China Lake, Calif.
THE SPATIAL DISTRIBUTION OF INFRARED RADIATION FROM THE CLEAR SKY INCLUDING SEQUENCES OF SKY MAPS AT VARIOUS ELEVATIONS, by H. E. Bennett, Jean M. Bennett, and Max R. Nagel (Air Force Cambridge Research Center). 30 Sep 59, 72p. 21 refs. NOTS Technical pub. 2302; NAVORD rept. 6577.
Order from LC mi$4.50, ph$12.30 PB 145 109

Series of measurements of the spatial distribution of radiation from the clear sky made from locations at approximately 1000, 6000 and 14,000 feet elevation are reported. A theoretical relation is shown to correctly predict the observed variation in radiance with elevation angle in the 2-40 micron wavelength region, where radiation from the sky is mainly due to thermal emission by the atmosphere. In the 0.6-2 micron region, where the radiation is mainly scattered sunlight, the spatial distribution is related to that which was observed simultaneously in the visible but forward scattering is relatively more important in the near infrared and the relative intensities in the two regions are not constant. (Author)

New York U., N. Y.
A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS, by J. H. Rohrbaugh. Scientific rept. no. 7, 1 Mar-31 May 59, on Millimeter Wave Project, Contract AF 19(604)2673. [1959] 71p. 4 refs. AFCRC-TN-59-784.
Order from LC mi$4.50, ph$12.30 PB 144 969

A perturbation method is described whereby the eigenfrequencies and the frequency distribution of an alkali halide may be calculated at an arbitrary temperature if this has been done at room temperature. This is applied here to find the eigenfrequencies of NaCl at 2°K, and to compare with the values at room temperature. A method is also presented for the calculation of the perturbed eigenvectors and several are calculated and examined. Results are given for the experiment investigating the effect of surface conductivity on the intensity distribution among the orders of an echelette grating. The findings are inconclusive. (Author) (See also PB 142 729)

Polan Industries, Inc., Huntington, W. Va.
INDUSTRIAL PREPAREDNESS STUDY FOR NEAR INFRARED FILTERS AND INTERMEDIATE INFRARED FILTERS, by D. N. Igou. Final rept. for 26 June 56-May 59 on Contract DA 36-039-sc-72739. May 59, 69p. 14 refs.
Order from LC mi$3.90, ph$10.80 PB 145 441

This report includes data on quarters, equipment, materials, methods and procedures used in manufacturing these filters. It also includes Near and Intermediate Infrared Filter Curves, photographs and drawings of equipment and facilities necessary for production. (Author)

Woods Hole Oceanographic Institution, Mass.
MEASUREMENT OF SPECTRAL DISTRIBUTION OF LIGHT UNDERWATER, by Charles J. Hubbard. Status rept. on Research in Underwater Optics, Contract Nonr-1720(00). Jan 58, 15p. Ref. no. 58-6; AD-154 363.
Order from LC mi$2.40, ph$3.30 PB 137 955

The optical system of the spectrophotometer swept the wavelength region from 4000 A to 6000 A with a bandwidth of about 100 A. The instrument was designed to be suspended by 4-conductor oil well logging cable. The detecting element of the instrument was a type 1P21 multiplier phototube. The optical system employed was a variation of the Littrow spectrometer in which the collimated light is passed twice through the dispersing prism. Included in the pressure case was a depth measuring element which consisted of a commercial pressure actuated potentiometer. A Sanborn 2-channel type recorder was used. The calibration of wavelength versus elapsed time, relative to the pulse from the depth meter was obtained by means of several gas discharge tubes of known emission line spectra. Eight successful lowerings of the spectrophotometer were made in the Atlantic slope water.

Solid State Physics

[Arkansas U., Fayetteville]
PHOTOLYSIS OF CRYSTALLIZED LEAD AZIDE, by Jack G. Dodd, Jr. [Rept. on Contract DA 44-009-eng-2439] 15 Aug 56, 73p. 49 refs. AD-124 250.
Order from LC mi$4.50, ph$12.30 PB 137 723

The photolysis of lead azide in the crystalline form has been studied as a function of wave length, intensity and time, and the results indicate that the mechanism of photolysis suggested by Thomas and Tompkins (Proc. Roy. Soc. 209A:550-561, 1951; 210A:111-125, 1951) for barium and potassium azides cannot apply without modification. It is shown that an unusual lattice contribution exists for lead azide by comparing the photolytic threshold of lead azide in solution with lead azide in the crystalline state. On the basis of this information a model involving the production, trapping, and subsequent decomposition of single excitons at, or near, the surface is proposed. This model requires the production of holes and F-centers, the holes at least to be mobile. The presence of F-centers is believed to have been demonstrated through photoemission studies in which two regions of photosensitivity are observed; one due to direct ionization of the F-center by the incident radiation, and the other to ionization of the F-center by excitons formed during photolysis. Some unexplained results indicating that the photolytic rate varies as some small power of the time are presented, and it is shown that simple diffusion theory applied to the escape of nitro-

gen from the interior of the crystal is inadequate to fit the data. Some sort of recombination between F-centers and holes is suggested. (Author)

Brown U. Div. of Engineering, Providence, R. I.
ON THE STEADY CREEP OF SHELLS, by R. T. Onat and H. Yuksel. Technical rept. no. 5 on Contract Nonr-662(20). Jan 58, 19p. 7 refs. AD-154 573.
Order from LC mi$2.40, ph$3.30 PB 137 916

The analysis of the steady creep deformations is usually based on the creep law which stipulates the proportionality of the strain rate tensor to the tensor of stress deviation, the proportionality factor being a function of the invariants of the deviatoric stress tensor. Wahl (J. Applied Mech. 23:231-238, 1956) suggested a modified law which is related to the Tresca's yield criterion of the theory of plasticity. The modified creep law which is particularly suitable for the investigation of rotationally symmetrical deformations of shells is discussed in geometrical terms. The modified law is applied to establish the creep behavior of a sandwich cylindrical shell in terms of the stress resultants and the rates of curvature and extension of the middle surface. An example is treated using the stress resultants and the deflection rates as relevant variables to show the simplifications achieved in the analysis. Finite deflections of a solid circular membrane under uniform pressure are also discussed as a further example of the modified creep law.

California U., Los Angeles.
YIELD SURFACE AND PLASTIC POTENTIAL OF METALS, by T. H. Lin. Rept. on Contract AF 49(638)20. July 59, 13p. 30 refs. AFOSR-TN-59-714.
Order from LC mi$2.40, ph$3.30 PB 144 931

The coincidence of the plastic potential and yield surface for both single crystal and polycrystal aggregate is derived from the consideration of elastic strain and slips in individual crystals. Uniqueness in single crystals for incremental stress and strain is discussed. Corners in yield surfaces of a polycrystal aggregate are shown to exist and the sharpness of the corner is shown to increase with loading. (Author)

Chicago Midway Labs., U. of Chicago, Ill.
PREPARATION AND PROPERTIES OF INDIUM ARSENIDE, by Roy H. Harada and Alan J. Strauss. Rept. on Contract AF 18(603)09. 31 July 58, 28p. 17 refs. CML-TN-P108-14; AFOSR-TN-58-[742; AD-202 311]
Order from LC mi$2.70, ph$4.80 PB 137 689

Arsenic prepared by reduction of arsenic trichloride and purified by a thermal gradient sublimation technique has been used to prepare zone-refined n-type InAs as pure as any previously reported, although its free carrier concentration is still somewhat greater than 10^{16} cm^{-3}. A horizontal modification of the Bridgman technique has been used to grow large single crystals of InAs. The results of electrical measurements on the n-type material are in good agreement with those obtained elsewhere. These results, together with the results of heat treatment experiments performed at the Naval Ordnance Laboratory, support the view that the free carriers in the InAs are produced by ionization of doner impurities (principally aulfur) which originate in the arsenic used for synthesis. Compensated samples of InAs have been prepared by doping with cadmium. One such sample exhibits anomalous electrical properties similar to those reported in the literature for samples doped with zinc. Another cadmium-doped sample has a resistivity of 80 ohm-cm at 77°K, by far the highest value ever reported for InAs. (Author)

Detroit U. Mich.
DEVELOPMENT OF A MATHEMATICAL THEORY OF PLASTICITY BASED ON THE CONCEPT OF SLIP, by H. Payne, S. J. Czyzak, and N. Bow. Rept. on Contract AF 18(600)1466. 1 Oct 59, 25p. 8 refs. AFOSR-TN-59-1030.
Order from LC mi$2.70, ph$4.80 PB 144 773

The model developed by H. Payne has been used to solve the problem of a thin wall cylinder which is subjected to a torsional strain following a plaster tensile strain and the results of this work are described in detail. The study of the Bauschinger effect has been started and the work contained in this report deals with the first phase of this study. The method for calculating the plastic behavior for a reversal of a uniaxial strain has been developed and is discussed. (Author) (See also PB 140 791)

Diamond Ordnance Fuze Labs., Washington, D. C.
MICROWAVE PROPERTIES OF YTTRIUM IRON GARNET, by E. G. Spencer, R. C. LeCraw and C. S. Porter. 30 June 59, 18p. 21 refs. TR-633; AD-205 261.
Order from LC mi$2.40, ph$3.30 PB 145 010

Single crystal yttrium iron garnets grown from lead monoxide solution have the narrowest ferromagnetic resonance line widths of any material yet reported. Measurements, on spheres, are described of line width, threshold field, and relaxation times. These properties are shown to be strongly dependent on the degree of polish of the specimen surface.

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 1, 1 June-31 Aug 51, on Contract DA 36-039-sc-5587. [1951] 23p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 138 065

Eucryptite $LiAlSiO_4$ was grown in this quarter in fairly large fragments from melts of its own composition giving rise to the possibility that crystals of sufficient size for piezoelectric tests can be grown by one or more of the fusion methods such as slow cooling or lowering of a melt through a thermal gradient.

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 3, 1 Dec 51-29 Feb 52, on Contract DA 36-039-sc-5587. [1952] 19p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 138 066

Although crystals of eucryptite can be grown by slow cooling of melts of the composition $LiAlSiO_4$, nevertheless some measures must be taken to prevent spontaneous nucleation at many points. A special furnace has been constructed as well as apparatus for lowering the desired melt through the selected region of the gradient of the furnace. (See also PB 138 065)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 4, 1 Mar-31 May 52, on Contract DA 36-039-sc-5587. [1952] 17p.
Order from LC mi$2.40, ph$3.30 PB 138 067

Crystallographic evaluation of the compounds covered in the comprehensive survey on "The Stuffed Derivatives of the Silica Structures" as piezoelectric materials is included in this report. The most promising compounds are those listed under high tridymite and eucryptite. (See also PB 138 066)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 7, 1 Dec 52-28 Feb 53, on Contract DA 36-039-sc-5587. [1953] 17p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 138 068

Microscopic examination revealed the precipitation of impurities within the crystals of eucryptite. Melts of $LiAlSiO_4$ are rather viscous at about 1430°C. thereby reducing the possibility of successful growth of eucryptite by the withdrawal technique. (See also PB 138 067)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 9, 1 June-31 Aug 53, on Contract DA 36-039-sc-5587. [1953] 17p.
Order from LC mi$2.40, ph$3.30 PB 138 069

One objective during this quarter was to obtain more of the two unidentified crystalline phases which were discovered while evaluating graphite as a crucible material in runs made at 1450°C. to 1725°C. A rather long needle-like crystal was grown. The needle-like crystals as well as the hexagonal plates have been tentatively identified as corundum by optical and x-ray means. The optimum temperature for growth of corundum under the conditions described in this report is approximately 1700°C. (See also PB 138 068)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 10, 1 Sep-30 Nov 53, on Contract DA 36-039-sc-5587. [1953] 14p.
Order from LC mi$2.40, ph$3.30 PB 138 070

Large eucryptite crystals were produced by slow cooling melts of $LiAlSiO_4$ composition from about 1390°C. to 1350°C. The dendritic growth encountered in these melts is believed to be due to the presence of impurities in the starting materials. (See also PB 138 069)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 11, 1 Dec 53-28 Feb 54, on Contract DA 36-039-sc-5587. [1954] 17p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 138 071

Crystals obtained as a result of the slow cooling of melts of the composition $KNa_3Al_4Si_4O_{16}$ were small. It is believed that the high viscosity of the melt inhibits the formation and growth of large crystals. (See also PB 138 070)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
STRUCTURE-DETERMINED PROPERTIES OF EVAPORATED BISMUTH FILMS, by Carl E. Drumheller. Final technical rept. on Contract AF 33(028)21255. 15 Apr 58, 27p. 2 refs. AFOSR-TR-58-57; AD-154 280.
Order from LC mi$2.70, ph$4.80 PB 138 059

Infrared and electrical studies were made on bismuth films evaporated at 10^{-5} mm pressure onto cellulose nitrate substrates. To about 2000 Å thickness the films possess a single-layer polycrystalline structure. The infrared studies indicate that there are two types of grain boundaries, namely, those which contribute to the conductivity and those which do not.

Harshaw Chemical Co., Cleveland, Ohio
PREPARATION OF OPTICAL THALLIUM HALIDES, by H. C. Kremers. Rept. on Contract NObs-28277. [1946] 5p.
Order from LC mi$1.80, ph$1.80 PB 137 807

Covers purification as well as preparation. Melting points are given. Cutting techniques for the crystals are briefly noted.

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE AND OPTICAL SPECTRA OF SINGLE CRYSTAL OXIDES CONTAINING PARAMAGNETIC IMPURITIES, by W. Low. Technical note no. 3 on Contract AF 61(052)59. July 58, 39p. 28 refs. AFOSR-TN-58-882; AD-203 906.
Order from LC mi$3.00, ph$6.30 PB 145 401

A summary of the results of paramagnetic resonance spectra and optical spectra of single crystal oxides of cubic and lower symmetries containing paramagnetic impurities is presented. These results are discussed with reference to the possibility of using these materials for microwave amplification, Maser appli-

cations. A discussion of the effect of the Jahn-Teller theorem and the effects of covalent bonding on these spectra is given. (Author)

Illinois U., Urbana.
CONFIGURATION INTERACTION IN ALKALI HALIDE PHOSPHORS, by Robert S. Knox. Rept. on Contracts AF 18(600)689 and Nonr-1834(12). 15 Feb 59, 61p. 53 refs. [AFOSR-TN-59-232; AD-211 845]
Order from LC mi$3.90, ph$10.80 PB 144 892

It is shown that excited state wave functions of free activator ions do not provide a completely adequate basis for a quantitative theory of the luminescence of alkali halides activated by heavy metals. It is proposed that better zero-order wave functions may be obtained by allowing interaction between different types of states of excitation, and as a practical example of an electronic configuration which can interact with excited activator configurations, the electron transfer states of the Seitz model are discussed in detail.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
DISPERSION RELATIONS AND VIBRATIONAL FREQUENCY SPECTRA, by A. A. Maradudin and G. H. Weiss. Rept. on Contract AF 18(600)1315. Oct 59, 12p. 11 refs. Technical note BN-187; AFOSR-TN-59-1104.
Order from LC mi$2.40, ph$3.30 PB 144 782

Many relations have been given connecting the dispersion relation and frequency spectrum for a vibrating lattice. It is the purpose of this paper to show that these relations can all be derived from a single integral representation by using different representations of the delta functions. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE ELECTRONIC GROUND STATE OF AN APERIODIC ONE-DIMENSIONAL DELTA-FUNCTION LATTICE, by Alexei A. Maradudin and Barry S. Gourary (Applied Physics Lab.). Rept. on Contracts AF 18(600)1315 and NOrd-7386. Nov 59, 6p. 1 refs. Technical note BN-189; AFOSR-TN-59-1191.
Order from LC mi$1.80, ph$1.80 PB 145 314

Institute for the Study of Metals, U. of Chicago, Ill.
SELF-DIFFUSION IN SILVER DURING PLASTIC DEFORMATION IN EXTENSION AND COMPRESSION, by J. B. Darby, Jr. C. T. Tomizuka, and R. W. Balluffi. Rept. on Contract AF 18(600)1489. 14 Nov 58, 35p. 21 refs. AFOSR-TN-58-941; AD-205 085.
Order from LC mi$3.00, ph$6.30 PB 137 841

Self-diffusion of Ag^{110} in silver single crystals subjected to simultaneous deformation at 800 and 900°C. was studied using the sectioning technique. The effect of straining on the rate of diffusion was found to be less than 50 percent. Increases in diffusion rate due to the generation of point defects or short circuiting paths during deformation were small.

Institute of Optics, U. of Rochester, N. Y.
HOST SENSITIZED LUMINESCENCE IN KI:Tl, by K. Teegarden. Technical note B 2 on Contract AF 49(638)433. 17 Nov 58, 11p. 6 refs. AFOSR-TN-58-917; AD-204 563.
Order from LC mi$2.40, ph$3.30 PB 138 146

Host sensitized luminescence has been observed in a single crystal of KI doped with about one part in 10^5 of thallium. Excitation and emission spectra for the room-temperature luminescence are given.

Massachusetts U., Amherst.
THE SCATTERING OF LIGHT BY SPHERES WITH RADIAL VARIATIONS IN POLARIZABILITY AND ORIENTATION, by Richard S. Stein. Technical rept. no. 9 on Contract Nonr-2151(00). 10 Feb 59, 32p. 19 refs. AD-213 455.
Order from LC mi$3.00, ph$6.30 PB 144 959

In previous publications experimental results and analysis of scattering from polyethylene films are reported. The date is interpreted in a phenomonological way rather than in terms of a specific structural model. Recent experimental results have indicated that scattering data might be interpreted in terms of a ringed spherulite type model. Theoretical examination of the scattering expected from ringed spherulites has been started. This report represents the contribution of the writer to this work. More extensive calculations are being made by the Monsanto group using IBM computors.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A HIGH TEMPERATURE X-RAY DIFFRACTOMETER SPECIMEN MOUNT, by William L. Baun. Rept. for Jan-Dec 58 on Materials Analysis and Evaluation Techniques. Oct 59, 18p. 4 refs. WADC Technical note 59-139.
Order from OTS $0.50 PB 161 360

This specimen mount makes possible the examination of materials at temperatures up to 1900°C in high vacuum or inert atmosphere. Diffraction patterns of crystalline materials may be recorded in the scanning range 17° to 122° using this specimen mount. Realignment of the sample at temperature may be accomplished from each point of the three point sample suspension system. A power regulator is described which permits automatic temperature regulation by means of a sensing device that maintains an accurate pre-set temperature. (Author)

Minnesota U., Minneapolis.
NATURAL AND INDUCED SPECTRA OF SOME FERRITES, by D. B. Bonstrom, J. P. Hanton, and A. H. Morrish. Rept. on Contract AF 18(603)113. Nov 59, 35p. 12 refs. AFOSR-TN-59-1128.
Order from LC mi$3.00, ph$6.30 PB 144 868

Two ferrite materials, magnetite (Fe_3O_4) and gamma ferric oxide (γ-Fe_2O_3) have been investigated in detail over the frequency range 0 - 10 kmc/sec. These materials were in the form of powders that contained acicular particles close to the single-domain size. Detailed investigations of some single crystals of magnetite at temperatures from 2 - 125°K have been carried out. Further work on non-stoichiometric samples of magnetite is in progress.

Northwestern U., Evanston, Ill.
DEFORMATION OF SINGLE CRYSTALS CONTAINING GUINIER-PRESTON ZONES, by A. Kelly. Rept. on Contract AF 18(600)1468. 30 Dec 58, 30p. 27 refs. AFOSR-TN-58-1083; AD-207 530.
Order from LC mi$2.70, ph$4.80 PB 144 852

This paper is based on a review lecture which was given at the Physical Society Conference on Internal Surfaces at the University of Cambridge, England, in December, 1958.

Pennsylvania State U., University Park.
DEVELOPMENT AND APPLICATION OF INSTRUMENTATION FOR X-RAY AND NEUTRON ANALYSIS, by Ray Pepinsky. Final rept. on Contract DA 36-061-ORD-565. 20 May 58, 25p. OOR rept. 1797.1; AD-201 340.
Order from LC mi$2.70, ph$4.80 PB 144 756

With the rapid advance of automatic computing techniques for the treatment of diffraction data and determination and refinement of approximate crystal structures, the problems of rapid and accurate acquisition of diffraction data, experimental information about morphology, measurement of physical properties of crystals, etc., assume correspondingly greater and greater importance. Under the present research contract a variety of instruments for these purposes have been developed and constructed. Results obtained during fourteen months' operation are outlined: more detailed information on some points may be had by referring to preceding quarterly status reports, and to technical reports and published papers. Some reports and papers are yet to be prepared.

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 3, 1 Nov 57-31 Jan 58, on Contract DA 36-039-sc-72705. [1958] 111p. Philco H-2761; AD-202 532.
Order from LC mi$6.00, ph$18.30 PB 145 445

Fabrication process of the 4.3 mc silicon, graded-base amplifying transistor. Problems encountered in the operations of diffusion, tab soldering, control of the prealloying base width, plating and high temperature whisker soldering in regard to the 4.3 mc silicon graded-base device. (See also PB 138 100)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 4, 1 Feb-30 Apr 58, on Contract DA 36-039-sc-72705. [1958] 111p. Philco no. H-2761; AD-204 256.
Order from LC mi$6.00, ph$18.30 PB 145 449

Germanium Program: Arsenic has replaced phosphorus as the diffusant for the germanium devices making possible a 100% increase in the output of diffused germanium blanks. Electrolytic clean-up etching has been instituted into the fabrication process with an impressive improvement in the surface condition of the unit, resulting in a much higher life expectancy characteristic. Silicon Program: A redesign of the boron diffusion furnace and a stringent program of cleanliness has virtually eliminated any surface problems and has decreased the length of time involved in the silicon diffusion by 65%. A one-step gold-phosphorus plating solution is being developed. Sealing the silicon graded-base devices in a dry nitrogen atmosphere, rather than in air, produces units having demonstrably superior electrical characteristics. (See also PB 145 445)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 5, 1 May-31 July 58, on Contract DA 36-039-sc-72705. [1958] 125p. 1 ref. Philco no. H-2761; AD-211 951.
Order from LC mi$6.30, ph$19.80 PB 145 447

Germanium: The problem of solution cavities and their degrading effects on the storage life of germanium transistors has now been almost completely eliminated by the use of tin-indium solder and electrolytic clean-up etching techniques. An electrolytic etching machine has been developed and the use of this machine has resulted in a much higher degree of reproducibility and a greater yield. Silicon: The technique of obtaining a high temperature whisker to electrode bond through the use of a gold whisker wire, without solder, is now in full application. It now appears that the most consistent method of obtaining reproducible injection in the silicon surface-alloy, diffused-base transistors is by adding antimony to the electrode through a second plating cycle. (See also PB 145 449)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 6, 1 Aug-31 Oct 58; on Contract DA 36-039-sc-72705. [1958] 126p. Philco no. H-2761; AD-211 952.
Order from LC mi$6.30, ph$19.80 PB 145 448

Germanium Devices: Accurate control of the depth of etching on the MADT blank was achieved through the introduction of a method of individually measuring the thickness of each blank and computing the etch time with a calculating machine. Investigations into the origin of the defect responsible for recent fatigue testing failures showed that an HF etch of the stem prior to sealing will correct the difficulty. Silicon Devices: A reduction in shrinkage losses has been effected through the modification of the alloying furnace and the replacement of the bar heater type of blank-to-tab soldering fixture with a two-probe tabbing fixture. (See also PB 145 447)

Willow Run Labs., U. of Michigan, Ann Arbor.
LIQUID HELIUM DEWAR FLASK WITH INCORPORATED MAGNET POLE TIPS, by David F. Edwards. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Nov 58, 11p. 4 refs. 2144-349-T; AD-206 297.
Order from LC mi$2.40, ph$3.30 PB 145 121

A special liquid helium dewar flask that incorporates magnet pole tips in the dewar wall has been constructed in our laboratory. This dewar permits the study of the effect of large magnetic fields on the absorption properties of semiconductors, Hall effect, and magneto-resistance. Magnetic fields greater than 30 kilogauss have been obtained with this special dewar. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
OPTICAL EFFECTS ON F-CENTER SPIN RESONANCE AT LOW TEMPERATURES, by John Lambe and John Baker. Memo. on Proj. Michigan, Contract DA 36-039-sc-78801. Nov 59, 9p. 2 refs. Rept. no. 2900-104-R; AD-228 201.
Order from LC mi$1.80, ph$1.80 PB 144 734

Because of possible maser applications, the interaction of light with spin systems is of considerable interest. In this connection, experiments were carried out to study the effect of light on the spin resonance of F-centers. These experiments were done at liquid-helium temperatures, since at this temperature the F-center has a long spin-lattice relaxation time. It was found that the spin population could be significantly affected by optical illumination. It is possible that such an effect could be useful in pumping a 3-level maser system from an optically heated 2-level spin system. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
SPIN RESONANCE OF V^{2+}, V^{3+}, V^{4+}, IN α-Al_2O_3, by John Lambe and Chihiro Kikuchi. Technical memo. on Contract DA 36-039-sc-78801. Nov 59, 32p. 30 refs. 2616-12-R; AFOSR-TN-59-922.
Order from LC mi$3.00, ph$6.30 PB 144 569

Divalent vanadium has properties similar to those of trivalent chromium in sapphire, which has wide application in masers. Because of its readily recognizable spin-resonance signature due to its nuclear spin, and because of the ease of producing different oxidation states, it is suggested that vanadium may be a suitable probe with which to study ionization effects in certain solids.

X-Ray and Crystal Analysis Lab., Pennsylvania State U., University Park.
CRYSTAL STRUCTURE RESEARCH BY X-RAY AND NEUTRON DIFFRACTION, by Ray Pepinsky. Final rept. for 1 June 54-31 May 57 on Contract DA 36-039-sc-63233. [1957] 79p. 36 refs. AD-207 990.
Order from LC mi$4.50, ph$12.30 PB 145 204

Research on the structure of ammonium substituted Rochelle salt produced definite evidence of preferential substitution on the K_1 sites, and some indication of remarkable vibrational anisotropy of the K_1. An extensive series of observations of the thermal, dielectric, and optical properties of the langbeinite type ferroelectric, $(NH_4)_2Cd_2(SO_4)_3$, and several other recently discovered ferroelectrics was completed. The transition in $(NH_4)_2Cd_2(SO_4)_3$ is judged to be first order but of a very unusual type. Ferroelectric behavior has been demonstrated in ammonium monochloracetate below -150°C.

Theoretical Physics

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
AN INVISCID BOUNDARY LAYER OF MAGNETOHYDRODYNAMICS, by William S. Lewellen. Rept. on Contract AF 18(600)1523. Sep 59, 51p. 5 refs. AFOSR-TN-59-927.
Order from LC mi$3.60, ph$9.30 PB 144 767

A boundary-layer approximation for fluids with large electrical conductivities is applied to the two-dimensional, steady, inviscid, incompressible magnetohydrodynamic equations for the case of a uniform magnetic field parallel to the free stream. Two approaches to the solution of the magnetic boundary layer are used. In the first, the approximate integral method is used to derive equations analogous to the von Kármán integral momentum equation of viscous theory. These equations are integrated for flow of the type $\mu_1 = C \times \eta$. In the second approach the exact magnetic-boundary-layer equations are transformed, for similar flows, into a system of ordinary differential equations. The solution of these equations is found in the form of a power-series expansion in a parameter equal to the Alfvén speed divided by the free-stream velocity. Numerical results are given for several cases of similar flow. In sub-Alfvenic flow evidence points to a boundary layer growing in the direction opposite to the flow. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
THE FIELD INDUCED BY A MAGNETIC POLE APPROACHING A PLATE OF FINITE CONDUCTIVITY AND THICKNESS, by Chester Snow. 30 Sep 59, 128p. Technical rept. TR-447.
Order from LC mi$6.30, ph$19.80 PB 145 271

This analysis deals with the problem of a magnetic pole approaching an infinite plate; the author has solved the quasistatic problem for the field of induced eddy currents in the general case where the sheet has arbitrary thickness and arbitrary conductivity. Maxwell's result for thin sheets is seen to be a limiting case in which the thickness approaches zero and the conductivity approaches infinity with their product being finite. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
SMALL PERTURBATIONS IN HYDROMAGNETICS, FREE OSCILLATIONS IN A RECTANGULAR BOX, AND THE PERFECTLY CONDUCTING GAS, by G. S. S. Ludford. Rept. on Contract AF 49(638)154. July 58, 26p. 5 refs. Technical rept. BN-143; AFOSR-TN-58-700; AD-162 234.
Order from LC mi$2.70, ph$4.80 PB 137 690

This paper treats the small perturbations of an electrically conducting inviscid gas in the presence of a uniform undisturbed magnetic field. In particular the free oscillations in a rectangular box are determined and used to examine the limit of infinite conductivity. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
ON EXPERIMENTAL TESTS OF THE GENERAL THEORY OF RELATIVITY, by L. I. Schiff. Technical note no. 7 on Contract AF 49(638)388. Sep 59, 14p. 4 refs. AFOSR-TN-59-1020.
Order from LC mi$2.40, ph$3.30 PB 144 774

This paper explores the extent to which the three "crucial tests" support the full structure of the general theory of relativity, and do not merely verify the equivalence principle and the special theory of relativity, which are well-established by other experimental evidence. It is shown how the first-order changes in the periods of identically-constructed clocks and the lengths of identically-constructed measuring rods can be found without using general relativity, and how the red shift and the deflection of light can be computed from them. Only the planetary orbit precession provides a real test of general relativity. Terrestrial or satellite experiments that would go beyond supplying corroborative evidence for the equivalence principle and special relativity would be extremely difficult to perform, and would for example require a frequency standard with an accuracy somewhat better than one part in 10^{18}. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
SPECTRAL REPRESENTATIONS OF GREEN'S FUNCTIONS IN PERTURBATION THEORY, by J. D. Bjorken (Doctoral thesis). Technical note no. 4 on Contract AF 49(638)388. Sep 59, 43p. 11 refs. AFOSR-TN-59-948.
Order from LC mi$3.30, ph$7.80 PB 144 764

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF MICROWAVE PROPERTIES OF PLASMAS, by M. Chodorow. Scientific rept. no. 2, 1 Feb-30 July 59, on Contract AF 19(604)5226. Oct 59, 16p. M. L. rept. no. 647; AFCRC-TN-59-796.
Order from LC mi$2.40, ph$3.30 PB 144 927

A convenient way to produce a plasma in the laboratory is by means of an arc discharge. This type of plasma has disadvantages. A new type of plasma will be produced and its properties studied. (Author)

Naval Ordnance Lab., White Oak, Md.
THE ABSORPTION OF LIGHT BY LIGHT AND ITS APPLICATION TO THE CONVERGENCE OF PERTURBATION THEORY, by Howard R. Reiss. 8 Sep 58, 84p. 25 refs. NAVORD rept. 6180; AD-209 365.
Order from LC mi$4.80, ph$13.80 PB 144 987

The mutual absorption of two photon fields is calculated by Dirac electron theory. One photon field is treated accurately in that wave functions are employed which are solutions of the Dirac equation containing the potential of this field in the Hamiltonian. The second photon field is introduced as a perturbation. The results yield the proper small field strength limit and low energy limit. It is proved that perturbation series will converge in this non-second-quantized theory. (Author)

Naval Ordnance Test Station, China Lake, Calif.
USE OF THE IBM ELECTRONIC DATA PROCESSING MACHINE FOR QUANTUM MECHANICAL CALCULATIONS. III. COULOMB, HYBRID AND MONO-NUCLEAR INTEGRALS, by D. S. Villars and Verner Schomaker. 23 Oct 59, 26p. 9 refs. NOTS TP-2349; NAVORD rept. 6608.
Order from LC mi$2.70, ph$4.80 PB 145 353

A program is described for reducing three of the 2-electron quantum mechanical integrals from 6-dimensional integrals to sums of a small number of 2-dimensional integrals. By means of a specially written subroutine which will carry out n multiple quadratures simultaneously, all terms of the sums are computed at the same time. The advantage of numerical quadrature is that it is only necessary to provide the program with the quantum numbers, the internuclear distance and the effective nuclear charges and the machine does all the rest of the bookkeeping. At the present stage the program takes too much machine time but the program will be of value for occasional checks of other methods. Results obtained compare favorably with values from the literature or values computed analytically. (Author)

Plasmadyne Corp., Santa Ana, Calif.
RELAXATION HEATING OF A PLASMA BY SURFACE INTERACTION WITH A MAGNETIC FIELD, by R. P. Treat. Technical note no. 3 on Contract AF 49(638)335. 15 Oct 59, 40p. 7 refs. T-3TN109-335; AFOSR-TN-59-1151.
Order from LC mi$3.00, ph$6.30 PB 144 971

The heating of a fully ionized deuterium plasma by collisional relaxation for temperatures of the order of one kev is explored. The model used for the study consists of a long cylindrical plasma column confined and manipulated by an axial magnetic field that is induced by currents flowing in a one-turn coil surrounding the plasma. Conditions are such that the field is excluded from the interior of the plasma: the interaction between plasma and field is essentially a surface phenomenon.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORY AND APPLICATIONS OF FLOW GRAPHS, by Charles S. Lorens. Doctoral thesis. Rept. on Contract DA 36-039-sc-64637. 15 July 56, 117p. 20 refs. Technical rept. 317; AD-158 736.
Order from LC mi$6.00, ph$18.30 PB 145 437

Our object is threefold: to develop a basic theory of flow graphs; to extend their known application to electrical networks; and to formulate the natural relation between flow graphs and the properties of discrete statistical systems. Part I deals with the first two objectives. Much of the linear theory of flow graphs parallels linear equation theory in such a manner that considerable meaning is given to many classical operations of formulation, inversion, and reduction. Part I covers additive functional systems; inversion; electrical network formulation; mathematical determinants; partitions and expansions of a determinant; rank, positive definite, eigenvalues, and eigenvectors; group multiplication; and transcendental equations. Part II deals with the third objective. The pictorial representation of a discrete statistical system specifies its properties. With flow graphs these properties are conveniently calculated and interpreted directly from the representative graph. The material of Part II covers recurrent events, transient systems, stationary state distributions, sensitivity and variation, generating functions, channel capacity, and information structure. (Author)

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
THE "IMPROVED" FREE VOLUME THEORY OF LIQUIDS, II, by John S. Dahler (Aeronautical Research Lab.) and Joseph O. Hirschfelder. Rept. on Contract AF 33(616)3414. Sep 59, 197p. 24 refs. WADC Technical note 59-284.
Order from OTS $3.00 PB 161 407

The Kirkwood nonlinear integral equation for determining the optimum free-volume of a liquid is integrated by an iterative procedure with the approximation that the cell distribution function is spherically symmetrical. The potential of the system is assumed to be pairwise additive and the interaction between two molecules obeys the Lennard-Jones 12-6 potential. To simplify the computations, the contributions to the cell potential by molecules beyond the first shell of nearest neighbors are calculated as though the molecules were located at their lattice points. The method of Levine, Mayer, and Aroeste was used to optimize the lattice dimensions and take into account the existence of holes. Extensive tables are given for the configurational internal energy, compressibility factor, and configurational entropy. Comparison of the configurational internal energy and compressibility factor with the Monte Carlo calculations indicates that our isotherms correspond to extensions of the crystalling phase into a metastable low density region. Comparison of our configurational entropy with experimental data indicates that we are lacking the entropy of fusion. Our values of the configurational internal energy agree rather well and our values of the compressibility factor agree very poorly with the experimental data. Comparisons are also made with the results of other theoretical treatments. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A GRAPHICAL SOLUTION OF SHOCK EQUATIONS, by Charles E. Treanor and Marcia J. Williams. Rept. on Contract AF 18(603)141. Nov 59, 46p. 8 refs. Rept. no. AD-1118-A-4; AFOSR-TN-59-1088.
Order from LC mi$3.30, ph$7.80 PB 144 909

A rapid graphical method for calculating the conditions behind a normal shock is described. The method applies to any gas for which the enthalpy is known as a function of pressure and density. The accuracy is limited only by that of the available graph of the gas properties. The necessary working graphs for air, O_2 and N_2 (complete thermodynamic equilibrium) and for NO (without chemical reaction) are included, along with a template for use in attaining the solution. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
THE INFLUENCE OF GAS DISSOCIATION ON HEAT TRANSFER, by William J. Thievon, Gerald A. Sterbutzel, and John L. Beal. Rept. for Feb 57-June 59 on Contract AF 33(616)5143. June 59, 151p. 15 refs. WADC Technical rept. 59-450.
Order from OTS $2.75 PB 161 418

Recovery factor and heat transfer rates for dissociating N_2O_4 gas were determined experimentally under turbulent flow in a tube. Recovery Factor Tests - The range of flow rates for the recovery factor tests was from 208, 580 to 722, 480 lb/hr-ft^2 with a diameter Reynolds number of 89, 420 to 541, 100. The flow velocity ranged from 386 to 845 feet per second. The temperature and dissociation range covered in these tests were 100 to 228°F and .26 to .91 respectively. Heat Transfer Tests - The range of flow rates used for these measurements was from 21, 000 to 90, 000 lb/hr-ft^2 at a length Reynolds number of 65, 000 to 2, 000, 000. The thermal flux at the inside tube wall ranged from 300 to 13, 300 Btu/hr-ft^2. Wall temperatures of the test section were varied from 131 to 370°F with the stream temperature varying from 108 to 222°F. The wall-to-stream temperature differential ranged from 0 to 179°F with a corresponding wall-to-stream enthalpy difference. The range of dissociation at the wall covered from .40 to .998 and the mean stream varied from .31 to .90. Radial velocity and temperature profiles were measured at various stations in the test section. Composition and enthalpy profiles were calculated and local heat

Duke U., Durham, N. C.
AN UNUSUAL STABILITY CRITERION FOR A DIFFERENCE ANALOGUE OF THE HEAT EQUATION, by Jim Douglas, Jr. Rept. on Contract AF 18(600)1341. Aug 58, 6p. 3 refs. AFOSR-TN-58-767; AD-201 922.
Order from LC mi$1.80, ph$1.80 PB 138 176

Frequently in the numerical solution of the heat equation by a difference equation, it is necessary to impose a restriction between the time increment Δt and the space increment Δx of the form

$$0 < \frac{\Delta t}{(\Delta x)^s} \leq k < \infty.$$

In attempting to obtain a high order correct difference analogue of the heat equation in two space variables, I developed several difference equations for which it is necessary that

$$0 < k \leq \frac{\Delta t}{(\Delta x)^s} < \infty,$$

for stability and convergence. One such analogue is derived in this short note.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
THE EFFECTS OF RESONANT ACOUSTIC VIBRATIONS ON HEAT TRANSFER TO AIR IN HORIZONTAL TUBES, by Jack M. Spurlock, Thomas W. Jackson and others. Rept. on Contract AF 33(616)5742. June 59, 57p. 9 refs. WADC Technical note 59-330.
Order from OTS $1.50 PB 161 361

Results are presented of a series of experiments conducted for the purpose of studying the effects of acoustic vibrations on convection heat transfer in horizontal tubes. The experimental apparatus was calibrated without sound to determine the relationships between local average Nusselt numbers and Graetz numbers in the test section with no sound influences. The results of the calibration tests were reproducible within ±5% and were correlated within a range of Graetz numbers from 60 to 1300 by an analytical equation. Experimental tests were then conducted using sound levels up to 151 decibels in the test section. Experimental evidence is given that a threshold sound pressure level exists below which little or no effect is produced. Above this value, significant increases of up to 75% in the local average Nusselt numbers are produced. This threshold sound pressure level value is approximately 141 decibels. Experimental sound studies were conducted at frequencies of 217 cps, 325 cps, and 500 cps, and at sound pressure levels between 140 db and 151 db for each frequency. The complexity of the phenomena has prevented either a qualitative analysis or an analytical expression for the acoustic effects on heat transfer with the present data. Further studies producing considerably more data are necessary before the analytical phase of this investigation can be accomplished. (Author)

Institute of Engineering Research, U. of Calif., Berkeley.
HEAT TRANSFER, RECOVERY FACTOR AND PRESSURE DISTRIBUTIONS AROUND A CYLINDER NORMAL TO A SUPERSONIC RAREFIED AIR STREAM. PART I. EXPERIMENTAL DATA, by O. K. Tewfik and W. H. Giedt. Rept. on Contract Nonr-222(45). 30 Jan 59, 88p. 16 refs. Technical rept. HE-150-162; Series no. 20, issue no. 124.
Order from LC mi$4.70, ph$13.80 PB 145 090

Local heat transfer, recovery factor, and pressure distributions around a circular cylinder normal to a supersonic rarefied air stream were measured in the Mach number range 1.3 - 5.9, the Reynolds number range 37 - 4100, and at two cylinder wall average temperature levels of 90 K and 210 K, under steady state thermal and flow conditions. The experimental data are presented in tabular and graphical form as Part I of a two-part report. The second part, now in preparation, will present an analysis and comparison of these results with available theories.

National Bureau of Standards, Boulder, Colo.
DESIGN AND CONSTRUCTION OF A LIQUID HYDROGEN TEMPERATURE REFRIGERATION SYSTEM, by D. B. Chelton, J. W. Dean, and B. W. Birmingham. 12 Jan 60, 39p. 11 refs. Technical note no. 38.
Order from OTS $0.75 PB 151 397

Maintaining a liquid hydrogen bubble chamber at 27°K has been achieved with an automatically controlled closed circuit hydrogen refrigeration system of 300 watts capacity. The system is sufficiently flexible to be used on other experimental apparatus requiring refrigeration at liquid hydrogen temperatures. Several control systems are discussed. Experimental evidence is compared to predicted performance for design operating conditions. General design charts are developed that enable heat exchanger lengths and associated operating parameters to be determined for the pertinent heat exchanger configuration when employed in liquid hydrogen refrigerators of other capacities. (Author)

National Bureau of Standards, Boulder, Colo.
HELIUM REFRIGERATION AND LIQUEFACTION USING A LIQUID HYDROGEN REFRIGERATOR FOR PRECOOLING, by D. B. Chelton, J. W. Dean and others. 27 Jan 60, 34p. 7 refs. Technical note no. 39.
Order from OTS $0.50 PB 151 398

Consideration is given to the use of a hydrogen refrigerator to assist in the production of temperatures below those obtained with hydrogen. A hydrogen refrigerator is used to maintain a precooling evaporator at or near 21°K in a helium gas circuit. The helium circuit may be arranged to produce liquid for external use or to produce refrigeration between 21°K and 4.2°K in a closed system. Charts have been developed that show the requirements of the composite helium - hydrogen system and the effect of heat exchanger performance. The relative quantities of refrigeration (hydrogen and helium) at various temperature levels have been determined. (Author)

Research Inst., Temple U., Philadelphia, Pa.
THE FASTEST BURNING FLAME--THE PREMIXED HYDROGEN-FLUORINE FLAME, by A. V. Grosse and A. D. Kirshenbaum. Technical note no. 8 on Study of Ultra High Temperatures, Contract AF 18(600)1475. 2 Feb 59, 77p. 33 refs. AFOSR-TN-59-621.
Order from LC mi$4.50, ph$12.30 PB 144 981

Techniques for premixing pure hydrogen and fluorine gas were developed. Burning velocities, both at 77 and 90°K. of various hydrogen-fluorine mixtures, with and without helium dilution, were determined. The hydrogen-fluorine flame is the fastest flame known and burning velocities up to 2100 cm/sec. at 77°K. were measured. Under the same conditions the hydrogen-oxygen flame has a velocity of approxi-

mately 200 cm/sec. or ten times smaller. The hydrogen-fluorine flame is also characterized by an unusually high flame pressure; a maximum of 60 mm Hg has been determined. (Author)

Research Inst., Temple U., Philadelphia, Pa.
HIGH TEMPERATURE PROJECT, by A. V. Grosse and J. B. Conway. Progress rept. no. 5, 1 July 51-1 Jan 52, on Contract N9onr-87300. 1 Jan 52, 38p. AD-135 204.
Order from LC mi$3.00, ph$6.30 PB 145 093

Experimental work concerned with the combustion of powdered metals: (a) powdered metal feed devices; (b) torch design; (c) operating characteristics; (d) flame temperatures obtained; (e) melting and cutting ability.

Temple U., Philadelphia, Pa.
RESEARCH DIRECTED TOWARD THE ATTAINMENT AND UTILIZATION OF HIGH TEMPERATURE (MULTI-FRAME HIGH SPEED CAMERA, EXPLODING WIRE PHENOMENA AND PLASMA ACCELERATION), by L. Lloyd Bohn, Francis H. Nadig, and Theodore Korneff. Final rept. on Contract AF 19(604)1561. 31 Mar 58, 109p. 14 refs. AFCRC-TR-58-289.
Order from LC mi$5.70, ph$16.80 PB 138 435

The three major topics discussed in this report are: (1) High speed camera, (2) Exploding wire phenomena, (3) Plasma acceleration experiments. A rotating mirror camera was devised for the express purpose of photographing the initial phases in a wire explosion. The camera depends on a unique optical system for forming the images. This makes possible the use of relatively low rotational speeds for frame rates up to 2×10^6 frames per second. The section of the report dealing with exploding wire phenomena has been written with the view of consolidating under one cover as many parameter dependent effects encountered in experiments as present equipment allows. The conclusions are substantiated by current and voltage oscillograms and, wherever possible, by high speed photographic techniques employing image converter and rotating mirror cameras. In the plasma acceleration experiments, the quantitative description is limited to giving orders of magnitude and general effects. The investigations are concerned with the directionality and velocity of the ionized particles. An exploding wire is the source of the plasma. Three methods have been used to study the plasma accelerations: (1) an image converter, (2) rotating mirror camera, and (3) biased gaps. An experimental curve giving average velocity of the plasma as a function of pressure is included.

Wayne State U. Coll. of Engineering, Detroit, Mich.
FREE CONVECTION HEAT TRANSFER, by Joseph Rutkowski. Final summary rept. on Contract DA 20-018-ORD-13356. July 59, 49p. 9 refs.
Order from LC mi$3.00, ph$7.80 PB 145 172

Aspects of research not previously reported are presented in more detail. The large amount of experimental data gathered has made the task of reduction, analysis and discrimination an impossible one at least for the contract period. It is planned in the near future to report the findings of this research as the finalized results are obtained.

Wave Propagation

Centro di Studio Per La Fisica Delle Microonde (Italy).
BABINET'S PRINCIPLES FOR DIFFRACTION AT A PLANE SCREEN WITH DIRECTIONAL CONDUCTIVITY, by G. Toraldo di Francia. Technical note no. 1 on Contract AF 61(052)67. 30 Apr 58, 9p. 8 refs. AFCRC-TN-58-198; AD-133 744.
Order from LC mi$1.80, ph$1.80 PB 137 911

A plane and infinitely thin screen Σ_1 of any type of connection is a part of a plane $\Sigma_1 + \Sigma_2$. A system of regular lines (lines of conductivity) is defined over Σ_1, such that through each point of Σ_1 there passes one line of the system, and only one. Conductivity is assumed to be infinite along the lines of conductivity, and to vanish along their normals. A general electromagnetic wave is incident upon Σ_1. A complementary case, in the sense of Babinet's principle, is obtained when Σ_1 has still the same properties, while Σ_2 becomes a screen of infinite and omnidirectional conductivity. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
DIFFRACTION OF SCALAR WAVES BY A CIRCULAR APERTURE, by J. Bazer and A. Brown. Rept. on Contract AF 19(604)5238. Aug 59, 42p. 12 refs. Research rept. no. EM-144; AFCRC-TN-59-594; AD-227 948.
Order from LC mi$3.30, ph$7.80 PB 145 071

The problems of the diffraction of scalar waves by a circular aperture in a perfectly soft and in a perfectly rigid infinite planar screen are treated, assuming axially-symmetric excitation. New integral representations of the solutions are presented. The unknown functions $f_1(t)$ and $f_2(t)$ are required to be odd and even analytic functions of t, respectively, regular in a neighborhood of the unit disc. The integrals satisfy the time-reduced wave equation, the radiation condition, and the boundary conditions; and have the appropriate edge behavior. A brief and elementary calculation reveals the f's to be solutions of Fredholm-type integral equations of the second kind whose kernels are small when ka (the wave number x the radius of the aperture) is small. The integral equations guarantee the existence of the desired types of f's whenever the exciting fields are suitably regular functions of the axis of symmetry in a neighborhood of the aperture, and, lead to approximate expressions for the f's when ka is small. These approximates are used to calculate the aperture fields, the far fields, the transmission coefficients, and the edge behaviors. The results obtained are in agreement with known results and, for some of these quantities, are more accurate, in that higher powers of ka are included. In the rigid-screen problem, for all positive values of ka, the form of the edge behavior is determined and a simple proof is given of the unique existence of the solution. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
ABSORPTION COEFFICIENTS OF AIR FROM 22,000° TO 220,000°, by Baxter H. Armstrong, Dan H. Holland, and Roland E. Meyerott. Final rept. on Contract AF 29(601)524. 15 Aug 58, 166p. 23 refs. AFSWC-TR-58-36; LMSD-5135; AD-218 905.
Order from LC mi$7.80, ph$25.00 PB 144 904

The photoelectric and free-free absorption coefficients of air have been computed over the temperature range 2 to 20 ev, density range $\sim 10^{-5}$ normal to normal, and energy range 1 ev to 1 kev. The occupations of ionic states were computed with the grand-canonical ensemble statistical method described by Brachman and Meyerott (ANL-4986 unpublished). For terms of principal quantum numbers 2 and 3, empirical energy values were used where known, and estimated by isoelectronic interpolation, or the Bacher-Goudsmit method (Phys. Rev. 46:1934), were made where empirical values are lacking. For $n \geq 4$, the Bohr formula with quantum defects was used, and separate angular momentum levels were included to $n = 9$. Multiple excitations were partially included by using one-electron levels of ionic cores for all core possibilities of the $n = 2$ shell. Screened coulomb gaunt factors were used, and fractional parentage coefficients were employed in order to account for transitions from equivalent electron states. (Author)

Puerto Rico U., Mayaguez.
PECULIARITIES AND SEASONAL VARIATIONS OF T. E. BACKSCATTER ECHOES OBSERVED AT MAYAGUEZ, PUERTO RICO, by B. Dueño. Research rept. 2 on Contract AF 49(638)172. [1959] 16p. 3 refs. AFOSR-TN-59-889; AD-225 968.
Order from LC mi$2.40, ph$3.30 PB 144 658

As a result of a backscatter experiment on 21.6 mcs. and 40.68 mcs. it has been observed that long range transequatorial echoes, which are most prevalent during the equinoxial periods, also exhibit a minimum of T. E. activity during the solstitial periods June, July and December and January. The mechanism for the production of long range transequatorial echoes (L. R. T. E.) is not well understood. Comparison of our data with N. B. S. propagation predictions from the combined action of the evening equatorial bulge and sizable horizontal gradients of ionization in the neighborhood of the geomagnetic equator. The minimum during December and January can be adscribed to the small horizontal gradient prevailing at the time. During June, July the horizontal gradient is not as small as in December, January. This fits with the observation that T. E. activity is not as low on June, July as it is on December and January. Due to the combined action of the equatorial bulge and the sizable horizontal gradients in the neighborhood of the g. m. equator radio waves of sufficiently high frequencies will be launched into the ionosphere in directions along the maximum of electron density of the elevated layer. To produce focussing by a bundle of rays a shallow distribution of electron density in the layer is necessary. This is in agreement with the postulated decrease in electron density as the geomagnetic equator is approached. (Author)

Schwinger, Julian, Cambridge, Mass.
INVESTIGATION OF HIGH FREQUENCY LIMITATIONS IN MILLIMETER WAVE GENERATORS, by Julian Schwinger. Semiannual rept. no. 3, Jan-July 58, on Contract DA 36-039-sc-73136. [1958] 25p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 145 231

The interaction between the electromagnetic field and a number of identical atomic systems, individually characterized by an electric dipole moment and two energy levels, is analyzed for the case where the atomic systems are inside a lossy cavity and exposed to a coherent driving field, resonance being assumed between atomic system, cavity, and driving field. The problem of introducing loss into a quantum-mechanical formalism is treated. Formal operator expressions are obtained for the field variables which include the absorption and the fluctuation (both thermal and quantum-mechanical) effects of the loss mechanism. (Author) (See also PB 142 633)

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Air Force Cambridge Research Center, Bedford, Mass.
A CONCISE BIBLIOGRAPHY OF THE LITERATURE ON ARTIFICIAL INTELLIGENCE, by Alice M. Pierce. Sep 59, 22p. 243 refs. AFCRC-TN-59-773.
Order from LC mi$2.70, ph$4.80 PB 145 105

This bibliography is a bare listing of the literature on "artificial intelligence" as the term applies to systems whose operating behavior would be called "intelligence" if exhibited by man. Unindexed, it has a minimum of cross references to related subjects, most references to physiology, psychology, logic, automata theory, decision theory, theory of games, and even neural net theory, having been omitted. (Author)

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
PROCEEDINGS OF SHOCK TUBE SYMPOSIUM [NO. 1] 26-27 FEBRUARY 1957. 205p. 63 refs. SWR-TM-57-2.
Order from LC mi$9.30, ph$31.80 PB 145 141

Contents:
Air Force Special Weapons Project's interest in shock tube research;
The Air Force shock tube as a research tool;
Design and performance of the General Electric six-inch shock tunnel facility;
The development of a shock tube to generate variable, stepped shock fronts;
Studies of transient air forces on two-dimensional airfoils;

Study of grids in shock tubes;
The development of the shock tube facility for airfoils studies;
The surface film thermometer: a versatile shock tube technique;
Some observations of bifurcated reflected shock waves;
Numerical solution for the reflection of a compression wave from a rigid wall;
The use of the shock tube in hypersonic research;
Study of re-entrant corners

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
PROCEEDINGS OF SHOCK TUBE SYMPOSIUM [NO. 2] 5-6 MARCH 1958. 308p. 133 refs. SWR-TM-58-3.
Order from LC mi$11.10, ph$47.10 PB 145 142

Contents:
AFSWP interest in shock tube research
Shock tube wind tunnel research at the Naval Ordnance Laboratory
Shock tube studies of blast pressures behind frangible wall panels
Comparison of shock tube and field test data on the pressure build-up behind frangible walls
Some results from use of a shock tube for biomedical investigation
Experimentation with General Electric six-inch shock tunnel
Pressure-time history in a chamber subjected to shock wave filling through an orifice
Determination of the time history of the flow field about a blunt body in a shock tube
Some experiments with periodic shocks
On the effect of attenuation on gas dynamic measurements made in shock tubes
A method of generating various desired pressure pulses in a shock tube
Problems in the use of piezogauges for shock tube instrumentation
Determination of the dynamic response characteristics of pressure measuring systems utilizing shock tube testing techniques
High temperature effects in shock structure
Shock wave calculations for high temperature gases
Laminar and turbulent heat transfer measurements on a hemispherical cylinder in the Lockheed 3-inch shock tube
A particular application of the conventional shock tube for the study of ignition and combustion in subsonic flow
One dimensional blast waves from an axially symmetric electrical discharge (See also PB 145 141)

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
PROCEEDINGS OF SHOCK TUBE SYMPOSIUM [NO. 3] 10-12 MARCH 1959. [1959] 270p. 90 refs. SWR-TM-59-2.
Order from LC mi$11.10, ph$41.10 PB 145 143

Contents:
Resume of experiments conducted in the high pressure shock tube of Gas Dynamics Laboratory at NASA
A probe for determining flow conditions in a short duration hypersonic stream
Calculation of the flow phenomena in the CONVAIR free jet shock tunnel facility
An explosive driven conical shock tube for the study of spherical shock waves
Shock tube investigation of hydrogen dissociation
Observations of ultra-violet absorption behind strong shock waves in oxygen
Diffusion effects on shock structure in a plasma
Technique of pressure measurement on an airfoil in a shock tube
Application of pressure and force transducers in hypersonic shock tunnel aerodynamic experimentation
Biological experiments utilizing a closed-end shock tube
Program for the NCEL blast simulator
Structural integrity of spread foundations subjected to extreme horizontal impulses
The shock chamber: A device for producing high strength spherically expanding shock waves
A one-inch force gage for drag measurements in the shock tube
Changes in pressure drag caused by shielding
Correlation between shock tube and wind tunnel drag coefficients
Interaction of blast waves with wings
Experiments and theory on explosive decompression in the six-foot shock chamber
Theory on filling process in chamber, shock tube, and field tests
Diaphragm calibration techniques in a 2.00-inch diameter shock tube
(See also PB 145 142)

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 6. MATERIALS TECHNOLOGIES, MATHEMATICS, AND OPERATIONS RESEARCH. 451p.
Order from OTS $4.50 PB 161 138

Contents:
Materials Technologies:
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Non-metallic materials technology
Photographic technology
Mathematics:
Multiple
Algebra and number theory
Analysis
Computation methods and techniques
Geometry and topology
Mechanics
Numerical and graphical methods
Operations analysis
Probability and statistics
Operations Research
(See also PB 151 499)

Dynamic Analysis and Control Lab., Mass. Inst. of Tech., Cambridge.
NONLINEAR CONTROL SYSTEMS WITH STATISTICAL INPUTS, by Richard C. Booton, Jr., 1 Mar 52, 36p. 6 refs. Rept. no. 61. ATI-150 275.
Order from LC mi$3.00, ph$6.35 PB 145 169

An approximation method is developed for the analysis of nonlinear systems that are composed of linear devices, feedback circuits, and purely amplitude-sensitive elements. The input functions are assumed to be defined only statistically, and consideration is given to nonstationary inputs. Initial consideration is given to the specific case of a simple-lag system in which the nonlinearity occurs as a rate limiting. The input is assumed to be a stationary Gaussian signal, and calculations are made of the rms error of the system. The actual system is simulated on an analogue computer, and the results are shown to agree with the predicted theoretical results within the accuracy of the computer. Following this particular case the results are extended to apply to more general situations.

Signal Corps Publications Agency, Fort Monmouth, N. J.
PREPARATION OF MANUSCRIPTS. PART ONE, TEXT. 15 Mar 57, 54p. SIG 730-1, supersedes SIG 730-1, Part One, 5 Mar 56.
Order from LC mi$3.60, ph$9.30 PB 144 998

This writing guide is part of Military Specification MIL-M-10953A (SigC). It specifies standards of style, presentation, and format for publications prepared for or by The Signal Corps Publications Agency.

Signal Corps Publications Agency, Fort Monmouth, N. J.
PREPARATION OF MANUSCRIPTS. PART TWO, ILLUSTRATIONS. 16 Oct 56, 81p. SIG 730-1.
Order from LC mi$4.80, ph$13.80 PB 144 999

This manual covers the requirements for reproducible illustrations that are: (1) Procured under the requirements of Military Specification MIL-M-10953 (SigC). (2) Prepared or submitted to The Signal Corps Publications Agency for use in technical manuals, field manuals, technical bulletins, changes, SIG manuals, school texts, training texts, and other publications.

Communication Theory

Ohio State U. Research Foundation, Columbus.
TESTS OF THE AURAL COMPREHENSION OF ENGLISH BY FOREIGN STUDENTS, by Henry M. Moser, John J. O'Neill, and Susan M. Wolfe. Technical rept. no. 50 on Contract AF 19(604)1577. Aug 58, 13p. 7 refs. AFCRC-TR-58-57; AD-152 649.
Order from LC mi$2.40, ph$3.30 PB 137 787

Parts of two tests of aural comprehension of English for foreign students were administered to forty-four foreign students representing 25 nationalities and varying backgrounds in English. All of the students were post graduates. The tests used were The Lado Test of Aural Comprehension, Form C and The MDAP English Proficiency Examination, Form B. Thirty orally-presented items were given from the MDAP test and 60 from the Lado Test. The data were analyzed in terms of the differences between mean scores (t test) and a product moment correlation (r). The results of the t test indicated significant differences between the two tests. This might be accounted for by the differences in numbers of items presented on each test as well as the difference in performance levels for each test as established by native speakers of English. The statistical evaluation of r indicated that there was a significant relationship between scores obtained on the two tests. The MDAP test deals more extensively with military vocabulary than does the Lado but they are both capable of evaluating the aural comprehension of foreign nationals. The Lado test is less time-consuming and would probably be preferred when technical language evaluation is not important. (Author)

Information Theory

Stanford U., Calif.
DETERMINING BOUNDS ON INTEGRALS WITH APPLICATIONS TO CATALOGING PROBLEMS, by Bernard Harris. Technical rept. no. 18 on Contract Nonr-225(21). 21 Apr 58, 58p. 8 refs; AD-158 558.
Order from LC mi$3.60, ph$9.30 PB 138 580

Photographic Equipment

Naval Ordnance Test Station, China Lake, Calif.
DEVELOPMENT OF AN UNDERWATER HOUSING FOR 35MM MITCHELL CAMERAS, by R. O. White. 28 Sep 59, 21p. NOTS TP-2323; NAVORD rept. 6591.
Order from LC mi$2.70, ph$4.80 PB 144 949

This report describes the development and design features of a camera housing and orienting mount for a 35mm Mitchell motion picture camera used in underwater metric photography. The housing is designed for operating depths ranging to 200 feet, and features a corrector lens which compensates for the increased refractive index of sea water. (Author)

SOCIAL SCIENCES

National Bureau of Standards, Washington, D. C.
DISTRIBUTION OF INCOMING LETTERMAIL AT

THE BALTIMORE, MARYLAND CITY POST OFFICE, by Bernard M. Levin and Arthur E. Newman. Oct 59, 121p. 4 refs. Technical note 33.
Order from OTS $2.50 PB 151 392

Lettermail at the Baltimore, Md. post office was sampled and studied for the purpose of estimating the distribution characteristics of letters for local delivery. Separate studies were conducted for first- and third-class mail and the results are reported both separately and combined. The study demonstrated an effective method of sampling incoming lettermail. It also yielded data needed for the design of efficient procedures for sorting mail using machinery now being developed. (Author)

Documentation

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
STUDY OF INDEXING AND MACHINE SEARCHING, by T. H. Rees, Jr., Allen Kent, and J. W. Perry. Rept. on Contract AF 30(602)1498. 1 Apr 59, 123p. 32 refs. RADC-TR-59-56; AD-213 786.
Order from LC mi$6.30, ph$19.80 PB 144 655

A number of machines and systems have been developed or adapted to cope with the documentation problem. A particularly difficult area of application of these machines and systems is for the searching and correlating of fragmentary information that is scattered through large files. A set of principles for coping with this area of application has been developed at the Center for Documentation and Communication Research for the American Society for Metals, embodying a balanced approach to: (1) detailed analysis of documents, (2) use of a semantic (thesaurus-like) dictionary, (3) a system of standardized simplified syntax, (4) a new set of machine functions as embodied in the WRU Searching Selector, and (5) a strategy for exploiting these capabilities. These methods have been applied to a file of articles from the New York Times. Also a modification of this approach has been applied to a previously generated subject index and a previously classified set of documents. The New York Times file has been searched in a simulated commercial intelligence situation and the results have been analyzed and evaluated. The files generated have also been studied from the point of view of applying these methods to equipment such as the Eastman Kodak Minicard and the IBM 650. Also covered during this program have been the development of methods for the automatic encoding of information files applying methods analogous to machine translation routines.

Documentation, Inc., Washington, D. C.
MEANING, LINGUISTIC STRUCTURES AND STORAGE AND RETRIEVAL SYSTEMS, by Mortimer Taube. Rept. on Contract AF 49(638)91. Feb 57, 15p. 9 refs. AFOSR-TN-57-125; AD-120 482.
Order from LC mi$2.40, ph$3.30 PB 137 728

This paper attempts to establish the positive thesis that storage and retrieval theory and the design of storage and retrieval systems need not concern itself with "the relationship between concepts and the words and symbols in which they are expressed", nor with the attempts to base such relationships on the distinction between nominal classes and "real" classes.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Mar 60.
Order from OTS $1.25, $10.00/year PB 161 279

Contents:
Articles:
Protection of columbium for high-temperature service, by B. F. Brown
Low-temperature R-F probe for nuclear magnetic resonance, by F. E. Geiger, Jr.
Frequency stabilization of point-to-point ISB circuits, by C. L. Spencer
Scientific program:
Astronomy and Astrophysics: Linear readout from resistance thermometers
Chemistry: Factors influencing the corrosivity of diester-base oils for lubricating aircraft engines. Reduction of the hydrogen overvoltage in nickel electrodes with palladium
Mathematics: NAREC computer program for zero-lift, multistage, launching vehicle trajectories
Mechanics: Mechanical properties of elastically shocked low-carbon steel specimens at temperatures between -300°F and +70°F. Effect of radiation upon ceramic-bonded strain gages. Data processing to obtain shock spectra
Metallurgy and Ceramics: Crack propagation tests of high-strength sheet materials--part iv--effect of warm pre-straining. Effect of environment on the creep-rupture properties of nickel. Specialized equipment for disassembly of highly radioactive reactor experiments
Nuclear and Atomic Physics: A standard source of radiation for radiac detectors
Optics: An f/3.3 medium-dispersion grating spectrograph. Influence of atmosphere on optical resolution in a typical Nevada tunnel
Radio: Broadband impedance transformers. Comparison of microwave and Langmuir probe techniques for the investigation of electrical discharges
Solid State Physics: Optical measurements of carefully prepared single crystals of KCl with wide range of Tl concentrations. X-ray analysis of diffusion of Nb with Cr. Fe, Ni, Mo, and stainless steel
Supporting techniques:
Aluminosilicate glass

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General

Air fluorescence in the upper atmosphere and its relation to the detection of nuclear explosions in space, by D. R. Westervelt. Los Alamos Scientific Lab., N. Mex. June 59. Contract W-7405-eng-36. 25 p. Order from LC. Mi $2.70, ph $4.80.
AECU-4499

Graphite-to-metal seal screening tests, September 1958, by J. S. Gilhart. Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va. Changed from OFFICIAL USE ONLY July 10, 59. Contract AT(30-1)-1940. 21p. Order from LC. Mi $2.40, ph $3.30.
BAW-1053

Operating manual for 105-C metal examination facility, by J. M. Fouts. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct., 58. 72p. Order from LC. Mi $4.50. ph $12.30.
HW-58220

Report on hapo unitized microfilm drawing system, by J. Durbin. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct. 59. 34p. Order from LC. Mi $3.00, ph $6.30.
HW-62099

Natural frequencies of structure 3.1.1, by Lydik S. Jacobsen and William M. Wells. Sandia Corp., Albuquerque, N. Mex. Nov 51. Changed from OFFICIAL USE ONLY Nov 59. 59p. Order from LC. Mi $3.60, ph $9.30.
SC-2090 (Tr)

Subject headings used by the USAEC Technical Information Service, by C. W. Hargrave. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Jan. 60. 476p. Order from OTS. $6.00.
TID-5001

Summary report of reactor hazards associated with the high temperature test facility, by W. A. Vogele and others. Atomic Energy Commission by Bettis Atomic Power Laboratory, Westinghouse Electric Corporation, Pittsburgh, Pa. Aug 59. Contract AT-11-1-Gen-14. 53p. Order from OTS. $1.50.
WAPD-SC-630

Biology and Medicine

Radiosensitivity of the Lymphocyte, Chicago, Univ. (1958?) Contract AT(11-1)-144. 7p. Order from LC. Mi $1.80, ph $1.80.
AECU-4334

Poliar absorption of mineral nutrients with special reference to the use of radioisotopes and the "leaf washing technique" (thesis), by W. H. Jyung. Michigan State Univ., East Lansing. 1959. 54p. Order from LC. Mi $3.60, ph $9.30.
AECU-4433

The effects of radioactive substances on plant pathogens and other microorganisms, Annual Report for Year, October 1, 1958 to September 30, 1959. University of Minnesota, Minneapolis, Minn. Sep 59. Contract AT(11-1)-42. 25p. Order from LC. Mi $2.70, ph $4.80.
AECU-4476

Biological and Medical Research Division semi-annual report. July through December, 1958, Argonne National Laboratory, Lemont, Ill. Dec 59. Contract W-31-109-eng-38. 109p. Order from OTS. $2.50.
ANL-6093

A study of techniques and the development of equipment for decanning EBR-II fuel elements, by J. P. Simon. Argonne National Laboratory, Lemont, Ill. Jan 60. Contract W-31-109-eng-38. 21p. Order from OTS. 75 cents.
ANL-6106

Radiation-induced somatic mutations in plants, by A. H. Sparrow and R. L. Cuany. Brookhaven National Lab., Upton, N. Y. (1959?) 10p. Order from LC. Mi $1.80, ph $1.80.
BNL-4296

Long-term ecological study of the Oak Ridge area: II. Observations on the mammals with special reference to Melton Valley, by J. C. Howell and P. B. Dunaway. Oak Ridge National Lab., Tenn. Oct 59. 24p. Order from LC. Mi $2.70, ph $4.80.
CF-59-10-126

A device for the collection of fecal specimens, by G. F. Stone. Oak Ridge National Lab., Tenn. Nov 59. 7p. Order from LC. Mi 1.80, ph $1.80.

CF-59-11-8

Portable radiation instrumentation standarization, by W. G. Spear. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 39p. Order from OTS. $1.00.

HW-60404

Semi-Annual Report For Period Ending June 30, 1959. by Hymer L. Friedell. Western Reserve Univ., Atomic Energy Medical Research Project, Cleveland, Ohio. June 59. Contract W-31-109-eng-78. 114p. Order from LC. Mi $6.00, Ph $18.30.

NYO-2063

Effect of segmental gut shielding on mortality from intestinal radiation, by J. C. Smith. Western Reserve University. Atomic Energy Medical Research Project, Cleveland, Ohio. Oct 59. 20p. Order from OTS. 50 cents.

NYO-2064

Effect of irradiation on cell division and nucleic acid synthesis in strain U-12 fibroblasts, by H. Harrington. Western Reserve University. Atomic Energy Medical Research Project, Cleveland, Ohio. Dec 59. Contract W31-109-eng-78. 21p. Order from OTS. 50 cents.

NYO-2907

An analogue computor for the generalized three-compartment model of transport in biological systems, by E. C. Gregg. Western Reserve University. Atomic Energy Medical Research Project, Cleveland, Ohio. Dec 59. Contract W31-109-eng-78. 24p. Order from OTS. 50 cents.

NYO-2906

Neutron flux and tissue dose studies with fission threshold detectors. Part I. Experimental measurements, by G. S. Hurst and others. Oak Ridge National Lab., Tenn. Mar 54. Contract W-7405-eng-26. 13p. Order from LC. Mi $2.40, ph $3.30.

ORNL-1671 (Del)

Determination and evaluation of the radiation field above White Oak Lake bed (thesis), by P. K. Lee and S. I. Auerbach. Oak Ridge National Lab., Tenn. Sep 59. Contract W-7405-eng-26. 72p. Order from LC. Mi $3.90, ph $10.80.

ORNL-2755

To investigate, develop, and evaluate radioisotopes for teletherapy. Final report. Arkansas University School of Medicine, Little Rock Ark. Sep 59. Contract AT-(40-1)-1771. 19 p. Order from LC. Mi $2.40, ph $3.30.

ORO-208

Whole body counters, by H. E. Voress. Atomic Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 8p. Order from OTS. 50 cents.

TID-3543

Relationships between the geologic environment and mortality from congenital malformation, by J. Kratchman and D. Grahn. Atomic Energy Commission Technical Information Service Extension, Oak Ridge, Tenn. Aug 59. 20 p. Order from OTS. $2.00.

TID-8204

Reprocessing of irradiated fisiion reactor fuel and breeding material, by J. M. Jacobs. Atomic Energy Commission Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 39p. Order from OTS. $1.25.

TID-3529(1st rev.)

Morphology and functional relations of sex chromatin in cultured amnion cells, by C. P. Miles. University of California, School of Medicine, Los Angeles. July 59. Contract AT-04-1-Gen-12. 28p. Order from LC. Mi $2.70, ph $4.80.

UCLA-443

A bibliography of biological applications of autoradiography, 1958 through 1959, by M. E. Johnston. University of California. Lawrence Radiation Lab., Berkeley, Calif. Aug 59. Contract W-7405-eng-48. 23p. Order from LC. Mi $2.70, ph $4.80.

UCRL-8901

Current-switching circuitry, by J. G. Salvador. University of Califronia. Lawrence Radiation Laboratory, Berkeley, Calif. Jan 60. Contract W-7405-eng-48. 33p. Order from OTS. $1.00.

UCRL-9035

Distribution and excretion of indium-114m after multiple intramuscular injection to the rat, by G. A. Smith and others. University of Rochester, Atomic Energy Project, Rochester, N. Y. June 59. Contract W-7401-eng-49. 65p. Order from LC. Mi $3.90, ph $10.80.

UR-554

The chemical toxicity of thorium dioxide following inhalation by laboratory animals, by H. C. Hodge and others. The University of Rochester Atomic Energy Project, Rochester, N. Y. Jan 60. Contract W-7401-eng-49. 33p. Order from OTS. $1.00

UR-562

Bibliography on the biological effects of thorium, by E. Hutchinson. The University of Rochester, Atomic Energy Project, Rochester, N. Y. Jan. 60. Contract W-7401-eng-49. 47p. Order from OTS. $1.50.

UR-563

Chemistry—General

Changes in extractors to prevent emulsions, by H. V. Farr and others. Mallinckrodt Chemical Works, St. Louis, Mo. Sep 59. 34p. Order from LC. Mi $3.00, ph $6.30.

A-1084

Analysis of yttrium oxide exchange samples, by C. J. Rodden. New Brunswick Lab., Atomic Energy Commission, N. J. July 59. 52p. Order from LC. Mi $3.60, ph $9.30.

AECD-4288

Progress report no. XXV, Massachusetts Inst. of Tech., Cambridge Lab. for Insulation Research, Cambridge, Mass. July 59. Contracts Nonr-1841(10); Nonr-1841(50); AT(30-1)-1937; AF19(604)-5482; and AF33(616)-5920. 88p. Order from LC. Mi $4.80, ph $13.80.

AECU-4306

An orifice plate pulse column for liquid-liquid extraction (thesis), by D. C. O'Brien. Massachusetts Institute of Tech., Oak Ridge, Mass. Aug 54. Contract W-7405-eng-26. 70p. Order from LC. Mi $3.90, ph $10.80.

AECU-4329

Catalytic combination of hydrogen and oxygen in thoria slurries. Part I. Technical report no. IV, by C. H. Pitts and others. University of Utah, Salt Lake City, Utah. May 59. Contract W-7405-eng-26, Subcontract 1075. 25p. Order from LC. Mi $2.70, ph $4.80.

AECU-4345

Equilibrium extraction characteristics of alkyl amines and nuclear fuels metals in nitrate systems. Quarterly Progress Report IV for the period April 1-June 30, 1959, by E. A. Mason and V. C. Vaughen. Massachusetts Institute of Tech., Cambridge Mass. June 59. Contract W-7405-eng-26, Subcontract 1327. 42p. Order from LC. Mi $3.30, ph $7.80.

AECU-4351

Progress report for July 1959. Technical report no. 8. Anderson Physical Lab., Champaign, Ill. 1959. Contract AT(11-1)-544. 7p. Order from LC. Mi $1.80, ph $1.80.

AECU-4359

Progress report for the month July 1959, by L. Hendricks. Anderson Physical Lab., Champaign, Ill. Aug 59. Contract AT(11-1)-544. 7p. Order from LC. Mi $1.80, ph $1.80.

AECU-4360

Exploration of radiometric methods. Report no. 2, by W. J. Driscoll and E. A. Huff. Nuclear-Chicago Corp., Chicago, Ill. Sep 59. Contract AT(11-1)-695. 24p. Order from LC. Mi $2.70, ph $4.80.

AECU-4417

Applications of rare earths to ferrous and non-ferrous alloys, by J. F. Collins and others. Gereral Electric Co. Aircraft Nuclear Pro-Pulsion Dept., Cincinnati, Ohio. Nov. 59. 26p. Order from LC. Mi $2.70, ph $4.80.

AECU-4424

Isotopic method for age determination of industrial products. Quarterly progress report, July-September 1959, by T. C. Gregson and S. W. Waisbrot. Goodyear Tire and Rubber Co., Akron, Ohio. 1959. Contract AT(11-1)-719. 30p. Order from LC. Mi $3.00, ph $6.30.

AECU-4441

Organic coolant reclamation. Quarterly progress report no. 3 for June 15, 1959-September 15, 1959, by R. J. Wineman and others. Monsanto Chemical Co., Everett, Mass. Oct 59. Contract AT(11-1)-705. 22p. Order from LC. Mi $2.70, ph $4.80.

AECU-4447

Exploration of radiometric methods. Report no. 3, by W. J. Driscoll. Nuclear-Chicago Corp., Chicago, Ill. Nov 59. Contract AT(11-1)-695. 8p. Order from LC. Mi $1.80, ph $1.80.

AECU-4471

Plate height in gas chromatography, by J. C. Giddings and others. University of Utah, Salt Lake City, Utah. 1959. 18p. Order from LC. Mi $2.40, ph $3.30.

AECU-4474

Final report on electron spin resonance spectra of radicals. Washington University, St. Louis, Mo. 1959. Contract AT(11-1)-85. 6p. Order from LC. Mi $1.80, ph $1.80.

AECU-4477

Chemical engineering division summary report for July, August and September 1957. Argonne National Lab., Lemont, Ill. Dec 57 Contract W-31-109-eng-38. 135p. Order from LC. Mi $6.90, ph $21.30.

ANL-5789-(Del)

Literature survey of the properties of fission product oxides, fluorides, and oxyfluorides, by G. Tennenhouse and M. J. Steindler.

Argonne National Lab., Lemont, Ill. July 59. 75p. Order from LC. Mi $4.50, ph $12.30.
ANL-RCV-SL-1545

U_3O_8 single crystals, by W. B. Wilson. General Electric Atomic Products Division Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Jan. 55. Contracts AF33(600)-38062 and AT(11-1)-171. 9p. Order from OTS. 50 cents.
APEX-187

New concepts for control and use of nuclear explosions, by F. B. Porzel. Illinois Institute of Tech., Armour Research Foundation, Chicago, Ill. Apr 59. 33p. Order from LC. Mi $3.00, ph $6.30.
ARF-TM-421

Distribution of radioelements in a qualitative analysis scheme, by M. M. Vick and S. A. Reynolds. Oak Ridge National Lab., Tenn. Dec 53. Contract W-7405-eng-26. 5p. Order from LC. Mi $1.80, ph $1.80.
CF-53-12-110

Measurement of the viscosity of composition 31, by S. I. Cohen and T. N. Jones. Oak Ridge National Lab., Tenn. Dec 55. 3p. Order from LC. Mi $1.80, ph $1.80.
CF-55-12-128 (Del)

Compendium of experimental results of the circulation of aqueous thorium oxide slurries in toroids, by G. E. Moore and others. Oak Ridge National Lab., Tenn. Apr 57. 68p. Order from LC. Mi $3.90, $10.80.
CF-57-4-85

On the chemistry of thermonuclear reactor breeder blankets, by M. T. Robinson. Oak Ridge National Lab., Tenn. Feb 58. Contract W-7405-eng-26. 9p. Order from LC. Mi $1.80, ph $1.80.
CF-57-12-39 (Rev)

Evaluation of liner material and product consolidation in the druhm process, by D. R. Edwards. Oak Ridge National Lab., Tenn. Sep 59. 10p. Order from LC. Mi $1.80, ph $1.80.
CF-59-8-118

Results of examinations of fused salt mixtures by optical and x-ray diffraction methods, by R. E. Thoma. Oak Ridge National Lab., Tenn. Oct 59. 72p. Order from LC. Mi $4.50, ph $12.30.
CF-59-10-18

Effect of excess acid on two-liquid-phase temperature limits for the homogenous reactor fuel solution and its concentrates, by R. E. Moore and W. L. Marshall. Oak Ridge National Lab., Tenn. Nov 59. Contract W-7405-eng-26. 12p. Order from LC. Mi $2.40, ph $3.30.
CF-59-11-27

Liquid-liquid immiscibility above 300°C in the system UO_3-SO_3-N_2O_5-H_2O, by C. J. Barton and others. Oak Ridge National Lab., Tenn. Nov. 59. 23p. Order from LC. Mi $2.70, ph $4.80.
CF-59-11-64

Turbidimetric microdetermination of sulfate in plutonium solutions, by H. D. Warren and A. Brunstad. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Mar 58. Contract W-31-1091eng-52. 6p. Order from LC. Mi $1.80, ph $1.80.
HW-55349

A review of uranium oxidation, by A. J. Scott. Hanford Atomic Products Operation Richland Wash. July 59. Contract AT(45-1)-1350. 16p. Order from OTS. 50 cents.
HW-61851

Zirconium fluoride phase studies. II. Sodium fluozirconate phase relationships, by A. J. Moffat. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office, Idaho Falls, Idaho. Dec 59. Contract AT(10-1-)-205. 20p. Order from OTS. 50 cents.
IDO-14499

Isotopic analysis of boron as trimethyl borate, by R. M. Abernathey. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office, Idaho Falls, Idaho. Jan 60. Contract AT(10-1)-205. 8p. Order from OTS. 50 cents.
IDO-14503

Preparation of yttrium fluoride using fluorine, by R. L. Tischer and G. Burnet. Ames Laboratory, Iowa State College, Ames, Iowa. June 59. Contract W-7405-eng-82. 41p. Order from OTS. $1.25.
IS-8

The determination of the melting point, the vapor pressure, and the decomposition temperature of yttrium tri-iodide, by D. H. Dennison and others. Ames Laboratory at Iowa State University of Science & Technology Iowa. Nov 59. Contract W-7405-eng-82. 16p. Order from OTS. 50 cents.
IS-57

TCI--An auxiliary one dimensional transient conduction code for use with the art, spy and ter reactor design codes, by J. W. Millard. Knolls Atomic Power Lab., Schenectady, N.Y. Sep 59. Contract W-31-109-eng-52. 59p. Order from LC. Mi $2.70, ph $4.80.
KAPL M-DGM-3

The determination of aluminum, iron, and silicon in silver-cadmium-indium alloys, by J. R. Ciaranello. Knolls Atomic Power Lab., Schenectady, N. Y. Aug 59. Contract W-31-109-eng-52. 10p. Order from LC. Mi $1.80, ph $1.80.
KAPL-M-JRC-1

A collection of mass spectrometric data of substituted borazoles and their benzene analogs, by E. D. Loughran and C. L. Mader. Los Alamos Scientific Laboratory of the University of California, Los Alamos, N. Mexico. Jan 60. Contract W-7405-eng-36. 37p. Order from OTS. $1.25.
LA-2368

Latent heat of vaporization and vapor pressure data for organic coolants, by R. W. Burkhardt. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 58. 14p. Order from LC. Mi $2.40, ph $3.30.
NAA-SR-MEMO-2671

Estimated thermal conductivity of polyphenyl reactor coolants, by G. Asanovich. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. May 58. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-2743

The presence of argon in terphenyl, by L. B. Gardner and R. L. Koontz. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Dec 58. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-3130

The properties of santowax-r (mixed terphenyl isomers) as organic moderator-coolant, by R. H. J. Gercke, and others. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. (19597) 76p. Order from LC. Mi $4.50, ph $12.30.
NAA-SR-MEMO-3223

Degasification of nitrogen from santowax r, by G. W. Corporales and P. R. Benson. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Mar 59. 12p. Order from LC. Mi $2.40, ph $3.30.
NAA-SR-MEMO-3652

Method for the analysis of diphenyl-terphenyl organic coolant mixtures by gas chromatography, by R. A. Baxter. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 59. 8p. Order from LC. Mi $1.80, ph 1.80.
NAA-SR-MEMO-3793

Hydrogen density of polyphenyl organic coolants, by R. T. Keen and R. A. Baxter. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. May 59. 16p. Order from LC. Mi $2.40, ph $3.30.
NAA-SR-MEMO-3797

A micro method for the determination of the high boilers fraction in omre coolant, by M. A. Rotheram. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 59 8p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-3816

Adsorption of diphenyl vapors in the presence of steam, by H. M. Gilroy. Atomics International Div., North American Aviation Inc., Canoga Park, Calif. July 59. 9p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4129

Vapor pressure of polyphenyl coolant and components, by F. C. Silvey. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. July 59. 13p. Order from LC. Mi $2.40, ph $3.30.
NAA-SR-MEMO-4187

Analytical chemistry of the polyphosphates. Period covered: July 16, 1958 to September 30, 1959, by W. Rieman. III. Rutgers University, New Brunswick, N. J. 1959. Contract AT(30-1)-1306. 18p. Order from LC. Mi $2.40, ph $3.30.
NYO-2916

Separation of uranium from bismuth using tris(2-ethylhexyl)phosphine oxide. Increase in selectivity with 1,2-cyclohexylene dinitrilo tetraacetic acid, by A. H. A. Heyn and G. Banerjee. Boston University, Boston, Mass. Nov 59. Contract AT(30-1)1873. 15p. Order from OTS. 50 cents.
NYO-7569

Reduction of cupric oxide by hydrogen. II. Conversion of hydrogen to water over fixed beds, by W. D. Bond and W. E. Clark. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 17p. Order from OTS. 75 cents.
ORNL-2816

Purification of promethium by liquid-liquid extraction, by B. Weaver and F. A. Kappelmann. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 25p. Order from OTS. 75 cents.
ORNL-2863

Organic compounds in fission reactors. II. Thorio-organic compounds, by W. H. Baldwin. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 6p. Order from OTS. 50 cents.
ORNL-2864

Analytical chemistry division annual progress report for period ending December 31, 1959. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26.

102p. Order from OTS. $2.50.
ORNL-2866

Wavelength table of rare-earth elements and associated elements including zirconium, thorium, hafnium, rhenium, and tellurium, by J. A. Norris. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 739p. Order from OTS. $7.25.
ORNL-2774

Solubility of zirconium dibutyl phosphate in solvent extraction solutions, W. Davis, Jr. and H. H. Carmichael. Oak Ridge National Laboratory, Oak Ridge, Tenn. Jan 60. Contract W-7405-eng-26. 13p. Order from OTS. 50 cents.
ORNL-2857

Comparison of a fluidized-bed and an agitated-trough chemical reactor for producing ThO_2 from $Th(NO_3)_4$, by S. D. Clinton. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 21p. Order from OTS. 75 cents.
ORNL-2875

The catalysis of the hydrogen-oxygen reaction by aqueous slurries of thorium oxide and thorium-uranium oxide, by N. A. Krohn. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 73p. Order from OTS. $2.25.
ORNL-2878

Synthesis and fabrication of refractory uranium compounds. Quarterly report no. 1 for May 13 to August 31, 1959, by K. M. Taylor and others. Carborundum Co. Research and Development Div., Niagara Falls, N. Y. Sep 59. Contract AT(40-1)-2558. 30p. Order from LC. Mi $3.00, ph. $6.30.
ORO-212

Synthesis and fabrication of refractory uranium compounds. Monthly progress report no. 3 for September 1 to September 30, 1959, by K. M. Taylor and others. Carborundum Co. Research and Development Div., Niagara Falls, N. Y. Oct 59. Contract AT(40-1)-2558. 5p. Order from LC. Mi $1.80, ph $1.80.
ORO-213

Preparation of pure americium, by V. A. Ryan and J. W. Pringle. Dow Chemical Co., Rocky Flats Plant, Denver. Jan. 60. Contract AT(29-1)-1106. 24p. Order from OTS. 75 cents.
RFP-130

Sodium fluoride as a spectroscopic carrier for plutonium metal analysis, by A. J. Johnson and E. Vejvoda. Dow Chemical Co. Rocky Flats Plant, Denver, Colo. Apr 59. Decl. July 59. Contract AT(29-1)-1106. 14p. Order from LC. Mi $2.40, ph $3.30.
RFP-143

Electron-spin-resonance and chemical studies of radiation damage of choline chloride and some of its analogs, by R. O. Lindblom. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Oct 59. Contract W-7405-eng-48. 122p. Order from OTS. $2.75.
UCRL-8910

Range and range straggling of heavy recoil atoms, by E. W. Valyocsik. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Nov 59. Contract W-7405-eng-48. 43p. Order from OTS. $1.25.
UCRL-8855

Saline water conversion, 1956-58, compiled by F. G. Bennett IV. Atomic International Division, North American Aviation, Inc. Canoga Park, Calif. Jan 60. 9p. Order from OTS. 50 cents.
NAA-SR-3737

Reactor chemistry and plant materials. Bettis Atomic Power Laboratory, Pittsburgh, Pa. Dec 59. Contract AT-11-1-GEN-14. 201p. Order from OTS. $3.50.
WAPD-BT-16

The determination of titanium as an impurity in zirconium and zircaloy, by D. V. Reed. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. May 59. 5p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-157

The spectrographic determination of impurities in zirconium and zircaloy using a chromium internal standard, by J. F. Frain and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. June 58. 6p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-162-7

The spectrographic determination of tin, iron, chromium, and nickel in zircaloy-2 using high voltage spark point-to-plane excitation, by R. M. Jacobs and N. E. Gordon. Westinghouse Electric Corp. Bettis Plant, Pittsburgh Pa. Oct 58. 6p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-162-12

The spectrographic determination of sodium, lithium, barium, and strontium in zirconium and zircaloy using the silver chloride carrier technique, by R. F. Farrell and G. J. Harter. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Apr 59. 7p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-162-14

The determination of carbon in zirconium and zirconium base alloys, by K. A. Morrow and E. F. Tretow. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa.

Apr 59. 5p. Order from LC. Mi $1.80. ph $1.80.
WAPD-CTA-GLA-181 (Rev 2)

The determination of tin in zirconium base alloys, by T. M. Reinhold. Westinghouse Electric Corp Corp. Bettis Plant, Pittsburgh, Pa. Aug 59. 4p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-371(Rev 2)

The determination of uranium as an impurity in zirconium and zircaloy, by D. L. Smith and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 59. 5p. Mi $1.80, ph $1.80. Order from LC.
WAPD-CTA-GLA-431 (Rev 2)

The determination of niobium in uranium niobium alloys, by G. W. Goward and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Feb 58, Decl. Nov. 59. 4p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-543

The spectrographic determination of impurities in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 8p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-631-1

Spectrographic determination of tantalum, titanium, and zirconium in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 4p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-631-2

The spectrographic determination of boron and cadmium in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 3p. Mi $1.80, ph $1.80. Order from LC.
WAPD-CTA-GLA-631-3

The spectrographic determination of tungsten in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 3p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-631-5

The determination of the primary impurities in hafnium by emission spectrographic analysis, by J. F. Frain and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 59. 11p. Order from LC. Mi $2.40, ph $3.30.
WAPD-M-GLA-701-1

Heat of recombination and recombiner exit temperature, by D. F. Rinald. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Engineering Dept., Pittsburgh, Pa. June 57. 6p. Order from LC. Mi $1.80, ph $1.80.
WCAP-567

Design and operation of a catalytic recombiner, by D. F. Rinald. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Engineering Dept., Pittsburgh, Pa. June 57. 13p. Order from LC. Mi $2.40, ph $3.30.
WCAP-569

The determination of oxygen as an impurity in zirconium and zircaloy, by P. Elbling and G. W. Goward. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. July 59. 12p. Order from LC. Mi 2.40, ph $3.30.
WAPD-CTA-GLA-592 (Rev 1)

The properties of thoria-heavy water slurries. Part I. Apparent density, heat capacity and thermal conductivity of the ThO_2-D_2O slurries, by R. J. Atkins and others. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Engineering Dept., Pittsburgh, Pa. Sep 57. 15p. Order from LC. Mi $2.40, ph $3.30.
WCAP-685

The spectrographic detection of trace impurities in beryllium oxide. Interim report, by O. P. Killeen. Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. Aug 59. Contract W-7405-eng-26. 12p. Order from LC. Mi $2.40, ph $3.30.
Y-1259

The spectrographic detection of trace impurities in beryllium oxide, by O. P. Killeen. Union Carbide Nuclear Company Division of Union Carbide Corporation Y-12 Plant, Oak Ridge, Tenn. Jan 60. 13p. Order from OTS. 50 cents.
Y-1259 (rev.)

Reduction cell with vertical rotating mercury cathode, by F. A. Schimmel. Union Carbide Nuclear Company Division of Union Carbide corporation Y-12 Plant, Oak Ridge, Tenn. Jan 60. Contract W-7405-eng-26. 21p. Order from OTS. 75 cents.
Y-1285

Chemistry—Radiation and Radiochemistry

Irradiation of radium in MTR, by G. H. Hanson. Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho. Nov 52. Decl. Nov 59. 14p. Order from LC. Mi $2.40, ph $3.30.
IDO-16033

A simplified analytical method for separating traces of fission products from uranium and thorium (UX), by C. A. Kienberger and A. R. Flynn. Carbide and Carbon Chemical

Co. K-25 Plant, Oak Ridge, Tenn. Dec 53. Decl. Nov 59. Contract W-7405-eng-26. 14p. Order from LC. Mi $2.40, ph $3.30.
K-1078

Exploratory studies of hydrazine formation by radioactive ionization, by H. M. Busey. Los Alamos Scientific Lab., N. Mexico. June 51. Decl Nov 59. Contract W-7405-eng-36. 25p. Order from LC. Mi $2.70, ph $4.80.
LA-1376

Substitute materials report for research for July 2, 1951 to October 1, 1951. Mound Laboratory, Miamisburg, Ohio. Nov 51. Contract AT33-1-GEN-53. 50p. Order from OTS. $1.25.
MLM-622(Del 1)

The measurement of uranium concentration in U-Al alloy by gamma counting, by J. W. Wachter and W. B. Wright. Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn. June 54. Decl. Nov 59. Contract W-7405-eng-26. 15p. Order from LC. Mi $2.40, ph $3.30.
Y-1080

Chemistry—Separation Processes for Plutonium and Uranium

Chemical engineering division summary report for January, February, March 1958. Argonne National Lab., Lemont, Ill. June 58. Decl. Nov 59. Contract W-31-109-eng-38. 132p Order from LC. Mi $6.90, ph $21.30.
ANL-5858

Theoretical study of single-transfer line concatenated pulse column systems, by H. F. Johnson. Oak Ridge National Lab., Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 22p. Order from LC. Mi $2.70, ph $4.80.
CF-56-6-119

Chemical technology division, chemical development, section c, monthly progress report, July 1959, by K. B. Brown and others. Oak Ridge National Lab., Tenn. Aug 59. Contract W-7405-eng-26. 32p. Order from LC. Mi $3.00, ph $6.30.
CF-59-7-68

Chemical technology division, chemical development, section, c, monthy progress report, August 1959, by K. B. Brown and others. Oak Ridge National Lab., Tenn. Sep 59. Contract W-7405-eng-26. 37p. Order from LC. Mi $3.00, ph $6.30.
CF-59-8-45

Uranium recovery from sodium-zirconium fluoride salt mixtures, volatility pilot plant runs L-1 through L-9, by C. L. Whitmarsh. Oak Ridge National Lab., Oak Ridge, Tenn. Sep 59. Contract W-7405-eng-26. 75p. Order from LC. Mi $4.50, ph $12.30.
CF-59-9-2

PRFR pilot plant: An evaluation of equipment performance during the processing of irradiated natural uranium in April 1959, by J. L. Matherne. Oak Ridge National Lab., Oak Ridge, Tenn. Sep 59. 22p. Order from LC. Mi $2.70, ph $4.80.
CF-59-9-49

Manganese dioxide precipitation in uranium-aluminum nitrate solutions, by H. E. Henry. Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C. Feb. 59. Decl. Sep 59. Contract AT(07-2)-1. 12p. Order from LC. Mi $2.40, ph $3.30.
DP-347

A survey of organic solvents for the electrodeposition of plutonium, by J. A. Porter. E. I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, South Carolina. July 59. Contract AT(07-2)-1. 12p. Order from OTS. 50 cents.
DP-389

Reprocessing of power reactor fuels seventh quarterly progress report. April 1 to July 1, 1959. by L. H. Meyer and E. S. Occhipinti. E. I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, South Carolina. Sep 59. Contract AT(07-2)-1. 10p. Order from OTS. 50 cents.
DP-421

Description of purex plant process, by E. R. Irish. Hanford Atomic Products Operation General Electric Company, Richland, Washington. May 59. Contract W-31-109-eng-52. 15p. Order from OTS. 50 cents.
HW-60116

Recovery of plutonium and neptunium from purex IWW by anion exchange, by H. H. Van Tuyl. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. Decl. with deletions Sept 59. 6p. Order from LC. Mi $1.80, ph $1.80.
HW-61145(Del)

Hanford neptunium oxalate-oxide process experience, by C. W. Pollock and R. A. Schneider. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. Decl. with deletions Oct 59. Contract AT(45-1)-1350. 11p. Order from LC. Mi $2.40, ph $3.30.
HW-61675(Del)

Preliminary investigation of the Ag-Mg system for recovery of uranium from Th-U alloy, by L. A. Hanson. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. June 59. 16p. Order from LC. Mi $2.40, ph $3.30.
NAA-SR-MEMO-3954

Process for dissolution of borax IV reactor fuel: laboratory development. by L. M. Ferris. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 23p. Order OTS. 75 cents.
ORNL-2821

Thermodynamic properties of the uranium mercurides. by H. C. Forsberg. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 57p. $1.75.
ORNL-2885

The preservation of foods by ionizing radiations. July 27-July 30, 1959. Department of Food Technology Massachusetts Institute of Technology, Cambridge Mass. Nov 59. Contract IAEA/STI/2, 59. 289p. Order from OTS. $4.00.
TID-7585

Controlled Thermonuclear Processes

Ion sources. by J. S. Luce. Oak Ridge National Lab., Oak Ridge, Tenn. Mar 55. Decl. Oct 58. 9p. Order from LC. Mi $1.80, ph $1.80.
CF-55-3-103

A coaxial discharge for multicharged ions. by J. S. Luce. Oak Ridge National Lab., Oak Ridge, Tenn. Nov 55. Decl. Oct 58. 5p. Order from LC. Mi $1.80, ph $1.80.
CF-55-11-135

Compilation of various undocumented classified memoranda on Sherwood program. by J. R. McNally, Jr. Oak Ridge National Lab., Oak Ridge, Tenn. June 57. Decl. Oct 58. Contract W-7405-eng-26. 14p. Mi $2.40, ph $3.30.
CF-57-6-115

Stability of a linear pinch. Part II. by B. R. Suydam. Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico. Feb 60. Contract W-7405-eng-36. 25p. Order from OTS. 75 cents.
LAMS-2381

The application of microwave techniques to stellarator research. by M. A. Heald. Project Matterhorn, Princeton University, Princeton, New Jersey. Aug 59. Contract AT(30-1)-1238. 107p. Order from OTS. $2.50.
MATT-17

Quarterly report covering the period July 1-September 30, 1959. Princeton University, Project Matterhorn, Princeton, N. J. Contract AT(30-1)-1238. 32p. Order from LC. Mi $3.00, ph $6.30.
MATT-Q-8

Sherwood progress report no. 3 for July 1958 to July 1959. by H. Grad and J. Berkowitz. New York University, Atomic Energy Commission Computing and Applied Mathematics Center. July 59. Contract AT(30-1)-1480. 19p. Order from LC. Mi $2.40, ph $3.30.
NYO-2544

B-1 magnetic measurements. Technical Memorandum no. 36. by A. Z. Kranz. Princeton University, Project Matterhorn, Princeton N. J. Nov 56. 7p. Order from LC. Mi $1.80, ph $1.80.
NYO-7878

Measurements on a low-inductance capacitor. by I Mansfield. Stevens Institute of Tech., Hoboken, N. J. May 58. Contract AT(30-1)-1921. 10p. Order from LC. Mi $2.40, ph $3.30.
NYO-8647

Boundary-layer formation in the pinch. by J. Killeen and others. California University, Lawrence Radiation Lab., Livermore, Calif. Aug 59. Contract W-7405-eng-48. 40p. Order from LC. Mi $3.00, ph $6.30.
UCRL-5195 (Rev)

Shielding against magnetic radiation loss from a hot plasma. by J. P. Wesley. California University, Lawrence Radiation Lab., Livermore, Calif. June 59. Contract W-7405-eng-48. 8p. Order from LC. Mi $1.80, ph $1.80.
UCRL-5606

Application of a modified Debyehuckel theory to fully ionized gases. by R. E. Kidder and H. E. De Witt. California Univeristy, Lawrence Radiation Lab., Livermore, Calif. Aug 59. Contract W-4705-eng-48. 16p. Order from LC. Mi $2.40, ph $3.30.
UCRL-5653

Controlled thermonuclear research quarterly report. December 1958, January and February 1959. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Mar 59. Contract W-7405-eng-48. 81p. Order from OTS. $2.25.
UCRL-8682

Criticality Studies

A uranium critical assembly at low U^{235} concentration. by G. A. Lienberger. Los Almos Scientific Lab., N. Mexico. 1956. Decl. June 56. Contract W-7405-eng-36. 14p. Order from LC. Mi $2.40, ph $3.30.
AECD-4285

Eurochemic assistance: Answers to questions on criticality. by E. D. Clayton. Oak Ridge National Lab., Oak Ridge Tenn. Sep 59. 4p. Order from LC. Mi $1.80, ph $1.80.
CF-59-9-3

Criticality of fuels of low enrichment in cylinders. by N. Ketzlach. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Aug 59. 12p. Order from LC. Mi $2.40, ph $3.30.
HW-61547

Critical mass of an OMR core using plate type fuel elements. by H. C. Field. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. June 59. 4p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-3980

Radioactivity in reactor coolants. Interim report. by J. E. Stewart. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. June 59. 8p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4057

Criticality criteria for fabrication of 2% enriched uranium hollow slugs. by T. S. Moy. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. July 59. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4099

Suggested experimental facilities for the experimental organic cooled reactor (EOCR). by J. E. Steward. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sept 59. 25p. Order from LC. Mi $2.70, ph $4.80.
NAA-SR-MEMO-4319

Preliminary power calibration of the OMR critical assembly. by R. J. Tuttle. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Aug 59. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4267

Prompt neutron lifetime of the aetr critical assembly. by A. V. Campise. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sep 59. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4272

Plutonium graphite assemblies. by A. Goodwin, Jr., and C. L. Schuske. Dow Chemical Co. Rocky Flats Plant, Denver, Colo. Sep 58. Decl. July 59. Contract AT(29-1)-1106. 25p. Order from LC. Mi $2.40, ph $3.30.
RFP-123

Nuclear safety analyses of a typical production line for high-fired UO_2 at > 4.5% U^{235} isotopic composition, by W. T. Mee and others. Union Carbide Nuclear Company a Division of Union Carbide Corporation, Y-12 Plant, Oak Ridge, Tenn. Sep 59. Contract W-7405-eng-26. 69p. Order from OTS. $1.75.
Y-1273

Health and Safety

An experimental evaluation of the radiation protection afforded by a large modern concrete office building, by J. F. Batter, Jr., and others. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 61p. Order from OTS. $1.50. CEX-59.1

Radiochemical analysis of marine biological samples following the "Redwing" shot series - 1956, by C. W. Thomas and others. Hanford Atomic Products Operation, Richland, Wash. Dec 58. Contract W-31-109-Eng-52. 81p. Order from OTS. $2.25. HW-58674

Nuclear safety in manufacturing plants, by J. E. McLaughlin. Health and Safety Laboratory, AEC New York Operation Office, New York, N. Y. Nov 59. 24p. Order from OTS. 75 cents.
HASL-66

Further investigations of natural environmental radiation, by L. R. Solon and others. Health and Safety Laboratory, New York Operation Office, New York, N. Y. Nov 59. 32p. Order from OTS. $1.00. HASL-73

Quarterly progress report research and development activities in the field of radiological sciences, April - June, 1959, by Members of the Staff of the Hanford Laboratories Operation. Hanford Atomic Products Operation, Richland, Wash. July 59. Contract AT(45-1)-1350. 42p. Order from OTS. $1.25. HW-61247

Calculation of temperature rise in deeply buried radioactive cylinders, by J. J. Perona, and M. E. Whatley. Oak Ridge National Laboratory, Oak Ridge, Tenn. Feb 60. Contract W-7405-eng-26. 43p. Order from OTS. $1.25. ORNL-2812

The fabrication of radioactive sources, by A. E. Salo and N. B. Garden. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Oct 59. Contract W-7405-eng-48. 31p. Order from OTS. $1.00. UCRL-8928

Neutron exposure dosimetry of humans by in vivo gamma measurement of sodium-24, by R. E. Cofield. Union Carbide Nuclear Co. Division of Union Carbide Corp. Y-12 Plant, Oak Ridge, Tenn. Sep 59. Contract W-7405-eng-26. 19p. Order from OTS. 75 cents. Y-1283

Instruments

Molecular ion source, by J. S. Luce. Oak Ridge National Lab., Oak Ridge, Tenn. Nov 55. Contract W-7405-eng-26. 6p. Order from LC. Mi $1.80, ph $1.80. CF-55-11-160

Metallographic examination of high velocity heat exchanger (SHE no. 1), by R. J. Gray. Oak Ridge National Lab., Oak Ridge, Tenn. May 56. Decl. Oct. 9, 1959. 14p. Order from LC. Mi $2.40, ph $3.30. CF-56-5-148

Examination of ORNL 1 and 2 intermediate heat exchangers, Type IHE-3, by J. H. DeVan and R. S. Crouse. Oak Ridge National Lab., Oak Ridge, Tenn. July 56. Decl. Oct. 9, 1959. 17p. Order from LC. Mi $2.40, ph $3.30. CF-56-7-135

Testing of dump valve trim in the valve test loop and the performance of dump valves in the HRT, by E. C. Hise. Oak Ridge National Lab., Oak Ridge, Tenn. Aug 59. 10p. Order from LC. Mi $1.80, ph $1.80. CF-59-8-86

Water wheel river and stream sampler, by K. J. Travers. E. I. du Pont de Nemours & Co. Explosives Department. Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Order from OTS $.50 DP-426

Continuous electrochemical determination of oxygen in gases, by K. Koyama. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. May 56. Decl. with deletions Apr 6, 1959. Contract W-31-109-Eng-52. 14p. Order from LC. Mi $2.40, ph $3.30. HW-42636(Del.)

A liquid-contact scintillation alpha counter, by U. L. Upson and P. E. Brown. Hanford Atomic Products Operation, Richland, Wash. Mar 59. Decl. with deletions Nov 17, 1959. Contract W-31-109-Eng-52. 52p. Order from OTS. $1.50.
HW-49003(Del.)

A method of determining the thermal conductivity of incandescent solids, by B. B. Brenden and H. W. Newkirk. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Mar 59. Contract W-31-109-Eng-52. 41p. Order from LC. Mi $3.30, ph $7.80. HW-59574

Interim report on investigation of dynamic characteristics of relays, covers the period 1 September to 31 October, by School of Electrical Engineering Oklahoma State University, Stillwater, Okla., for Sandia Corporation, Albuquerque, N. Mex. Jan 60. 111p. Order from OTS. $2.75.
SC-4390(RR)

Creepage test of SR-4 strain gages under high steady state strains, by L. L. Lathrop. Sandia Corp., Albuquerque, N. Mex. June 55. 4p. Order from LC. Mi $1.80, ph $1.80.
SCTM-132-55-52

Broadband pulse transformer with millimicrosecond rise time, by E. N. Pinson. Dandia Corp., Albuquerque, N. Mex. Sep 55. 15p. Order from LC. Mi $2.40, ph $3.30.
SCTM-197-55-51

Zero shift in piezoelectric transducers, by P. E. Scarborough, Jr. Sandia Corp., Albuquerque, N. Mex. Oct 59. 16p. Order from LC. Mi $2.40, ph $3.30. SCTM-315-59-16

An electroluminescent transducer, by L. C. Meyer. Sandia Corp., Albuquerque, N. Mex. Aug 59. 44p. Order from LC. Mi $3.30, ph $7.80. SCTM-326-59-52

Hot laboratories. A literature search, by R. L. Scott. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 12p. Order from OTS. $1.00.
TID-3545

Metallurgy

Study of factors influencing ductility of iron-aluminum alloys. Monthly letter report no. 5 for March 15, 1959 to March 15, 1960, by G. Rauscher, and others. University of Denver, Denver Research Institute, Denver, Colo. Sep 59. Contract AT(11-1)-742. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4335

Electrochemical studies of hafnium, zirconium and yttrium. Quarterly progress report no. 8 for April 1, 1959 to June 30, 1959. Bureau of Mines. Reno Metallurgical Research Center, Nev. and Bureau of Mines. Boulder City Metallurgy

Research Lab., Nev. 1959. Contract AT(11-1)-475. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4368

Electrochemical studies of hafnium, zirconium, and yttrium. Quarterly progress report no. 7, for November 1, 1958 to March 31, 1959. Bureau of Mines. Electrometallurgical Experiment Station, Boulder City, Nev. 1959. Contract AT(11-1)-475. 14p. Order from LC. Mi $2.40, ph $3.30. AECU-4372

Measurement of the equilibrium concentration of lattice vacancies in aluminum. Technical report no. 17, by R. O. Simmons and R. W. Balluffi. University of Illinois, Urbana, Ill. July 59. Contract AT(11-1)-182. 35p. Order from LC. Mi $3.00, ph $6.30. AECU-4374

Measurements of the high temperature electrical resistance of aluminum: The resistivity of lattice vacancies. Technical report no. 18, by R. O. Simmons and R. W. Balluffi. University of Illinois, Urbana, Ill. July 59. Contract AT(11-1)-182. 28p. Order from LC. Mi $2.70, ph $4.80. AECU-4375

Diffusionless phase changes in nonferrous metals and alloys. Technical progress report for April 1, 1956 to February 28, 1957, by T. A. Read and others. University of Illinois, Urbana, Ill. Mar 57. Contract AT(11-1)-67. 63p. Order from LC. Mi $3.90, ph $10.80. AECU-4392

Diffusionless phase changes in nonferrous metals and alloys. Technical progress report for March 1, 1957 to March 31, 1958, by T. A. Read and others. University of Illinois, Urbana, Ill. Apr 58. Contract AT (11-1)-67. 46p. Order from LC. Mi $3.30, ph $7.80. AECU-4393

Diffusionless phase changes in nonferrous metals and alloys. Technical progress report for period April 1, 1958 to April 30, 1959, by T. A. Read and others. University of Illinois, Urbana, Ill. 1959. Contract AT(11-1)-67. 198p. Order from LC. Mi $8.70, ph $30.30. AECU-4394

Diffusionless phase changes in nonferrous metals and alloys, Progress report for the period October 15, 1954 to July 15, 1955, by T. A. Read and others. University of Illinois, Urbana, Ill. July 55. Contract AT(11-1)-67. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4398

Technical progress report on diffusionless phase changes in nonferrous metals and alloys for period July 16, 1955 to March 31, 1956, by T. A. Read and others. University of Illinois, Urbana, Ill. Mar 56. Contract AT(11-1)-67. 6p. Order from LC. Mi $1.80, ph $1.80. AECU-4399

Study of factors influencing ductility of iron-aluminum alloys. Monthly report no. 6, by F. C. Perkins and J. F. Nachman. University of Denver. Denver Research Inst., Denver, Colo. Oct 59. Contract AT(11-1)-742. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4400

UO_2 bearing fuel plates. Progress report for September 1, 1959 through September 30, 1959, by G. J. Comstock. Stevens Inst. of Tech., Hoboken, N. J. Oct 59. Contract AT(30-1)-2258. 7p. Order from LC. Mi $1.80, ph $1.80. AECU-4410

The mechanical properties of yttrium, scandium and rare earth metals, by C. R. Simmons. General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Nov 59. 55p. Order from LC. Mi $3.60, ph $9.30. AECU-4423

Forming and fabrication of yttrium metal, by J. M. Williams and C. L. Huffine. General Electric Co., Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Nov 59. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4427

The determination of the equilibrium phase diagram, zirconium-niobium, by C. E. Lundin. University of Denver, Denver Research Institute, Denver, Colo. Nov 59. Contract AT(11-1)-752. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4448

Magnesium oxide (MgO), by C. F. Barrett, Jr. Knolls Atomic Power Lab., Schenectady, N. Y. Mar 54. 2p. Order from LC. Mi $1.80, ph $1.80. AECU-4456

Study of factors influencing ductility of iron-aluminum alloys. Monthly letter report no. 7, by F. C. Perkins and J. F. Nachman. University of Denver, Denver Research Institute, Denver, Colo. Nov 59. Contract AT(11-1)-742. 10p. Order from LC. Mi $1.80, ph $1.80. AECU-4467

Pure metals project, zirconium and hafnium program. Quarterly progress reports no. 1 through 6 for November 1, 1956 to June 30, 1958. Bureau of Mines. Electrometallurgical Experiment Station, Boulder City, Nev. [nd] Contract AT(11-1)-475. 72p. Order from LC. Mi $4.50, ph $12.30. AECU-4468

Status report on a study of the use of furnace calorimetry for the rapid determination of specific heat of solids at high temperatures, by J. H. Boggs and J. A. Wiebelt. Oklahoma State University, School of Mechanical Engineering, Stillwater, Okla. Nov 59. Contract AT(11-1)-71. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4473

Techniques for X-ray examinations of weld closures and can-to-cap brazes on CP-6 type fuel elements. Final report, by S. S. Sidhu. Argonne National Lab., Lemont, Ill. Jan 54. Decl. Nov 30, 1959. Contract W-31-109-eng-38. 16p. Order from LC. Mi $2.40, ph $3.30. ANL-4987

Eddy current and ultrasonic testing of CP-6 fuel elements, by W. J. McGonnagle and W. B. Doe. Argonne National Lab., Lemont, Ill. Dec 53. Decl. Nov 30, 1959. Contract W-31-109-eng-38. 208p. Order from LC. Mi $9.30, ph $31.80. ANL-5161

Testing of fuel element parts and assemblies by the radiographic method, by R. H. VanderLaan. Argonne National Lab., Lemont, Ill. July 54. Decl. Jan 1, 1960. Contract W-31-109-eng-38. 15p. Order from LC. Mi $2.40, ph $3.30. ANL-5279

Fuel development for the treat reactor, by R. C. Lied and J. H. Handwerk. ARgonne National Laboratory, Lemont, Ill. Jan 60. Contract W-31-109-eng-38. 19p. Order from OTS. 75 cents. ANL-5960

The fabrication of the fuel elements for the transient reactor test, by C. H. Bean and others. Argonne National Lab., Lemont, Ill. June 59. 30p. Order from LC. Mi $2.70, ph $4.80. ANL-FGF-162

Progress report for the month of January 1952, by H. W. Russell and others. Battelle Memorial Institute, Columbus, Ohio. Feb 52. Decl. with deletions Apr 18, 1957. Contract W-7405-eng-92. 48p. Order from LC. Mi $3.30, ph $7.80. BMI-726(Del.)

Progress report for the month of February 1952, by H. W. Russell and others. Battelle Memorial Institute, Columbus, Ohio. Mar 52. Decl. with deletions Apr 18, 1957. Contract W-7405-eng-92. 43p. Order from LC. Mi $3.30, ph $7.80. BMI-731(Del.)

The ductility of brazed stainless steel joints, by H. A. Saller and others. Battelle Memorial Institute, Columbus, Ohio. July 53. Decl. Nov 20, 1959. Contract W-7405-eng-92. 8p. Order from LC. Mi $2.40, ph $3.30. BMI-847

Survey of materials for supercritical-water reactor, by M. C. Udy and F. W. Bougler. Battelle Memorial Inst., Columbus, Ohio. Nov 53. Decl. Aug 10, 1959. Contract W-7405-eng-92. 52p. Order from LC. Mi $3.30, ph $7.80. BMI-890

The fabrication of stainless steel-uranium dioxide fuel elements, by J. R. Keeler and others. Battelle Memorial Inst., Columbus, Ohio. Mar 54. Decl. Aug 10, 1959. Contract W-7405-eng-92. 28p. Order from LC. Mi $2.70, ph $4.80. BMI-904

Electroplated metals on uranium, by J. G. Beach and others. Battelle Memorial Inst., Columbus, Ohio. May 54. Decl. with deletions June 18, 1959. 33p. Order from LC. Mi $3.00, ph $6.30 BMI-912 (Del.)

The fabrication of subassemblies for the supercritical-water reactor, by J. R. Keeler and A. W. Hare. Battelle Memorial Inst., Columbus, Ohio. Aug 54. Decl. Aug 10, 1959. Contract W-7405-eng-92. 30p. Order from LC. Mi $2.70, ph $4.80. BMI-919

Extrusion cladding of fuel elements, by C. J. Slunder and others. Battelle Memorial Inst., Columbus, Ohio. Mar 55. Decl. Feb 10, 1960. Contract W-7405-eng-92. 33p. Order from OTS. 50 cents. BMI-989

Electroplated metals on uranium for aluminum cladding, by J. C. Beach and others. Battelle Memorial Inst., Columbus, Ohio. May 55. Decl. Feb 11, 1960. Contract W-7405-eng-92. 28p. Order from OTS. 50 cents. BMI-996

Further studies on large-batch melting of uranium, by G. W. Rengstorff and H. W. Lownie, Jr. Battelle Memorial Inst., Columbus, Ohio. July 55. Decl. Feb 11, 1960. 31p. Order from OTS. 50 cents. BMI-1015

Enamels and enameling techniques for coating uranium slugs, by H. P. Tripp and others. Battelle Memorial Inst., Columbus, Ohio. Aug 55. Decl. Feb 11, 1960. Contract W-7405-eng-92. 18p. Order from OTS. 50 cents. BMI-1024

Particle Accelerators and High-Voltage Machines

Megatron accelerator progress report, by K. C. Rogers and others. Stevens Inst. of Tech., Hoboken, N. J. Aug 59. Contract AT(30-1)-2410. 19p. Order from LC. Mi $2.40, ph $3.30. AECU-4406

Quarterly report of the laboratory director for the period July 1, 1959 to September 30, 1959. Midwestern Universities Research Assn., Madison, Wis. 1959. 10p. Order from LC. Mi $1.80, ph $1.80. AECU-4446

Particle accelerator division summary report for November, 1958 through May, 1959, by A. V. Crewe and others. Argonne National Laboratory, Lemont, Ill. Dec 59. Contract W-31-109-eng-38. 42p. Order from OTS. $1.25. ANL-6032

Current sources for scaling magnetic fields (II), by Midwestern Universities Research Association, Madison, Wis. Dec 59. Contract AT(11-1)-384. 10p. Order from OTS. 50 cents. MURA-539

Scatterbrain--an automated experiment on the 90-inch cyclortron, by J. Benveniste and others. University of California. Raidation Laboratory, Livermore, Calif. Oct 58. Contract W-7405-eng-48. 18p. Order from LC. Mi $2.70, ph $4.80. UCRL-5311

Epoxy plastics, by J. W. Bryan and R. A. Perkins. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Dec 59. Contract W-7405-eng-48. 12p. Order from OTS. 50 cents. UCRL-9020

Physics and Mathematics

Power from Radioisotopes, by K. P. Johnson. Martin Co. Nuclear Div., Baltimore, Md. 1958. 18p. Order from LC. Mi $2.40, ph $3.30. AECU-4373

Studies of the optical absorption spectrum of rutile single crystals, Technical report no. 140, by B. H. Soffer. Massachusetts Institute of Tech., Lab. for Insulation Research, Cambridge, Mass. Aug 59. Contract AT(30-1)-1937. 25p. Order from LC. Mi $2.70, ph $4.80. AECU-4377

An experimental evaluation of the effect of length-to-width ratio on the critical flow velocity of single plate assemblies, by W. L. Zabriskie. General Electric Co. General Engineering Lab., Schenectady, N. Y. Sep 59. 60p. Order from LC. Mi $3.90, ph $10.80. AECU-4388

On the decay interaction of strange particles, by B. Sakita and S. Oneda. University of Wisconsin. Madison, Wis. and University of Maryland, College Park, Md. 1959. 15p. Order from LC. Mi $2.40, ph $3.30. AECU-4411

Pulsed neutron measurements on plexiglas, by K. W. Seemann. General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. June 59. 14p. Order from LC. Mi $2.40, ph $3.30. AECU-4416

Hydrodynamic aspects of boiling heat transfer (thesis) by N. Zuber. University of California, Research Laboratory, Los Angeles and Ramo--Wooldridge Corp., Los Angeles, Calif. June 59. 196p. Order from OTS. $2.00. AECU-4439

The overhauser effect in paramagnetic systems, by W. A. Barker. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 36p. Order from OTS. $1.00. ANL-6069

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Applied Mathematics Division summary report for July 1, 1958 through June 30, 1959. Argonne National Laboratory, Lemont, Ill. 1959. Contract W-31-109-eng-38. 65p. Order from OTS. $1.75. ANL-6089

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A Monte Carlo code for the transport of neutrons, by W. V. Baxter, E. I. du Pont de Nemours & Co., Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Lab., Aiken, S. C. Dec 59. Contract AT(07-2)-1. 34p. Order from OTS. $1.00. DP-446

New data on the emission spectrum of air, by D. F. Heath. University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Jan 59. Contract W-7405-ENG-36. 79p. Order from OTS. $2.25. LA-2335

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Coordinate transformations in intranuclear cascade studies, by R. L. Bivins and others. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Sep 59. Contract W-7405-ENG-36. 19p. Order from OTS. 75 cents. LAMS-2360

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Half-life of radium-223, by H. W. Kirby and others. Mound Lab., Miamisburg, Ohio. July 59. Contract AT-33-1-GEN-53. 12p. Order from LC. Mi $2.40, ph $3.30. MLM-1093

Neutron moderation by acoustic modes of metal hydrides, by E. U. Vaughan. Atomics International, A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contrcct AT(11-1)-GEN-8. 25p. Order from OTS. 75 cents. NAA-SR-3788

Transient bubble growth in a homogeneous reactor, by H. P. Flatt. Atomics International, A Division of North American Aviation, Inc., Canoga Park, Calif. Jan 60. Contract AT(11-1)-GEN-8. 33p. Order from OTS. $1.00. NAA-SR-3923

Progress Reports

Semiautomatic carbon arc gouging machine, by J. J. Maginnis and others. Union Carbide Nuclear Co., Union Carbide Corp., Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Feb 60. Contract W-7405-eng-26. 20p. Order from OTS. 75 cents. K-1443

Quarterly status report of the lasl plasma thermocouple development program for period ending December 20, 1959. by S. Glasstone University of California, Los Alamos Scientific Laboratroy, Los Alamos, N. Mex. Jan. 60. Contract W-7405-ENG-36. 21p. Order from OTS $.75. LAMS-2396

Radiation Effects on Materials

Some effects of radiation on solvent extraction processes. By Wallace Davis, Jr., and Robert M. Wagner. Jan. 26, 59. 14p. Contract W-7405-ENG-26. Mi. $2.40 Ph. $3.30 Order from LC. CF-59-1-90

Radioactive Waste

Retention efficiencies of charcoal traps for fission gases. by R. C. Koch and G. L. Grandy Aug. 57 Nuclear Science and Engineering Corporation, Pittsburgh, Pennsylvania. Order from OTS $1.75. 63p. NSEC-7

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Uranium surface contamination on nuclear reactor fuel elements by W. M. Cashin. General Electric Company, Knolls Atomic Power Laboratory Schenectady, New York. Operated for the United States Atomic Energy Commission, Contract W-31-109-ENG-52. 62p. Order from OTS $2.00. KAPL-2061

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JOURNAL ARTICLES JULY-DECEMBER 1958, comp. by Peter S. Deck. 25 Sep 59, 12p. 29 refs. CWL Special Pub. 4-14.
Order from LC mi$2.40, ph$3.30 PB 145 635

This list of articles published in journals during July-December 1958 was compiled from reprint orders and notifications of publication made available by the authors. A file of reprints, covering all but a few articles, is available in the Technical Information Division. In most cases, copies of reprints may be obtained from the authors. The articles are listed chronologically within each Directorate. (Author) (See also PB 138 345)

Electrical Engineering Research Lab., U. of Texas, Austin.
SUMMARY BIBLIOGRAPHY OF TECHNICAL REPORTS, PUBLICATIONS AND THESES. Rept. on Contract Nonr-375(01). 28 Feb 59, 51p. 423 refs. Rept. no. 106.
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This report has been prepared in an effort to consolidate all technical publications of this Laboratory in one volume. To reduce the size of the publication, detailed references have been made only to the technical as contrasted to the status type report and a previously included section on papers presented at technical meetings has been deleted. The section on theses has been retained. The technical publications are listed numerically with title, data, classification (if any), author(s) and contract number serving as identification. They are grouped generally into broad subdivisions of Navy, Air Force and Army support.

ASTRONOMY

Saskatchewan U. (Canada).
INVESTIGATIONS OF THE MEINEL N_2^+ BANDS IN THE AURORA IN THE 1.0 TO 2.0μ REGION, by A. W. Harrison. Scientific rept. no. BR-9 on Contract AF 19(604)1831. Mar 58, 15p. 15 refs. AFCRC-TN-58-293; AD-152 541; AD-230 666.
Order from LC mi$2.40, ph$3.30 PB 145 657

Saskatchewan U. (Canada).
A NOMOGRAM FOR SOLVING SPHERICAL TRIANGLES, by D. M. Hunten. Scientific rept. no. BR-8 on Contract AF 19(604)1831. Mar 58, 14p. 2 refs. AFCRC-TN-58-292; AD-152 540; AD-230 667.
Order from LC mi$2.40, ph$3.30 PB 145 586

A nomogram is presented which converts between celestial and horizon coordinates for a single latitude. In 8 by 10 inch size the accuracy averages half a degree. It may also be used to find range and bearing of any point on the earth from its latitude and longitude. The construction is easy since it consists of two straight lines and a circle graduated according to simple rules. Examples of use, directions for construction, and theory are included. (Author)

Astrophysics

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
DEDUCTION OF VERTICAL THERMAL STRUCTURE OF A PLANETARY ATMOSPHERE FROM A SATELLITE, by J. I. F. King. Rept. on Contract AF 04(647)269. 11 Dec 59, 17p. 6 refs. Technical Information Series R59SD477.
Order from LC mi$2.40, ph$3.30 PB 145 180

An inversion technique is developed for deducing the temperature stratification of a planetary atmosphere from the variation of the emission spectrum with air mass. This is a planetary application of the well-known solar limb-darkening effect. Mathematically, the emergent intensity is an integral transform of the Planckian temperature taken as a function of optical depth. The solution therefore consists in devising a scheme for inverting the transform. Pending satellite observations, the following approach is used for the verification of the theory. Ground observations of the 9.6 micron ozone band as a function of air mass thickness have been taken. These radiative data provide information on ozone "at a distance", in a manner similar to the remote satellite viewing from above. Four sets of ozone emission data have been analyzed and the vertical thermal structure of the ozonosphere deduced therefrom. A critique of the method together with future research directions is given. (Author)

Dublin Inst. for Advanced Studies [Eire].
[INVESTIGATIONS OF THE RATES OF EXTENSIVE PENETRATING SHOWERS, HIGH ENERGY LOCAL SHOWERS AND DENSE ELECTRONIC SHOWERS OF THE COSMIC RADIATION, by C. B. A. McCusker]. Final technical rept. for 1 Dec 58-30 Nov 59 on Contract AF 61(052)163. 12p. 15 refs. AFOSR-TR-60-12.
Order from LC mi$2.40, ph$3.30 PB 145 678

The report covers work on solar time variations in local penetrating and dense extensive cosmic ray showers; on the variation over the sky of primaries causing extensive air showers at sea level; on the structure of extensive air showers; the performance of directional arrays and on pressure variations resulting from atmospheric tides. (Author)

Oslo U. (Norway).
THE DETERMINATION OF POSITION AND POLARIZATION OF SOURCES OF ENHANCED SOLAR RADIATION ON 200 Mc/s, by Per Maltby. [1958] 32p. 15 refs. Scientific rept. no. 10(20) on Contract AF 61(514)1122. AFCRC-TN-58-471; AD-160 747.
Order from LC mi$3.00, ph$6.30 PB 145 656

An interferometer has been built at the Solar Observatory, Harestua, for observing the position of sources of enhanced solar radiation on 200 Mc/s. The interferometer, the method for analysing the observations, and some sources of error are described in Part I. Part II of the present paper deals with the measurement of polarization by means of three antennas, one of which is polarized orthogonally. Several sources of error are discussed. (Author)

Oslo U. (Norway).
RESEARCHES IN THE FIELD OF SOLAR RADIO NOISE, SUNSPOTS, PROMINENCES AND FLARES. Technical (final) rept. on Contract AF 61(514)1122. 21 Jan 59, 39p. 13 refs. AFCRC-TR-59-233; AD-213 622.
Order from LC mi$3.00, ph$6.30 PB 145 650

A summary is presented of the many projects underway. An appendix contains a series of 30 frames of solar images in H_α-light was selected from a film taken at Tromsö during a 28 hour spell of fair observational conditions.

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TACTUAL CODING OF CYLINDRICAL KNOBS, by James V. Bradley. Rept. on Control Design and Arrangement, done partially at Antioch Coll. on Contract AF 33(616)6095. Sep 59, 33p. 18 refs. WADC Technical rept. 59-182.
Order from OTS $1.00 PB 161 483

Tactual coding of knobs by use of bizarre shapes is frequently achieved at the expense of manipulability and setting precision, which appear, in many cases, to be optimal when knobs are cylindrical. In order to be able to maximize both discriminability and manipulability, certain parameters of cylindrical knobs were investigated as bases for tactual coding. Rim surface, diameter and thickness were all found to be useful for this purpose. When feeling one of two knobs whose pictures were before them, subjects rarely (less than 1% of the time) identified the wrong picture as the felt knob in any of the following situations: diameters differ by 1/2 inch or more, thicknesses differ by 3/8 inch or more, rim surfaces belong to different ones of the three families: smooth, fluted, knurled. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
A COMPARISON OF TWO METHODS OF CONTROLLER TRAINING IN SIMULATED AIR TRAFFIC CONTROL TASK. A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL, by J. S. Kidd. Rept. on Contract AF 33(616)3612. Jan 59, 27p. 16 refs. WADC Technical rept. 58-449; AD-212 269.
Order from LC mi$2.70, ph$4.80 PB 146 196

Improvement in performance with training in a complex task of radar air traffic control was compared under a condition of constant high input load during training vs. a condition of graduated input load during training. Relative input load was defined as the number of aircraft under the control of a single pattern-feeder operator. The test performance of controllers trained under constant high input load was significantly superior on several criteria to that of controllers trained under the graduated input load condition. An explanation was proposed in terms of the heightened frequency of feedback of knowledge of performance experienced by the high constant input load group. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
INFORMATION INPUT AND PROCESSING VARIABLES IN MAN MACHINE SYSTEMS: A REVIEW OF THE LITERATURE, by William C. Howell and George E. Briggs. Rept. on Contract N61339-508. 26 Oct 59, 75p. 245 refs. Technical rept. NAVTRADEVCEN-508-1.
Order from LC mi$4.50, ph$12.30 PB 145 160

The results of this survey provide recommendations for the handling of information by the various sensory systems. Specifically, the results point out: (1) The variables relevant to sensory input with regard to their potential as display channels, and the problems involved in detecting and responding to distorted signals. (2) The variables involving the amount of input information and the manner in which it is distributed over time and space. (3) A few highly selected display-control relationships that are worthy of future experimentation and study.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
OPERATOR CHANGE-OVER EFFECTS IN A COMPLEX TASK, by J. S. Kidd and Robert G. Kinkade. Rept. on Contract AF 33(616)3612, continuation of Contract AF 33(616)43. Aug 59. 17p. 14 refs. WADC Technical rept. 59-235.
Order from OTS $0.50 PB 161 529

The two experiments covered in this report were concerned primarily with the loss in system performance due to operator change-over and extended work duration. Using 12 laboratory-trained controllers in a simulated air traffic control task, it was found that (a) a significant but short-duration decrement occurred at operator change-over, (b) performance was highly stable over the 3.5-hr. work period, (c) a prominent "end-spurt" occurred, and (d) the degree of prechange-over participation by the replacement controller could modify the extent of performance loss at change-over. These findings were evaluated with respect to studies of warm-up, preparatory set, and work fatigue effects observed in other task settings. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
SIZE, BLUR, AND CONTRAST AS VARIABLES AFFECTING THE LEGIBILITY OF ALPHA-NUMERIC SYMBOLS ON RADAR-TYPE DISPLAYS, by William C. Howell and Conrad L. Kraft. Rept. on Contract AF 33(616)3612. Sep 59, 43p. 17 refs. WADC Technical rept. 59-536.
Order from OTS $1.25 PB 161 454

The purpose of this study was to determine the functions relating size, blur, and contrast, and their interactions, to legibility of alpha-numeric symbols on a radar-type display. Twelve subjects served under all 64 conditions obtained by combining factorially four levels of each of three variables: size, blur, and contrast. The stimuli, 36 alpha-numeric symbols, were projected on a ground-glass screen one at a time at a rate controlled by the subject's verbal responses. Instructions stressed equally speed and (Behavioral Sciences--Human Engineering, accuracy. Performance indices were information transmitted, speed, and accuracy. Confusion data were also reported for specific conditions. The results indicated that each of the three variables and two of the interactions significantly influenced legibility. Optimum legibility was obtained at 26.80-min. size, high contrast, and low blur. Larger sizes frequently degraded performance. The implications and possible generality of these data are discussed. (Author)

Personnel and Training

Educational Research Corp. [Cambridge, Mass.]
A COMPARISON OF TWO METHODS OF TEACHING TYPEWRITING, by Phillip J. Rulon and W. Douglas Brooks. Rept. on Contract N61339-294. 11 Jan 60, 39p. 13 refs. Technical rept. NAVTRADEVCEN 294-1.
Order from OTS $1.00 PB 161 512

This study was undertaken to compare the existing method of teaching typewriting in the Navy with a method proposed by L. Robins. The Navy method is characterized by the use of lettered keyboards, demonstration by the instructor and emphasis on speed. All home keys are taught together and additional characters are introduced in groups of two or three. Thus, the keys are learned by their spatial relationship to the home keys. The Robins method is based on the principle of reinforced learning. With this method, all keys are covered and each character is taught separately. Accuracy is emphasized and students discover which letter will be typed when a particular key is depressed. Comparisons of the two groups were made in terms of: (1) typing speed in net words per minute; (2) typing speed in gross words per minute and percentage of strokes resulting in errors considered simultaneously; and (3) the number of periods of classroom instruction required to achieve a prescribed typing speed in net words per minute.

Family Relations Center, San Francisco, Calif.
PROGRAM EFFECTIVENESS IN NAVAL RETRAINING, by E. K. Gunderson, S. D. Mock and others. Technical rept. no. 7 on Rehabilitation of Naval Disciplinary Offenders, Contract Nonr-1535(00). 3 Feb 58, 13p. 11 refs. AD-159 623.
Order from LC mi$2.40, ph$3.30 PB 137 805

An attempt was made to assess retraining program effectiveness under 2 different program orientations. The old program consisted of 3 wk of orientation classes which provided information, films, and counseling designed to promote the mental health of the confinees, assist in their adjustment to confinement, and encourage their military development. The new orientation program for all confinees was reduced from 3 to 2 wk. Confinees designated by the courts to return to duty following their confinement were placed in separate groups from those slated for other than honorable separation from the service. It was stated as policy that the classes in the new program would be directed toward increasing knowledge of military skills and heritage only. The 2 programs differed markedly in their effects on the attitudes, institutional behavior, and postinstitutional military adjustment of confinees. The findings strongly support the hypothesis that a correctional institution cannot achieve its objective of successful treatment unless it has an organized program to substitute conventional orientations for the delinquent values of sentenced offenders.

Naval Personnel Research Field Activity, Washington, D. C.
THE DEVELOPMENT AND VALIDATION OF THE ADVANCED TECHNICIANS TEST, by John J. La Gaipa. July 59, 21p. 2 refs. BuPers Technical Bulletin 59-15. AD-227 324.
Order from LC mi$2.70, ph$4.80 PB 145 044

This is a report of the development of an Advanced Technicians Test (ATT) designed to improve the selection into advanced technical training programs, with particular immediate application to selection for Nuclear (NP) training. Two forms of the ATT have been constructed, consisting of four parts, Reading Comprehension (of technical material), Mathematics, Physics and Electricity. The forms have been tried out on students at the Submarine NP school. A high correspondence was found between total scores on the ATT and grades in the school, and the scores on the Mathematics subtest showed an even higher ability to

predict school grades. Use of the Mathematics test of the ATT as a substitute or a supplement to the Basic Test Battery selection standards is recommended as an aid in selection for the Nuclear Power schools. (Author)

Personnel Lab., Wright Air Development Center, Lackland AFB, Tex.
RATER TENDENCIES IN ESTIMATING QUALIFICATIONS REQUIRED BY AIR FORCE TASKS, by Llewellyn Wiley, Hal B. Harber, and Joyce Giorgia. Sep 59, 12p. WADC-TN-59-195; AD-227 634.
Order from LC mi$2.40, ph$3.30 PB 145 135

The purpose of this study is to determine whether personal evaluation habits may influence interrater agreement. Tasks were drawn from 15 Air Force career fields, and a group of ROTC pilot trainees rated these tasks and the specialties that include them. Judgments were made on 5-point scales to determine how much resourcefulness, general vocabulary, tool and instrument knowledge, number skill, physique and stamina, human contact skill, precision, formal training, and on-the-job training time is needed. Correlation of each rater's over-all mean rating in one session with that of the mean for the second session demonstrated consistent tendencies to give high, low, or medium ratings. Similar correlations between mean standard deviations gave evidence of individual tendencies to use or refrain from using the extremes of the rating scale. (Author)

Psychology

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AN EXPLORATORY STUDY OF PROLONGED INTERMITTENT PHOTIC STIMULATION, by Harold S. Alexander and W. Dean Chiles. Rept. on Human Performance in Advanced Systems. Nov 59, 11p. 2 refs. WADC Technical rept. 59-715.
Order from OTS $0.50 PB 161 504

In order to investigate the resistance of the human operator to effects of intense, flashing lights for prolonged periods of time, four subjects were exposed to very bright intermittent photic stimulation at 5, 10, and 15 cycles per second for a period of 2-1/2 hours. None of the subjects suffered any adverse subjective or behavioral effects, although all became somewhat drowsy from time to time, presumably as a result of the boring nature of the situation. After about one hour of stimulation, all four subjects showed definite evidences of electroencephalographic responses to the lights. (Author)

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
SOME ASPECTS OF PROBLEM-SOLVING: I. METHOD AND MATERIALS, by Paul A. Kolers. Rept. on Psychological Research on Human Performance. Jan 60, 20p. 8 refs. WADD Technical rept. 60-2.
Order from OTS $0.50 PB 161 534

A method is described which enables the experimenter to generate problems of known characteristics for study of perceptual problem-solving behavior. The kinds of data which result from the application of this method are illustrated. The characteristics of the method are: it is free of the experimenter's bias in generating problems; the problems are relatively "content-free" in that little special knowledge is required for their solution; the results are readily interpreted in quantitative terms; and the characteristics of the problems can be manipulated systematically along dimensions of similarity, difficulty, and others. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
STUDIES IN RESEARCH METHODOLOGY. II. CONSEQUENCES OF VIOLATING PARAMETRIC ASSUMPTIONS: FACT AND FALLACY, by James V. Bradley. Research conducted at Antioch Coll. on Contract AF 33(616)3404. Sep 59. 37p. 81 refs. WADC Technical rept. 58-574(II).
Order from OTS $1.00 PB 161 452

Methods of investigating the effects of assumption-violation are examined. Particular attention is given to methodological, and other, bias operating in favor of the conclusion that parametric tests are extremely insensitive to violations of their assumptions. Fallacious arguments advanced in support of this non-normality upon the probability levels and power of the critical ratio test is investigated. Results show that under certain perfectly realistic conditions the test is rendered completely powerless by the violation investigated. (Author) (See also PB 161 335)

Fels Group Dynamic Center, U. of Delaware, Newark.
USE OF AUTOCORRELATION AND UNCERTAINTY MEASURES FOR THE ANALYSIS OF DECISION BEHAVIOR, by Alan Lewis and Vera T. Kanareff. Rept. on Research on Human Intellectual Functions, Contract AF 33(616)5845. Aug 59, 39p. 28 refs. WADC Technical rept. 59-434.
Order from OTS $1.00 PB 161 453

A discussion of two methods of analysis of sequential dependencies is discussed in relation to the study of decision behavior. The methods considered are autocorrelation and uncertainty analysis. Each of these approaches is described in terms of computational techniques and specific applications are presented. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
AUGMENTED FEEDBACK AND TRACKING SKILL, by Robert G. Kinkade. Rept. on Contract N61339-508. 26 Oct 59, 33p. 12 refs. Technical rept. NAVTRADEVCEN-508-3.
Order from LC mi$3.00, ph$6.30 PB 145 162

The results of this study are: (1) The optimum relative amount of augmented feedback is a function of the skill of the operator. (2) In a particular training situation it is important that both the amount and schedule of feedback be considered since these two variables show a significant interaction with one another. (3) Abrupt changes in the amount of feedback have a deleterious effect on performance, especially if the number of sensory cues are diminished.

Laboratory of Aviation Psychology, Ohio State U., Research Foundation, Columbus.
THE DIFFERENTIAL EFFECTS OF SPEED AND LOAD STRESS ON TASK PERFORMANCE, by Gabriel Jeantheau. Master's thesis. Rept. on Contract AF 33(616)3612, Continuation of Contract AF 33(616)43. July 59, 18p. 8 refs. WADC Technical rept. 59-7.
Order from OTS $0.50 PB 161 482

This study investigated effects of speed-load stress (input rate and variety) on performance in an information-processing task requiring discrimination of pairs of identical symbols within matrices of three levels of word length and five levels of presentation rate. Error scores and a derived information measure were used to assess performance. Results indicated that increases in both speed and load seriously impair performance. The data fitted to an information specification of the stimulus situation failed to provide a unitary function. Information scores plotted against mean number of paired comparisons per second, however, yielded a single function which described all conditions and accounted for the high interaction component. It was concluded that (a) specification of the stimulus situation alone does not adequately explain performance, and (b) use of information measures in tasks of this type adds little or nothing to such explanations. A more pertinent consideration is the actual operations required in responding to the task situation. (Author)

Laboratory of Aviation Psychology, Ohio State U., Research Foundation, Columbus.
FIDELITY OF SIMULATION: I. TIME SHARING REQUIREMENTS AND CONTROL LOADING AS FACTORS IN TRANSFER OF TRAINING, by George E. Briggs and Earl L. Wiener. Rept. on Contract N61339-508. 26 Oct 59, 14p. 5 refs. Technical rept. NAVTRADEVCEN-508-4.
Order from LC mi$2.40, ph$3.30 PB 145 163

With a high level of time-sharing, subjects trained with minimum force cues achieved less transfer to a situation characterized by optimum force cues than did subjects trained under a low level of time sharing. Time-sharing requirements tend to increase the importance of proprioceptive information or "control feel" in a two-dimensional compensatory tracking task.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
ON THE RELATIVE IMPORTANCE OF TIME SHARING AT CENTRAL AND PERIPHERAL LEVELS, by George E. Briggs and William C. Howell. Rept. on Contract N61339-508. 26 Oct 59, 19p. 14 refs. Technical rept. NAVTRADEVCEN-508-2.
Order from LC mi$2.40, ph$3.30 PB 145 161

Performance on a task demanding either central time sharing alone or central plus peripheral time sharing deteriorates as input frequency increases. Central time sharing determines the performance levels with display separations of less than 30 degrees of visual angle. The permissible amount of separation between the displays is a function of input frequency with the higher frequency the smaller the separation.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus, Ohio.
SYSTEM PERFORMANCE FOLLOWING RADAR FAILURE IN A SIMULATED AIR TRAFFIC CONTROL SITUATION, by William C. Howell, R. Thomas Christy, and Robert G. Kinkade. Rept. on Contract AF 33(616)3612. Sep 59, 21p. 7 refs. WADC Technical rept. 59-573.
Order from OTS $0.75 PB 161 499

The present experiment investigated the ability of controllers to take over and maintain control of aircraft after loss of PPI information in a simulation of an air traffic control system. The variables examined were the level of control flexibility and prebreakdown activity of controllers. Flexibility, or the number of alternatives available to the controller, was defined by the number of fixed flight paths used (3 vs. 17), and prebreakdown activity was defined by the task of monitoring vs. active controlling. A condition requiring control after prebreakdown monitoring was intended to simulate manual takeover after failure of a semiautomatic control system. In general, the results indicated that whereas procedural flexibility is beneficial to performance during normal operations, it becomes less beneficial and even harmful subsequent to PPI breakdown. Whether the controller is monitoring or controlling prior to breakdown appears to have little effect on performance after breakdown. (Author)

Laboratory of Social Relations, Harvard U., Cambridge, Mass.
EMPIRICAL TESTS OF THE FIRO THEORY OF INTERPERSONAL BEHAVIOR, by William C. Schutz. Final rept. on Contract Nonr-1866(06). 1958, 22p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 145 087

This report covers two empirical studies designed to test certain theorems derived from the postulates of the FIRO theory. Both these studies tested the possibilities of predicting sociometric choice through the use of only one personality questionnaire (FIRO-B) and a theory of compatibility, on two widely different task-oriented groups. Since this is a final report, a brief summary of the relevant parts of the FIRO theory is given before the experiments are described.

Minneapolis-Honeywell Regulator Co., Minn.
SURVEY OF HUMAN DYNAMICS DATA AND A SAMPLE APPLICATION, by John W. Senders. Rept. on Contract AF 33(616)5607. Nov 59, 21p. 11 refs. WADC Technical rept. 59-712.
Order from OTS $0.75 PB 161 503

An approach has been made to the application of the results of research on the human transfer function. A form of a quasi-linear human transfer function has been laid out on the basis of previous experimental results. It has been assumed that human reaction time and neuromuscular lag are constant and that the pilot will adopt a gain and compensation through training which will minimize the mean square tracking error of the system of which he is part. Calculations were made of the mean square tracking error for a one-dimensional simulation of a typical aircraft tracking task. The effects of variation of aircraft dynamics on tracking error were examined. (Author)

Research Center for Mental Health, New York U., N. Y.
PERSONOLOGICAL CORRELATES OF REACTIONS TO PERCEPTUAL ISOLATION, by Robert R. Holt and Leo Goldberger. Rept. on Biophysics of Flight, Contract AF 33(616)6103. Nov 59, 52p. 36 refs. WADC Technical rept. 59-735.
Order from OTS $1.50 PB 161 505

This report describes the aspects of personality (independently measured by objective tests and by clinical Q-sort ratings) that were found to correlate with reactions to eight hours of experimental reality-deprivation (perceptual isolation, sensory deprivation). Fourteen male college students were subjected to an experimental deprivation situation similar to that used in the McGill studies, and from their behavior and verbalizations fourteen measures of reaction were derived. Most of these fell into two internally consistent, not significantly correlated patterns: an adaptive and a maladaptive syndrome. The findings reported and discussed were obtained by correlating rank orders on these syndromes and on each of the fourteen reaction-measures with the various measures of personality. It is hoped that these findings may be relevant to the problems of space crew selection. (Author)

BIOLOGICAL SCIENCES

Anatomy and Physiology

Aerospace Medical Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
DEVELOPMENT OF AN OXYGEN PARTIAL PRESSURE TRANSDUCER, by Edmund B. Weis, Jr., Adolf Marko and others. Rept. for Sep 58-Sep 59 on Instrumentation Research. Nov 59, 19p. 9 refs. WADC Technical note 59-395.
Order from OTS $0.50 PB 161 524

This investigation was undertaken to establish a method for monitoring oxygen supply of man during stress experiments. An analysis of various systems for measuring oxygen partial pressure led to the selection of the polarographic principle. The polarographic system of analysis was examined in detail and a modified polarographic cell with a bare cathode and a fast response time was investigated. The bare cathode oxygen sensor has instabilities due to interface variations which will require extensive study to achieve accuracy. Polarographic analysis is useful for blood and atmospheric oxygen tension monitoring. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
INFLUENCE OF PRIOR BODY COOLING WITH AIR ON HUMAN HEAT TOLERANCE, by James H. Veghte and Paul Webb. Rept. on Physiology in Extended Environments. Sep 59, 17p. 6 refs. WADC Technical rept. 59-350.
Order from CTS $0.50 PB 161 485

This study was conducted with three experienced subjects to determine the feasibility of using a ventilating suit as a vehicle for body cooling prior to heat exposures. Various ventilating air temperatures, flows, and time durations were explored. The results confirm the applicability of this approach for prior body cooling and extension of tolerance times to a heat stress. Optimal air temperature for air cooling in terms of subjective comfort appears to be approximately 45°F. for 60 minutes or longer. Maximum airflow rate recommended with the ventilating garment is 25 c.f.m. Heavy insulation should be worn over the ventilating garment while cooling and may be worn throughout the heat or flight situation with no tolerance impairment. (Author)

Allan Memorial Inst. of Psychiatry (Canada).
MANUAL OF SURFACE ELECTROMYOGRAPHY, by John F. Davis. Rept. on Contract DA 49-007-md-70, 1952, reissued by Antioch Coll. on Criteria for the Design and Arrangement of Displays, Contract AF 33(616)6095. Dec 59, 131p. 15 refs. WADC Technical rept. 59-184.
Order from OTS $2.75 PB 161 528

The methodology and instrumentation of surface electromyography are presented in detail. Principles (and applications of principles) of electrode placement are given along with certain standard placements. Various types of ink-writing electromyographs and accessories are evaluated and specifications are outlined for a satisfactory research instrument. These specifications include type of power supply, type of recorder, and desirable characteristics for the pre-amplifiers, the main amplifiers, and the control panel. Basic principles are given for layout and construction of laboratory rooms so as to minimize artifacts in the EMG record. Finally, the manual discusses the operation of EMG instruments, including methods of eliminating various artifacts, and the measurement of both primary and integrated records. Illustrations of electrode placements and construction and schematics of ink-writing electromyographs are provided. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
STUDIES ON THE PARASITES OF EDIBLE ANIMALS OF ALASKA, by T. T. Dunagan. Oct 57, 18p. 1 ref. Technical note AAL-TN-57-14.
Order from LC mi$2.40, ph$3.30 PB 145 372

Considering the number and types of parasites found in all groups of edible animals in the arctic and subarctic, climate apparently has very little adverse influence on parasite distribution or the maintenance of their life cycles.

Army Chemical Warfare Labs., Army Chemical Center, Md.
RECIPROCAL POTENTIATING ACTION OF DEPOLARIZING SUBSTANCES ON THE ISOLATED FROG RECTUS ABDOMINIS MUSCLE, by Joseph H. Fleisher, Joseph P. Corrigan, and John W. Howard. Sep 59, 16p. 14 refs. CWLR-2315; AD-228 454.
Order from LC mi$2.40, ph$3.30 PB 145 140

The action of the organophosphorus compounds, diisopropyl phosphorofluoridate (DFP) and isopropyl methylphosphonofluoridate (GB), at neuromuscular junctions, has been attributed in part to a direct enhancement of the response to acetylcholine over and above that due to the anticholinesterase properties of these compounds. Subthreshold concentrations of the depolarizing agents, acetylcholine (ACh) and decamethonium (C-10), were found to potentiate the contracture of the myoneural junction of the isolated frog rectus abdominis muscle elicited by effective doses of the same drugs and choline in the absence of GB. Comparable potentiation of the contracture produced by C-10 or choline could be obtained by alternate stimulation with ACh in the absence of DFP or GB. Furthermore, DEP alone did not effect potentiation in the absence of alternate stimulation with ACh. Finally, the inhibitory action of d-tubocurarine on receptor sites of the frog rectus muscle was not antagonized by GB over and above the anticurare activity derived from its anticholinesterase action. It is concluded that the enhancement of the response of the frog rectus abdominis muscle to ACh produced by DEP and GB is brought about exclusively by their action as cholinesterase inhibitors. The apparent capacity of DFP or GB to potentiate contractures elicited by C-10 and choline may be attributed to a facilitation of the action of the depolarizing compounds by subthreshold concentrations of ACH available in the presence of these anticholinesterases. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
BEHAVIORAL AND PHYSIOLOGICAL EFFECTS OF EXPOSURE TO A SIMULATED JUNO II ACCELERATION PATTERN, by Robert M. Herrick, George H. Kydd, and Richard L. Fenichel. 21 Sep 59, 14p. 4 refs. NADC-MA-5913; Bu Med. Proj. MR 005.15-0002.16, R-1; Bu Aer Proj. TED ADC AE 1412.2.
Order from LC mi$2.40, ph$3.30 PB 145 133

The purpose of the present experiment was to determine how exposure to a simulated accleration pattern of the Juno II missile system affected the subsequent behavior of rats. The findings of the experiment indicate that, within the limits of the simulation, exposure to the acceleration pattern will not detrimentally affect rats either physiologically or behaviorally. This means that in an analysis of the results of a biosatellite study designed to evaluate the influence of zero G upon behavior the fact that the rats were exposed to the Juno II acceleration pattern may be ignored. (Author)

George Washington U., Washington, D. C.
AN IMMUNOLOGICAL INVESTIGATION OF THE HERPES SIMPLEX VIRUS. A STUDY OF THE INTERFERENCE PHENOMENON WITH THE HERPES SIMPLEX VIRUS, by Mary Louise Robbins. Final rept. for 1 June 51-30 Sep 55 on Contract Nonr-291(00). [1955] 5p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 137 504

The purpose of this project was to perfect a complement fixation test for the diagnosis of herpes simplex infection, to investigate the antigenic structure of the herpes simplex virus, and to study the interference phenomenon with the herpes simplex virus as an aid to demonstration of strain differences.

Lamont Geological Observatory, Palisades, N. Y.
AN OPEN CONSTANT TEMPERATURE BOX, by Carolyn Beckman. Technical rept. no. 1 on Effect of Temperature on the Population Growth of Marine Organisms, Contract Nonr-266(41). Jan 58, 11p. CU-2-58 Nonr 266(41) Geol.; AD-152 328.
Order from LC mi$2.40, ph$3.30 PB 138 284

Seven open constant-temperature boxes were fabricated for use in the study of the effect of temperature on the population growth of marine woodborers. The outer box comprised 11 1/4-by 12-in. ends, 12-by 23-in. sides, and an 11 1/4-by 22 1/4-in. bottom and was constructed of 3/8-in. plywood and lined with Al foil. The inner box was constructed of 1/4-in. plywood and comprised 6 1/2-by 8 1/2-in. ends, 8 1/2-by 16 1/2-in. sides, a 6-by 16-in. bottom, tapered 6 1/2-by 11 1/4-in. top ends, and tapered 16-by 22 1/2-in. top sides; 3/16-in. holes were drilled 1 cm apart in the walls to aid in the distribution of the heat from the space between the walls. The wiring consists of an electric cord, 15 ft of asbestos insulated B and S, 26-gage, Chromel A, heating wire and a Fenwal thermostat 17300-0. Transite brackets hold the wire near the surface of the inner box. Glass-fiber building insulation fills the space between the walls of the boxes. Of the 2 boxes tested, box 1 was kept in a refrigerator which varied 4°C. Air temperature variation within the box under these conditions was about 0.6°C at a refrigerator temperature of 0°C. Box 2, exposed to room temperature which varied about 8°C, varied 1.2°C.

Miami Valley Hospital, Dayton, Ohio.
I131-LABELED DIIODO-AMINOHIPPURIC ACID AS A TRACER IN CARDIAC OUTPUT STUDIES, by George M. Homer, Robert E. Zipf and others. Rept. for 31 July 58-31 July 59 on Physiology of Flight, Contract AF 33(616)3588. Dec 59, 48p. 11 refs. WADC Technical rept. 59-126.
Order from OTS $1.25 PB 161 527

Radioiodinated diiodo-p-aminohippuric acid ($DI^{131}PAH$) has been synthesized as the sodium salt and examined for its potential usefulness in measuring the cardiac output in animals. This labeled compound has been injected intravenously into rats, rabbits, and eleven dogs for study. Following the administration of $DI^{131}PAH$ to dogs, the rapid removal from the blood stream has been calculated as 50% and 90% in 1.8 and 9.3 minutes, respectively. Forty percent of the injected radioactivity was collected in the urine over an average experimental period of 3 hours. On autopsy of injected and sacrificed dogs, only a very low level of radioactivity was found to have localized in the tissues. Although the gall bladder was found to concentrate the injected compound or a metabolite thereof in the bile, this organ was readily emptied of its contents by means of olive oil administration to the animal previous to and following the injection of $DI^{131}PAH$. Cardiac output values determined with $DI^{131}PAH$ on dogs were reproducible and in the range of reported values determined with other materials. The advantage of $DI^{131}PAH$ over other labeled materials for the measurement of cardiac output is discussed. (Author)

Rochester U., N. Y.
LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE, by Robert M. Boynton, Charles Elworth, and Richard M. Palmer. Rept. on Improving Visual Efficiency of Flying, Contract AF 33(616)2565. Apr 58, 67p. 14 refs. WADC Technical rept. 55-304, Pt. 3; AD-142 274.
Order from LC mi$3.90, ph$10.80 PB 146 138

A mathematical relationship is worked out which yields the contrast required for 60% correct recognition as a function of subject-target distance, exposure time, and number of confusion forms (struniforms) among which the critical target may be located. By translating altitude into experimental distance, aircraft velocity into viewing time, and conditions of viewing (including meteorological conditions) into contrast, predictions are made about how performance should vary as a function of altitude, from 500 to 30,000 ft. General statements are given which attempt to summarize the results of these calculations. (See also PB 146 139)

Rochester U., N. Y.
LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE by Robert M. Boynton and William R. Bush. Rept. on Improving Visual Efficiency of Flying, Contract AF 33(616)2565. Apr 57, 54p. 4 refs. WADC Technical rept. 55-304, pt. 2; AD-118 250.
Order from LC mi$3.60, ph$9.30 PB 146 139

This is the second part of a three-stage program concerning the investigation of relevant variables involved in visual air reconnaissance. Using the apparatus and procedures developed during the first stage, experimentation has been conducted to determine the effects of (a) brightness contrast, (b) an extended range of distances, (c) response tendencies of the subjects, (d) numbers of figures in an array, (e) exposure time, and (f) experience with an array, on the ability of human subjects to detect and correctly identify a rectilinear form among a group of curvilinear forms. Results are presented as percent correct recognition (i.e., correctly identifying a "target"), although some data for detection and error responses are also given. Recognition is found to increase with (a) increased contrast, (b) decreased distances, (c) decreased numbers of figures, and (d) increased exposure time, but does not significantly change with either (a) response tendencies, or (b) experience within arrays. Both detection and errors are affected by response tendencies. Conclusions from this research and some consideration of further experimentation are presented in the text. (Author) (See also PB 146 140)

Rochester U., N. Y.
LABORATORY STUDIES PERTAINING TO VISUAL AIR RECONNAISSANCE, by Robert M. Boynton and William R. Bush. Rept. on Improving Visual Efficiency of Flying, Contract AF 33(616)2565. Sep 55, 47p. 5 refs. WADC Technical rept. 55-304, Pt. 1; AD-91 874.
Order from LC mi$3.30, ph$7.80 PB 146 140

An apparatus has been constructed whereby three observers can view a complex array of forms under varying conditions of distance, exposure time, number of forms, and brightness contrast. An empirical investigation is reported of the recognizability of various-shaped figures as a function of brightness contrast and distance. Forty-six figures, both rectilinear and curvilinear, have been selected as a result of this study, for use in investigating the variables involved in "seeking out" critical targets in a heterogeneous array. Rectilinear figures, placed among an array of curvilinear figures, have been presented to subjects and the per cent correct responses tabulated. The probability of correct response increases linearly with exposure time (up to approximately 12 sec), decreases linearly with log number of curvilinear forms, and decreases linearly with subject-figure distance. The effects of figure-density, figure-cluster, and learning are also evaluated. (Author)

School of Aviation Medicine [Brooks AFB, Tex.]
THE MULTIPLE FACTOR THEORY OF RESPIRATORY REGULATION. II. UNCOMPENSATED METABOLIC DISTURBANCES OF ACID-BASE BALANCE, by John S. Gray. 14 Dec 45, 19p. 15 refs. Proj. no. 386, rept. no. 2; AD-121 894.
Order from LC mi$2.40, ph$3.30 PB 145 524

On the basis of well-known physico-chemical properties of blood, it has been calculated that the addition of fixed acid to blood in vitro under conditions where gas exchange is prevented should produce extensive increase in H ion concentration and CO_2 tension with little change in bicarbonate content. Analysis of available experimental data reveals that changes resembling the above type occur in vivo in conditions of metabolic acidosis in which respiratory compensation is delayed or prevented. Similar calculations reveal that the addition of $NaHCO_3$ to blood should produce marked increases in CO_2 tension with only mild decreases in H ion concentration. Changes of the above type should occur transiently in vivo following the intravenous injection of $NaHCO_3$, and according to the multiple factor theory should result in a transient hyperpnea followed by a slight depression of respiration. According to the literature these are the respiratory responses observed to occur experimentally. The multiple factor theory, therefore, provides a simple explanation for this phenomenon without assuming that cellular and arterial pH's change in opposite directions on injecting $NaHCO_3$. (Author)

School of Aviation Medicine, Brooks AFB, Tex.
PHYSIOLOGIC RESPONSE TO WEIGHTLESSNESS; INITIATION OF MICTURITION, by Julian E. Ward, Willard R. Hawkins, and Herbert D. Stallings. Aug 59 6p. 3 refs. Rept. no. 59-35.
Order from LC mi$1.80, ph$1.80 PB 145 099

The capability of subjects to initiate micturition during weightlessness following a period of hydration was studied. One subject was unable to void in the zero-gravity state but was able to in straight and level flight. Four subjects were unsuccessful in either situation. A majority (58 percent) of the subjects noted a slight to marked decrease in urinary urgency when exposed to weightlessness. This may have been due to psychologic factors such as anxiety, apprehension, or diversion of attention induced by a new and exciting environment which completely nullified the vesical contractions. However, there should be another explanation since the majority of these subjects were experienced in jet flying. The consideration is offered that the floor of the urinary bladder may be the primary sensory zone for the sensation of bladder fullness. Scheduling of body waste elimination should be incorporated into the crewman's standard operating procedures and check list.

Pharmacology and Toxicology

[Army] Chemical Corps, Fort Detrick, Md.
SHELLFISH POISONS. I. THE ISOLATION, PURIFICATION AND CHARACTERIZATION OF CLAM AND MUSSEL POISONS, by Edward J. Schantz, James D. Mold and others. Feb 56, 89p. 64 refs. Special rept. 250.
Order from LC mi$4.80, ph$13.80 PB 145 218

The objective of the work was to isolate the highly toxic shellfish poisons in pure form, determine their chemical structure, and use this information as a starting point for the synthesis and development of new CW or BW agents. Volume (I) covers the background and history of the project and details on the purification procedure, evidence for purity, and chemical and physical properties.

[Army] Chemical Corps, Fort Detrick, Md.
SHELLFISH POISONS. II. STUDIES ON THE CHEMICAL STRUCTURE OF CLAM AND MUSSEL POISONS, by James D. Mold, William L. Howard and others. Apr 56, 229p. 140 refs. Special rept. 250.
Order from LC mi$9.90, ph$34.80 PB 145 219

Volume II, contains detailed data on preparation of functional group derivatives of the poison, oxidation of the poison with periodate, permanganate, hydrogen peroxide, and several other oxidizing agents; oxidation in dilute aqueous alkali and at high pH; and acid hydrolysis of the poison. The concluding sections cover preparation of model compounds for use in the determination of the poison structure and an evaluation of degradative studies on the poison in terms of probable structure. (See also PB 145 218)

[Army Chemical Warfare] Labs., Army Chemical Center, Md.
THE ACUTE INHALATION TOXICITY OF THE THERMAL DECOMPOSITION PRODUCTS OF SEVERAL SYNTHETIC LUBRICATING OILS, by Leo Feinsilver, John L. Ferrari and others. Apr 55, 18p. 10 refs. Medical Labs. Research Rept. no. 357.
Order from LC mi$2.40, ph$3.30 PB 146 202

Rats, cats, and dogs were exposed for 4 hours to the fogs resulting from momentarily heating sprays of several synthetic lubricating oils to temperatures of 400° and 700°F. The following oils were tested: bis(2-ethylhexyl) sebacate, a formulated bis(2-ethylhexyl) sebacate, bis(2-ethylhexyl) azelate, bis(2-ethyl hexyl) adipate, di-isoamyl adipate, and dipropylene glycol dipelargonate. Every oil pyrolyzed at 700° F. except di-isoamyl adipate which was nontoxic, produced eye and respiratory irritation in all species; the mortality increased with increasing rate of dispersion of the oil. On the other hand, oils pyrolyzed at 400° F. produced a low incidence of mortality and few pathological changes or toxic signs. Quantitative determination of the following components of the pyrolyzed oil fog were made: carbon monoxide, total aldehydes, and total esters. The toxicity of the pyrolysis products appeared to depend upon the concentration of aldehydes and not on the other two components. (Author)

Colorado U. School of Medicine, Denver.
SEMI-ANNUAL PROGRESS REPORT, by Joseph H. Holmes, Maurice Gaon, and Kurt von Kaulla. Rept. for Oct 58-Mar 59 on Contract DA 18-108-405-cml-264. [1959] 32p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 145 525

Radiobiology

Aerospace Medical Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
MODIFICATION OF TECHNIQUES FOR DETERMINING THE UPTAKE OF IRON-59 IN NEWLY FORMED RED BLOOD CELLS, by Rodney L. Preston and Arthur P. Raun. Rept. on Physiology of Flight. Dec 59, 10p. 4 refs. WADC Technical note 59-214.
Order from OTS $0.50 PB 161 523

Data are presented on the validity of a simplified technique for measuring the incorporation of radioactive iron-59 into newly formed red blood cells in the rat following intraperitoneal administration of the isotope. The method, as described herein, should prove useful in measuring this physiological process under experimental conditions where erythropoiesis may be disturbed. (Author)

Western Biological Labs., Culver City, Calif.
CHRONIC EFFECTS OF LOW LEVEL RADIATION UPON PROTEIN AND AMINO ACID REQUIREMENTS, by B. H. Ershoff, A. F. Wells and others. Rept. for 1 Aug 58-31 May 59 on Health Hazards of Materials and Radiation, Contract AF 33(616)5873. Dec 59, 54p. 4 refs. WADC Technical rept. 59-609.
Order from OTS $1.50 PB 161 501

Immature male rats were fed highly purified diets containing 10, 15, 25, or 45% protein in the form of a cystine-supplemented casein and were continuously exposed for periods as long as 20 weeks to gamma radiation from a cesium-137 source at levels of 0.3, 3, 30, or 300 r per week. Control groups were fed the same diets but were not irradiated. The effects of radiation were neither diminished nor accentuated by alterations in the protein content of the diet. Substituting other proteins or mixtures of amino acids isonitrogenously for cystine-supplemented casein was also without significant effect on radiation response. Oral administration of AET in the diet or by forced feeding just prior to exposure did not afford protection against a single acute dose of x-irradiation in the rat. Incorporating AET in the diet was also ineffective in protecting rats continuously administered gamma radiation for 8 weeks at a level of 300 r per week. Rats continuously exposed to gamma radiation exhibited an impaired discrimination learning performance and depressed general activity at levels well below the minimum dose, required for detectable chemical or morphologic effects. (Author)

CHEMISTRY

Analytical Chemistry

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
X-RAY POWDER PATTERNS AND INDEX; METAL COMPOUNDS WITH N-BENZOYL-N-PHENYLHYDROXYLAMINE, by Frank L. Chan and Ross W. Moshier. Rept. on Experimental Techniques for Materials Research. Sep 59, 31p. 11 refs. WADC Technical rept. 59-533.
Order from OTS $1.00 PB 161 496

Studies on the organic reagent N-benzoyl-N-phenylhydroxylamine have resulted in the preparation of twenty-eight metallic products with this compound. The method of preparation of each compound, its ultimate analysis, formula, melting point, and characteristic color are given. The X-ray diffraction powder patterns and indexes are tabulated for ready reference and identification. The reagent and fifteen compounds are reported. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PRODUCTION CONTROL METHOD FOR DETERMINING THE CHARCOAL LOADING OF WET-PROCESS GAS-AEROSOL MATERIAL CORE LAYERS (E18), by Henry Greenhouse. Sep 59, 9p. CWLR-2312.
Order from LC mi$1.80, ph$1.80 PB 145 633

A production control method has been devised for determining the charcoal loading of E18 core material which is composed of vinyon, viscose, glass fibers, and charcoal. The method is based on two assumptions: first, that the percentages by weight of viscose and vinyon in the sheet are equal; secondly, that the percentage by weight of glass in the sheet is equal to that originally placed in the furnish. An acetone extraction of a sample will give the percentage of vinyon. The percentage of viscose will then be known and using the percentage of glass placed in the furnish the charcoal percentage may be calculated. A number of trial extractions indicate that this method can be applied with an accuracy of about 2%. (Author)

Inorganic Chemistry

James Forrestal Research Center, Princeton, N. J.
IONIC DISORDER IN MANGANOUS OXIDE, by C. Ernest Birchenall. Rept. on Contract AF 49(638)533. Dec 59, 8p. 4 refs. Metallurgy rept. no. 21; AFOSR-TR-60-62; AD-232 393.
Order from LC mi$1.80, ph$1.80 PB 145 668

The dissociation pressure curve of nonstoichiometric manganous oxide determined by Davies and Richardson (Trans. Farad. Soc. 55:604, 1959) was studied. An alternative interpretation is presented which is also based on appreciable intrinsic disorder interacting with the disorder resulting from the deviations from stoichiometric composition. The proposal is made that the dissociation pressure curve can be calculated reasonably well over the whole composition range studied without activity corrections by choosing appropriate equilibrium constant for the reactions $Mn^{2+} \; Mn_i^{2+} + Mn_V''$ and $2\,Mn^{2+} + 1/2\,O_2\,(g) \rightleftharpoons O= + Mn_V'' + 2Mn^{3}$.

Uppsala U. (Sweden).
ADDITION COMPOUNDS OF PHOSPHINE OXIDES, by Ingvar Lindqvist and Gerd Olofsson. Technical note no. 4 on Contract AF 61(052)43. 17 July 59, 12p. 17 refs. AFOSR-TN-59-574; AD-217 021.
Order from LC mi$2.40, ph$3.30 PB 145 620

The formation of addition compounds with phosphine oxides as donor molecules has been studied. New compounds have been prepared. The weak interaction between $HgCl_2$ and $PO(C_6H_5)_3$ has been revealed by a study of the infrared spectra of the compounds $HgCl_2 \cdot PO(C_6H_5)_3$ and $HgCl_2 \cdot PO(C_6H_5)_3$.

Johns Hopkins U., Baltimore, Md.
THE SPECTRA OF RARE EARTH IONS, by G. H. Dieke. Annual rept. no. 1 on Contract AF 49(638)535. 31 Dec 59, 27p. AFOSR-TN-60-43.
Order from LC mi$2.70, ph$4.80 PB 145 687

The following report deals with the free ion spectra of the rare earths. This report also summarizes the work for the whole year and gives in addition enough background material to show the motivation for the work. It is an informal interim report and contains no references.

Organic Chemistry

British Cotton Industry Research Association.
POLYMERS RELATED TO CELLULOSE. Final technical rept. no. 2, 15 Oct 58-14 Oct 59, on Contract DA 91-591-EUC-965. Oct 59, 35p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 240

In extending the study of the reactions between oxycelluloses and amino-compounds special consideration has been given to urea. All the urea-treated products show a greater stability to laundering than the parent oxycelluloses. The mechanism of the reaction between oxycelluloses and urea is discussed. Further reactions of periodate oxidized methyl 4:6-O-benzylidene-α-D-glucoside (OMBG) have been investigated. Several crystalline derivatives of the periodate oxidation products of methyl 4:6-O-p-chlorobenzylidene-, 4:6-O-o-chlorobenzylidene-, and 4:6-O-o-bromobenzylidene-α-D-glucoside have been prepared. The reaction of the p-chloro-compound with aniline also gives a cyclic derivative but with cyclohexylamine an open chain derivative is formed.

California U., Berkeley.
MATRIX ISOLATION STUDIES: POSSIBLE INFRARED SPECTRA OF ISOMETRIC FORMS OF DIAZOMETHANE AND OF METHYLENE, CH_2, by Dolphus E. Milligan and George C. Pimentel. Rept. on Contract AF 49(638)1. 10 Sep 58, 20p. 27 refs. AFOSR-TN-58-818; AD-202 643.
Order from LC mi$2.40, ph$3.30 PB 138 170

The photolysis of diazomethane has been studied by the matrix isolation method. Argon and nitrogen matrices were used at 20°K. There is distinct infrared spectral evidence that unstable species have been detected spectroscopically: the production of stable products is inhibited until diffusion is permitted and a red glow accompanies diffusion. Among the identified products produced during diffusion are ethylene, propylene, methane, and polyethylene. The data suggest that methylene is present as well as a tautomeric structure of diazomethane. One of the absorptions observed at 1362 and 1114 cm^{-1} could be the bending mode of CH_2. (Author)

Florida U., Gainesville.
A STUDY OF POLYMERIZATION BY AN ALTERNATING INTRAMOLECULAR-INTERMOLECULAR CHAIN PROPAGATION MECHANISM, by George B. Butler and Martin D. Barnett. Final rept. for 16 Sep 56-15 Sep 59 on Contract AF 18(603)116. [1959] 15p. 4 refs. AFOSR-TR-59-146; AD-228 268.
Order from LC mi$2.40, ph$3.30 PB 145 435

The peroxide-initiated polymerization of diallyl- and diallyldimethylammonium bromide has given saturated, linear, soluble polymers containing recurring N-substituted piperidinium halide units alternating along the chain with methylene groups. The structure of the polymers was confirmed by degradative cleavage of the piperidinium rings. Acrylic anhydride has been polymerized in solution to afford a series of saturated, linear polymers whose molecular weights ranged from a few thousand up to 95,000. The properties of the polymers showed that polymerization had occurred by an intramolecular-intermolecular mechanism leading to a poly[3(5)-methylene-glutaric anhydride] structure. The poly[acrylic acid] obtained by hydrolysis of a poly[acrylic anhydride] was shown by X-ray diffraction patterns to have a much more regular structure than normal poly[acrylic acid]. Poly[methacrylic anhydride] has been prepared from methacrylic anhydride and found to have properties similar to poly[acrylic anhydride]. The methyl allyl, methyl 2-butenyl, and methyl 3-butenyl mixed esters of maleic and fumaric acid have been synthesized and polymerized in bulk to afford a series of low molecular weight polymers containing 37-77% residual unsaturation. This indicated that the approximate percent cyclization in the various polymers ranged from 23 to 63%. Although the cyclic portions of the polymers were composed predominately of six- and seven-membered lactone rings, the infrared spectra of poly[methyl allyl maleate] and poly[methyl 2-butenyl maleate] also showed the presence of five-membered lactone rings. Several unsymmetrical dienes were prepared and subjected to free-radical polymerization conditions. (Author)

Maryland U., College Park.
PREPARATION AND PROPERTIES OF SOME POLYPHENYLS, by G. Forrest Woods. Rept. on New Synthetic Methods, Contract AF 33(616)5063. Sep 59, 178p. 96 refs. WADC Technical rept. 59-496.
Order from OTS $3.00 PB 161 508

Methods of synthesis are reported for the introduction of ortho, meta, and para linkages in an order as may be desired in the polyphenyls and these methods have been applied to synthesize a number of types of polyphenyls. Certain physical properties of these substances were determined such as melting point, infrared spectra, ultraviolet spectra and behavior in vapor phase chromatography. A listing of the polyphenyls, along with certain of their physical properties, made in the course of this research is presented under the headings: (1) linear, (2) singly-branched and (3) doubly branched. Among these were three isomeric quinquephenyls each of which contained an ortho, meta and para linkage but which differed in the order of the linkages. For these three substances the melting point was the most sensitive while the ultraviolet and infrared spectra and behavior toward vapor phase

chromatography were the least sensitive of the four phenomena studied. Tables of aryl substituted cyclohexanones, cyclohexenones, and cyclohexadienes and bromopolyphenyls which were obtained as intermediates in the synthesis in the polyphenyl series are included.

Metcalf Research Lab., Brown U., Providence, R. I.
LEAST SQUARES REFINEMENT OF CENTROSYMMETRIC STRUCTURES INCLUDING ANISOTROPIC THERMAL PARAMETERS (I) [AND] A FIRST REFINEMENT OF THE STRUCTURE OF CUPRIC TROPOLONE (II) by Walter M. Macintyre. Technical rept. no. 5 on Contract Nonr-562(04). Jan 58, 19p. 5 refs. AD-156 119.
Order from LC mi$2.40, ph$3.30 PB 137 949

I. A program designed for the IBM704 computer is described. It carries out least squares refinement of crystal structure parmeters, including anisotropic temperature parameters, for centrosymmetric crystals. II. New measurements of the intensities of the (hkO) zone of reflections from cupric tropolone have been made. The structure has been refined by the method of least squares, using the program of I, in this zone. The results indicate that in cupric tropoline the ring is irregular and slightly puckered. (Author)

Pennsylvania State U., University Park.
CONDITIONS FOR STEREOSPECIFIC OLEFIN-MERCAPTAN RADICAL ADDITIONS, by Philip S. Skell and Richard G. Allen. Technical rept. on Contract AF 49(638)48. 8 Feb 60, 4p. 8 refs. AFOSR-TN-60-80.
Order from LC mi$1.80, ph$1.80 PB 145 667

Steric control of mercaptan addition is achieved by the rapid reaction of the diastereomerically related 3-methylthio-2-butyl radicals with hydrogen bromide, a reaction which is more rapid than the isomerization of the radicals.

Rochester U., N. Y.
THE PHOTOLYSES OF 2-PENTANONE AND 2-PENTANONE-1, 1, 1, 3, 3, -d_5, by P. Ausloos and E. Murad. Rept. on Contract AF 18(600)1528. 25 Nov 58, 15p. 14 refs. AFOSR-TN-58-529; AD-158 343.
Order from LC mi$2.40, ph$3.30 PB 138 144

The photolyses have been investigated at long wavelengths at maximum intensity of 3.7×10^{14} quanta/c.c./sec. and at short wavelengths. This investigarion was carried out in the temperature range 25-83°C.

Texas U. [Austin].
THERMAL DECOMPOSITION OF BUTANE II, by James Cunningham and R. C. Anderson. Technical note 3 on Contract AF 18(603)142. Aug 58, 29p. 6 refs. AFOSR-TN-58-761; AD-201 860.
Order from LC mi$2.70, ph$4.80 PB 137 539

Experimental studies of the thermal decomposition of butane have been extended to additional temperatures and to a wider range of flow velocities. The effects of increased surface, and of added oxygen and ethylene oxide were also investigated. (See also PB 133 293)

Physical Chemistry

Aerojet-General Corp., Azusa, Calif.
APPLICATION OF SURFACE DECOMPOSITION KINETICS TO DETONATION OF AMMONIUM NITRATE, by W. H. Andersen and R. F. Chaiken. Rept. on Contract AF 18(603)74. 19 June 58, 13p. 12 refs. TN-26; AFOSR-TN-58-617; AD-162 146.
Order from LC mi$2.40, ph$3.30 PB 137 773

Kinetic rate data for the linear surface gasification (pyrolysis) of ammonium nitrate is used in conjunction with the Eyring grain-burning theory to calculate the detonation reaction time for ammonium nitrate. A new grain-burning mechanism is presented which results in a reaction time for detonating ammonium nitrate that is consistent with the one calculated by means of the nozzle and curved-front diameter theories. The implications of the new model with respect to low-velocity detonations in mixtures of granular explosives is discussed. (Author)

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
A STUDY OF THE INTERACTION BETWEEN CARBON AND DISSOCIATED GASES, by W. G. Zinman. Rept. on [Contract AF 04(647)269]. 5 Nov 59, 15p. 23 refs. Technical Information Series R59SD457.
Order from LC mi$2.40, ph$3.30 PB 145 183

The reaction of active nitrogen (atomic nitrogen) with carbon at 800°C was studied. The consistent failure to obtain measurable amounts of cyanogen as a reaction product showed that the collision efficiency of cyanogen formation was less than 10^{-4}. On the other hand, when nitrogen containing 30 ppm of hydrogen was activated, significant amounts of HCN were obtained. These results indicate that atomic hydrogen promotes a reaction between atomic nitrogen and carbon on at least one out of every thousand collisions. A mechanism accounting for these results is postulated. (Author)

Alabama U., University.
CONDUCTANCE OF THE HEXAFLUOCOMPLEXES OF THE FOURTH GROUP, by E. L. Grove and Robert Schmitt. Rept. on Contract AF 18(600)1567. 25 July 59, 58p. 15 refs. AFOSR-TN-59-616; AD-217 403.
Order from LC mi$3.60, ph$9.30 PB 145 639

The purpose of this research was to investigate the variation of equivalent conductance with concentration for eighteen alkali-hexafluocomplex solutions. The electrolytes used were the potassium, rubidium, and cesium hexafluocomplexes formed with silicon,

germanium, tin, titanium, zirconium and hafnium. During the progress of this work it was also found necessary to measure the pH of all the solutions investigated, to develop methods of preparation for some of the compounds, and to determine accurately the solubility at 25°C of all the salts prepared.

Arkansas U., Fayetteville.
THE INFLUENCE OF SPECTRAL RADIATIONS ON SELECTED SOLIDS UNDER BOMBARDMENT BY ELECTRON AND ION STREAMS, by Z. V. Harvalik. Final rept. for 10 Dec 54-9 Oct 56 on Contract DA 44-009-eng-2439. 9 Oct 56. 23p. 15 refs. AD-124 248.
Order from LC mi$2.70, ph$4.80 PB 137 722

A report is made of the attempt to duplicate certain experiments dealing with decomposition of explosives in order to obtain information relative to a theory of interaction phenomena. The behavior of metastable substances was studied under the exposure of optical radiations alone. Lead azide was employed in the investigations. The purity criteria of the substances were investigated, and a thermolysis and a photolysis were made of lead azide. A hypothesis on the spontaneous detonation of lead azide was tested. Metal azide emulsions were produced and photographed. A discussion is presented of the theory and experiments undertaken in the photolyses of crystalized (PB 137 723) and amorphorus lead azides.

Battelle Memorial Inst., Columbus, Ohio.
A KINETIC STUDY OF THE THERMAL DECOMPOSITION OF TETRAPHENYLSILANE, TRIPHENYLPHOSPHINE, DIPHENYL SULFIDE DIPHENYL SULFOXIDE, AND DIPHENYL SULFONE, by Arthur Levy and Charles J. Ambrose. Rept. for 1 May 57-30 Apr 59 on Contract AF 33(616)5217. Oct 59, 41p. 11 refs. WADC Technical rept. 59-560.
Order from OTS $1.25 PB 161 498

The gas phase decomposition kinetics of diphenyl sulfoxide, diphenyl sulfone, triphenylphosphine, diphenyl sulfide, and tetraphenylsilane were studied between 350° and 650°C. The compounds increase in stability in the order presented. The decompositions are first order and the principal decomposition products common to all five compounds are benzene and high molecular weight polymers. Although the mechanism for the formation of benzene is not fully established by these studies, a specific relationship exists between the number of benzene molecules formed and the number of phenyl groups in the starting compound. The kinetics suggest a molecular rearrangement mechanism, although a free-radical mechanism is not entirely excluded.

Cobb Chemical Lab., U. of Virginia, Charlottesville.
MOLECULAR DIMENSION AND COMPLEX FORMATION WITH HYDROGEN PEROXIDE, by Martin E. Everhard and Paul M. Gross, Jr. Final rept. for 16 Jan-31 Aug 59 on Contract DA 36-034-ORD-2831. 1 Sep 59, 35p. 2 refs. OOR rept. 2295. 1-C.
Order from LC mi$3.00, ph$6.30 PB 145 174

Columbia U., New York.
PARAMAGNETIC RESONANCE ABSORPTION SPECTROSCOPY, by George K. Fraenkel. Rept. no. 16 (Final) 1 Apr 55-30 Sep 59 on Contract AF 18(600)1390. [1959] 11p. 3 refs. CU-16-[59]-1390-Chem.; AFOSR-TR-59-201; AD-230 591.
Order from LC mi$2.40, ph$3.30 PB 145 523

Du Pont de Nemours, E. I., and Co., Wilmington, Del.
THE PURIFICATION OF HELIUM GAS, by E. Field and A. J. Wells. Formal rept. on Contract NOa(s)343. 14 July 43, declassified. 36p.
Order from LC mi$3.00, ph$6.30 PB 137 533

The work covered by this report discloses two methods by which helium gas may be freed of such impurities as nitrogen and oxygen and one method by which it may be freed of hydrogen.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
THE MATHEMATICAL FORMULATION OF RADIATIVE TRANSFER PROBLEMS FOR NON-UNIFORM GASES IN TERMS OF DERIVATIVES OF HEMISPHERICAL EMISSIVITIES, by A. Thomson and S. S. Penner. Technical rept. no. 30 on Contract Nonr-220(03). Feb 59, 17p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 145 258

A method is described for the formulation of radiative transfer problems involving non-uniform gases. Our procedure is simpler to use than the conventional approach which has been described, for example, by Chandrasekhar, in those cases in which emissivity compilations are available. (Author)

Indiana U., Bloomington.
AN EXPERIMENTAL INVESTIGATION ON THE CHEMISTRY AND INTERCONVERSION OF BORON HYDRIDES, by Riley Schaeffer. Rept. for 1 July 58-30 June 59 on Contract AF 33(616)5827. July 59, 51p. 25 refs. WADC Technical note 59-258.
Order from OTS $1.50 PB 161 479

A novel method for preparing diborane by radical catalyzed reaction of trichloroborane and monosilane is described. Experimental studies of various steps in the thermal conversion of diborane to pentaborane-11 are described. These include a study of the isotope effect on diborane pyrolysis, reaction of a possible triborane with diborane and isolation of tetraborane-8 carbonyl as an intermediate in tetraborane pyrolysis. Physical properties of tetraborane-8 carbonyl including vapor pressures, infrared spectrum, NMR spectrum and mass spectrum are reported. Reaction of bridge labelled decaborane with acetonitrile released hydrogen of deuterium content corresponding closely to release of one bridge and one non-bridge (probably 5, 7, 8, 10) proton. Reaction of bridge labelled decaborane with CH_3MgI produced about 25% CH_3D. Attack at the top of the molecule is indicated. A new amine derivative of a borane has been obtained by treatment of $(CH_3)_3NB_3H_7$ with hydrogen chloride and diborane.

Johns Hopkins U., Baltimore, Md.
THE EFFECT OF SUBSTITUTION ON THE IONIZATION POTENTIALS OF FREE RADICALS AND MOLECULES. I. A NEW SET OF CONSTANTS, THE δ_K VALUES, by Joyce J. Kaufman and W. S. Koski. Rept. on Contract AF 18(600)1526. [1960] 27p. 43 refs. AFOSR-TN-60-52; AD-231 045.
Order from LC mi$2.70, ph$4.80 PB 145 686

Several new applications of ionization potentials are presented.

Lund U. (Sweden).
EQUILIBRIUM STUDIES ON DISULFIDES BY USE OF VAPOR PHASE CHROMATOGRAPHY, by C. J. Olander and S. Sunner. Technical note no. 1 on Contract AF 61(052)46. 1 June 59, 6p. 6 refs. AFOSR-TN-59-731.
Order from LC mi$1.80, ph$1.80 PB 145 610

Some general aspects are given on the use of vapor phase chromatographic technique for the determination of equilibrium constants. The usefulness has been demonstrated for the disproportionation reaction between dimethyl and diethyl disulfide. (Author)

Lund U. (Sweden).
EXPLORATORY STUDIES ON THE PHOTOLYSIS OF DISULFIDES IN AN ORGANIC MATRIX AT 77°K, by Kjell Rosengren, S. Sunner and Dietrich Timm. Technical note no. 2 on Contract AF 61(052)46. 1 Aug 59, 15p. 6 refs. AFOSR-TN-59-572; AD-217 006; AD-230 183.
Order from LC mi$2.40, ph$3.30 PB 145 677

In an exploratory investigation aiming at the determination of "bond formation" energies by measuring the heat effect accompanying the recombination of radicals trapped in an organic matrix at 77°K, the photolysis of disulfides has been studied.

Massachusetts Inst. of Tech., Cambridge.
THE CONFIGURATION OF THE TRIIODIDE GROUP IN TETRAPHENYL ARSONIUM TRIIODIDE, $(C_6H_5)_4AsI_3$, by R. C. L. Slater. Technical rept. no. 2 on Contract AF 18(603)84. 26 Oct 58, 23p. 24 refs. AFOSR-TN-58-834; AD-202 919.
Order from LC mi$2.70, ph$4.80 PB 138 134

Tetraphenyl arsonium triiodide crystallizes with the space group symmetry P 2/n. There are two formula weights of $(C_6H_5)_4AsI_3$ in the unit cell, for which a = 15.34 ± .01Å, b = 7.63 ± .01Å, c = 10.63 ± .01Å and β = 93.4°. A trial structure was deduced from two dimensional Patterson and Fourier series, and refined by Fourier difference series. The triiodide ion in this crystal is equibonded. The bond length is 2.90 ± .02Å. Triiodide ions measured in crystals having cations which are small compared to $(C_6H_5)_4As^+$ have non-equivalent bond lengths. The small differences which have been reported in the configuration of the I_3^- ion in different crystals are discussed with reference to the crystal environments. An explanation based on the general behavior of a simple linear triatomic system is suggested. (Author)

Milan U. (Italy).
RHENIUM COORDINATION COMPOUNDS, by Lamberto Malatesta. Technical (scientific) note no. 2 on Contract AF 61(052)83. 31 Oct 59, 16p. 5 refs. AFOSR-TN-59-1081.
Order from LC mi$2.40, ph$3.30 PB 145 675

New coordination compounds of rhenium(I), rhenium(II), and rhenium(III) with halogens, triphenylphosphine (PR_3), and carbon monoxide are described.

Naval Ordnance Lab., White Oak, Md.
A STUDY OF THE POLYMERIZATION OF EPOXIDE POLYMERS BY ELECTRICAL RESISTIVITY TECHNIQUES, by R. W. Warfield and M. C. Petree. 25 Apr 59, 20p. 25 refs. NAVORD rept. 6657; AD-220 209.
Order from LC mi$2.40, ph$3.30 PB 145 820

Electrical resistivity measurements made isothermally during polymerization have been used to study the bulk polymerization of both amine and acid anhydride polymerized epoxide polymers. Whenever possible kinetic data have been calculated. The reactions with the amines proceed at a much greater rate and in a different manner than when the polymerization is conducted with maleic anhydride. The results of this study indicate that resistivity measurements are sensitive to the extent of polymerization and can be used to follow the rate of polymerization. (Author) (See also PB 145 822)

Polacoat, Inc., Blue Ash, Ohio.
PHOTOTROPY, A LITERATURE REVIEW, by Glenn H. Brown. Rept. on Health Hazards of Materials and Radiation, Contract AF 33(616)5469. Dec 59, 62p. 171 refs. WADC Technical rept. 59-436.
Order from OTS $1.75 PB 161 519

This review of phototropic phenomenon literature is limited to the articles referenced in Chemisches Zentralblatt from 1880 to 1910 and in Chemical Abstracts from 1907 to 1955. Various books dealing with photochemistry are also reviewed. (Author) (See also PB 161 433)

Polytechnic Inst. of Brooklyn, N. Y.
THE ADSORPTION OF POLYDIMETHYL SILOXANES ON SOLIDS, by Robert Perkel and Robert Ullman. Technical rept. no. 1 on Contract Nonr-839(19). 31 Jan 58, 47p. 14 refs. AD-200 520.
Order from LC mi$3.30, ph$7.80 PB 137 958

A comparison was made of the adsorptive properties of the carbon chain polymers with a siloxane chain polymer, where the polar constituents have been transferred to the backbone. The adsorbents chosen

were Fe powder prepared from iron carbonyl and ground pyrex glass. The Fe powder was chosen so that a comparison could be made between polyvinyl acetate and polydimethylsiloxane. IR absorption spectra were used to analyze solutions for polymers. The rate of adsorption was studied to determine the time necessary to reach equilibrium. Equilibrium was established in about 1 hr with Fe and in about 2 min with glass. High molecular weight polymer appeared to be adsorbed first and was then rapidly replaced by smaller molecules. Isotherms were obtained with constant quantities of Fe powder while varying the concentration of silicone solution in benzene distilled over Na. Water had an inhibiting effect on the adsorption. The adsorption of silicone on glass appeared to be more sensitive to molecular weight variation than adsorption onto Fe; the affinity decreased for each surface with molecular weight. Monomeric vs polymeric adsorption was compared by studying 2 isotherms of a linear dimer of various concentration on Fe and glass. A plot of the change in concentration as initial concentration indicated that if any adsorption occurred it was less than could be detected by the method of analysis used. Desorption studies were undertaken with glass and Fe and benzene and heptane. Considerable desorption occurred with Fe powder but attempts to desorb from glass by using benzene and heptane were unsuccessful.

Princeton U. [N. J.]
AN APPROXIMATE CALCULATION OF EQUILIBRIUM CONDITIONS BEHIND SHOCK WAVES IN THE NOBLE GASES, by G. B. F. Niblett and Anne Kenny. Rept. on Contract N6ori-105(02). Oct 57, 17p. 4 refs. Technical rept. II-24; AD-144 571.
Order from LC mi$2.40, ph$3.30 PB 137 702

Graphs are presented to show the degree of ionization α, the temperature T_2 and the density ratio ρ_2/ρ_1 at equilibrium behind a shock of Mach number M in the noble gases. The calculations are for initial pressures of 0.1, 1.0 and 5.0 cms of mercury and an initial temperature of 296°K. It is assumed there is no heat loss and no electronic excitation. At the two highest initial pressures the results for helium, neon, krypton and xenon (dotted lines) have been obtained from the argon results by an approximate method.

Princeton U., N. J.
METAL COMBUSTION PROCESSES, by Irvin Glassman. Technical rept. on Contract AF 18(600)1527. Aug 59, 43p. 92 refs. Aeronautical Engineering Lab. rept. no. 473; AFOSR-TN-59-1083; AD-228 566.
Order from LC mi$3.30, ph$7.80 PB 145 531

Some preliminary conclusions on burning characteristics of the light metallic elements are presented. These conclusions are based on fundamental physical considerations and not on experimental results.

Purdue U., Lafayette, Ind.
THE THERMODYNAMIC PROPERTIES OF TECHNETIUM AND RHENIUM COMPOUNDS. VII. HEATS OF FORMATION OF RHENIUM TRICHLORIDE AND RHENIUM TRIBROMIDE. FREE ENERGIES AND ENTROPIES, by J. P. King and J. W. Cobble. Rept. on Contract AF 18(600)1525. Oct 59, 11p. 19 refs. AFOSR-TN-59-968.
Order from LC mi$2.40, ph$3.30 PB 145 532

The heats of oxidation of $ReCl_3$ (c) and $ReBr_3$ (c) by basic hypochlorite have been determined. From these data the heats of formation at 25°C, have been calculated to be: $ReCl_3$ (c), -63.1 ± 0.8 kcal. $mole^{-1}$ and $ReBr_3$ (c), -39.9 ± 0.8 kcal. $mole^{-1}$. Free energy and entropy estimates are also given. (Author) (See also PB 124 141)

Research Inst., Temple U., Philadelphia, Pa.
AN EXPERIMENTAL DETERMINATION OF THE DENSITIES OF MOLTEN METAL FLUORIDES IN THE RANGE OF 1600° TO 2500°K, by A. D. Kirshenbaum and J. A. Cahill. Technical note no. 9 on Study of Ultra High Temperature, Contract AF 18(600)1475. 30 Apr 59, 51p. 12 refs. AFOSR-TN-59-844.
Order from LC mi$3.60, ph$9.30 PB 145 363

Using a graphite crucible and a tungsten sinker, the liquid densities of the alkaline earths and two rare earth fluorides were determined by the loss in weight of an immersed sinker method. The liquid molar volumes of the alkaline earth fluorides exhibit a linear relationship when plotted against period in the Periodic Table.

Research Inst., Temple U., Philadelphia, Pa.
PREMIXED FLAMES OF CYANOGEN AND THE ENDOTHERMIC OXIDES OF NITROGEN AND THE PREMIXED, PREHEATED OXY-CYANOGEN FLAME, by Charles S. Stokes, Robert P. M. Werner and others. Technical note no. 7 on Study of Ultra High Temperatures, Contract AF 18(600)1475. 2 Sep 58, 27p. 16 refs. AFOSR-TN-58-810; AD-202 355.
Order from LC mi$2.70, ph$4.80 PB 137 838

The combustion of cyanogen with the oxides of nitrogen, namely N_2O, NO and NO_2, has been studied and the stoichiometry of the nitric oxide cyanogen flame experimentally verified. Theoretical flame temperatures of the reactions between cyanogen and the oxides of nitrogen were calculated. Burning velocity was measured as a function of temperature for the oxy-cyanogen flame and as a function of concentration for the combustion of cyanogen with the oxides of nitrogen. The candlepower of the oxy-cyanogen flame has been measured over a range of combustible compositions. (Author)

Research Inst., Temple U., Philadelphia, Pa.
STUDY OF ULTRA HIGH TEMPERATURES, by A. V. Grosse, comp. by C. S. Stokes. Final rept. for 1 May 55-30 Apr 59 on Contract AF 18(600)1475. 30 Apr 59, 31p. 31 refs. AFOSR-TR-59-168.
Order from OTS $1.00 PB 161 460

Covers such topics as: The production of high temperature flames; Systems of carbon, nitrogen and oxygen; The cyanogen-oxygen flame as a high temperature tool; Systems using fluorine; The fastest burning flame - the premixed hydrogen-fluorine flame; Systems using ozone; Imaging of the oxygen-aluminum flame and its use as an artificial sun furnace; Two phase reactions at high temperatures; Combustion of beryllium in oxygen; The temperature of the zirconium-oxygen flame; An experimental determination of the densities of molten metal fluorides in the range of 1600° to 2500°K; Preparation of carbon-phosphorus compounds.

Rochester U., N. Y.
THE FLUORESCENCE OF BIACETYL VAPOR, by Julian Heicklen. Rept. on Contract AF 18(600)1528, 12 Sep 58, 16p. 7 refs. AFOSR TN-58-846; AD-203 336.
Order from LC mi$2.40, ph$3.30 PB 138 246

The fluorescence and phosphorescence of biacetyl have been studied at 40° as a function of pressure and incident wavelength from 4358A to 3020A. A mechanism is proposed which explains both the light emission and the photochemistry.

Royal Inst. of Tech. (Sweden).
APPLICATION OF A LIQUID DISTRIBUTION METHOD TO THE STUDY OF THE HYDROLYSIS OF AG^+, by P. J. Antikainen and David Dyrssen. Technical note no. 4 on Contract AF 61(052)162. 30 July 59, 20p. 9 refs. AFOSR-TN-59-664.
Order from LC mi$2.40, ph$3.30 PB 145 612

The distribution of silver at 25°C between solutions of quinoline (Q) in benzene and 3 M $Na(ClO_4, OH)$ has been studied as a function of $[Q]_{org}$, $[OH^-]$ and the silver concentration.

Royal Inst. of Tech. (Sweden).
STUDIES ON THE HYDROLYSIS OF METAL IONS. POTENTIOMETRIC STUDY ON THE ARGENTATE (I) COMPLEX IN ALKALINE SOLUTION, by P. J. Antikainen, Sirkka Hietanen, and Lars Gunnar Sillen. Technical note no. 3 on Contract AF 61(052)162. 27 July 59, 17p. 9 refs. AFOSR-TN-59-663.
Order from LC mi$2.40, ph$3.30 PB 145 613

The composition of the argentate (I) complex formed in alkaline solutions of silver oxide has been studied by emf titrations with constant ionic medium) (0.95 and 12.6 M NaOH, 1.15 and 11.5 M KOH) using Ag-AgI electrodes. It is concluded that the formula of the complex is $Ag(OH)_2^-$. No evidence has been found for the presence of the polynuclear argentate complexes proposed by some previous workers. The solubility product of $Ag_2O(s)$ in 3 M $Na(ClO_4)$ at 25°C was determined as $\log K_{sO} = \log [Ag^+]\,[OH^-] = -7.42 \pm 0.02$.

Stanford Research Inst., Menlo Park, Calif.
THE HILL REACTION AS A MODEL FOR CHEMICAL CONVERSION OF SOLAR ENERGY, by Rudolph J. Marcus. Technical rept. no. 15 on Contract AF 18(603)07. 1 Dec 59, 9p. 6 refs. AFOSR-TR-59-208.
Order from OTS $0.50 PB 161 462

The possibility of storing solar energy for use during dark periods by decomposition of water into its elements was explored along two lines. One of these consisted of taking advantage of the electron transfer spectra of inorganic ions. These were surveyed and listed, together with chemical and thermodynamic correlative data. The other method consisted of a study of various Hill reaction oxidants. Two new electron acceptors, $Co(C_2O_4)_3^{-3}$ and Cr^{+3}, were found to be active in the Hill reaction.

Stanford Research Inst., Menlo Park, Calif.
ION-MOLECULE REACTIONS IN MASS SPECTROMETRIC STUDIES OF ALKALI HALIDE SALTS, by Thomas A. Milne. Technical note no. 5 on Contract AF 49(638)89. Dec 59, 6p. 8 refs. SRI Project no. 2024; AFOSR-TN-59-1331; AD-231 607.
Order from LC mi$1.80, ph$1.80 PB 145 641

An experiment was made to demonstrate directly and sensitively the contribution of ion-molecule reactions to the observed intensities of M_2Cl^+ under the experimental conditions used. A double orifice cell containing pure KCl in one chamber and pure NaCl in the other was used. A Bendix time-of-flight spectrometer with a 2-channel pulse counter and electron multiplier was utilized to detect individual ions formed. Some $NaKCl^+$ was found; no clear evidence was noted of an ion-molecule reaction contribution to $NaKCl^+$. An estimation was made that if ion-molecule reactions were the sole source of M_2X^+, the ratio $Na_2Cl^+/NaKCl^+$ should be about 0.5. The conclusion was drawn that under these experimental conditions ion-molecule reactions account for less than 0.1% of the observed M_2X^+.

Stanford Research Inst., Menlo Park, Calif.
NEW ELECTRON ACCEPTORS FOR THE HILL REACTION. II: CHROMIC ION, by Rudolph J. Marcus. Technical note no. 3 (Rept. no. 14) on Contract AF 18(603)7. 1 Dec 59, 11p. 6 refs. AFOSR-TN-59-1321.
Order from LC mi$2.40, ph$3.30 PB 145 671

A new electron acceptor for the Hill reaction, chronic ion, has been found on the basis of previous work on the absorption spectra of Hill reaction oxidants. Because of its low solubility at physiological pH, this oxidant must be used in conjunction with a secondary oxidant (MnO_2), an excess of which will maintain a constant, but small, concentration of chromic ion by immediate reoxidation of the reduction product. No reoxidation appears to take place in the absence of MnO_2, either by reduction of water or by ultraviolet photooxidation of the reduction product. (Author)

Stanford U., Calif.
THE INFLUENCE OF EXCHANGE INTERACTION ON PARAMAGNETIC RELAXATION TIMES, by J. P. Goldsborough, M. Mandel and G. E. Pake. Technical note no. 3 on Contract AF 18(603)131. Nov 59, 11p. 10 refs. AFOSR-TN-59-1245.
Order from LC mi$2.40, ph$3.30 PB 145 313

Technical U., Trondheim (Norway).
AN ELECTRON DIFFRACTION OF THE MOLECULAR STRUCTURE OF ALLENE, by A. Almenningen, O. Bastiansen, and M. Tratteberg. Technical note on Contract AF 61(052)72. 31 Aug 59, 10p. 8 refs. AFOSR-TN-59-704.
Order from LC mi$1.80, ph$1.80 PB 145 611

The electron diffraction sector method was used to determine the structure of allene vapor. The observed molecular parameters are the following: C-H: 1.0816 Å (u = 0.0795 Å), C=C: 1.3116 Å (u = 0.0390 Å), C_1C_3: 2.617 Å (u = 0.0519 Å) and ∠ H-C=C: 120.8°. The C_1C_3 distance was found to be shorter than twice the C=C distance. This can be explained by out-of-linearity vibrations. (Author)

University of Southern California, Los Angeles.
PHOTOIONIZATION INDUCED ION-MOLECULE REACTIONS IN A MASS SPECTROMETER, by Gilbert R. Cook, J. A. R. Samson and G. L. Weissler. Technical rept. on Contract AF 19(604)2049. 1 June 59, 88p. 57 refs.
Order from LC mi$4.80, ph$13.80 PB 145 185

The usual method of ionizing the neutral molecule X is by electron impact, but in this research, X^+ has been produced by photoionization using monoenergetic photons from a grating monochromator. Photoionization has been found to possess several advantages over electron impact methods. The primary aim of this research was to look for the occurrence of ion-molecule reactions and to determine their reaction rate and cross section. The gases studied were hydrogen, methane, and a one-to-one mixture of hydrogen and nitrogen, and the observed product ions detected were H_3^+, CH_5^+, and N_2H^+, respectively. Of secondary interest were the appearance potentials of ions and the dependence of ion intensities on photon energy.

Uppsala U. (Sweden).
THE TWO-ELECTRON HOMOPOLAR CHEMICAL BOND; HYDROGEN, by Harrison Shull. Technical note no. 17 on Contract AF 61(514)1200, continuation of Contract AF 49(638)318. 15 Sep 58, 45p. 46 refs.
Order from LC mi$3.30, ph$7.80 PB 145 328

The correlation energy of the hydrogen molecule is considered as related to the He atom and to the infinitely separated atoms, and it is shown that one can obtain a consistent qualitative picture of the electron-electron interaction in the molecular bond in this way. Previous approximate wave functions for hydrogen are analyzed quantitatively into approximate natural spin orbital functions with particular attention to the corresponding occupation numbers. The analysis demonstrates(1) the very great similarity of all such trial wave functions, (2) the largely molecular orbital nature of the wave function, (3) the great similarity between the molecular orbital and valence bond functions, and (4) the necessity for allowing for angular correlation of the electrons. Finally the analysis shows very clearly that the concepts of "covalent" and "ionic" "character", at least as applied to the two-electron homopolar chemical bond, have no real significance and should be abandoned. (Author)

Watertown Arsenal Labs., Mass.
THERMAL DECOMPOSITION OF HYDRAZINE, by Arthur Kant and William J. McMahon. Oct 59, 8p. 8 refs. Technical rept. no. WAL TR 804/20; AD-228 313.
Order from LC mi$1.80, ph$1.80 PB 145 221

The thermal decomposition of gaseous hydrazine is at least in part heterogeneous. In a quartz or glass vessel the reaction proceeds according to the equation $3N_2H_4 = 4NH_3 + N_2$. A study of the isotopic composition of molecular nitrogen from the thermal decomposition of hydrazine enriched in $H_2N^{15}\text{-}N^{14}H_2$ shows that no randomization of the nitrogen atoms during the reaction. Lack of randomization clearly signifies that the N-N bond existing in molecular nitrogen has not broken during the process of decomposition. Reaction mechanisms are discussed in the light of this result. It is shown that free radical mechanisms are either inconsistent with the non-randomization result or are ruled out by other considerations. Results of the randomization studies are consistent with a previous proposal that the decomposition of hydrazine occurs through a surface adsorbed activated complex. (Author)

EARTH SCIENCES

Climatology and Meteorology

Allied Research Associates, Inc., Boston, Mass.
THE MOTION AND PREDICTABILITY OF PRECIPITATION LINES, by Ronald J. Boucher and Raymond Wexler. Scientific rept. no. 2 on Contract AF 19(604)5204. 14 Oct 59, 39p. 6 refs. AFCRC-TN-59-614.
Order from LC mi$3.00, ph$6.30 PB 145 765

Analysis of radar film data from New England and the midwest has yielded new information on such characteristics of precipitation lines as their speed and its variability and the relation of line motion to upper winds, the direction of motion, the line lifetimes and the regions of origin and decay. The mechanics of line motion are discussed and an expression derived taking into account advection and development. A series of objective tests on the line predictability leads to a suggested technique for forecasting the arrival of a line at a particular point. (Author)

Daniel Guggenheim Airship Inst., U. of Akron, Ohio.
STUDY OF NATURAL WIND AND COMPUTATION OF THE AUSTAUSCH TURBULENCE CONSTANT, by P. O. Huss and D. J. Portman. Technical rept. no. 1 on Contract N6onr-276, T. O. 1. Jan 48, 88p. 24 refs. DGAI Rept. no. 149; ATI-99 758.
Order from LC mi$4.80, ph$13.80 PB 146 232

This paper contains a description of the micrometeorological station set up by the Daniel Guggenheim Airship Institute. The purpose of the investigation is to obtain simultaneous meteorological data at several levels of a 350 foot tower and to study the variation of the Austausch Turbulence Constant.

Allied Research Associates, Inc. [Boston, Mass.]
METHODS OF PRESENTATION OF TIME-HEIGHT REFLECTIVITY PROFILES, by Raymond Wexler. Scientific rept. no. 3 on Contract AF 19(604)5204. Oct 59, 25p. 3 refs. AFCRC-TN-59-615.
Order from LC mi$2.70, ph$4.80 PB 145 256

Two methods for presenting vertical reflectivity profiles are evaluated for possible participation in Weather System 433L. Interpretations of the physical processes and indication of trends are made for four cases. A code for teletype transmission of the data for the two methods is presented. (Author)

Deutscher Wetterdienst, Offenbach (West Germany).
MEDIUM-RANGE FORECASTING TECHNIQUES FOR CENTRAL EUROPE, PART II, by A. Hofmann, H. Diehl and others. Final rept. on Contract AF 61(514)954. Sep 57, 48p. 15 refs. AFCRC-TR-58-225; AD-152 505.
Order from LC mi$3.30, ph$7.80 PB 137 523

The Medium Range Forecasting Techniques as applied in Central Europe is divided into two parts, the Extended Range Forecast and the Sliding Forecast. The last one goes towards the Long Range Forecast as a monthly or seasonal one. The extended forecast as demonstrated in this paper is a combination of an extrapolation method with a statistical method. The method of extrapolation uses the isopleths of surface pressure and pressure changes respectively in a system of longitude and time for constant latitudes. The statistical method uses multiple correlation tables for the surface pressure changes as predictands. The sliding forecast methods are mainly restricted to the winter season. All three methods were applied to the winter 1956/57 and the forecasting area of Central Europe. 43 statistical relations of 49 were successful (88%). The success of all sliding forecasts in the winter 1956/57 as a combination of all three methods was 78%.

Deutscher Wetterdienst, Frankfurt (West Germany).
THE ZONAL WIND COMPONENT IN THE ATLANTIC-EUROPEAN SECTOR AS INFLUENCED BY SHORT-SCALE FLUCTUATIONS IN SOLAR ACTIVITY, by H. Trenkle. Scientific rept. no. 2 on Contract AF 61(514)954C. Jan 57, 14p. 20 refs. AFCRC-TN-57-299; AD-117 192.
Order from LC mi$2.40, ph$3.30 PB 137 522

After an introduction to pertinent literature, verification is produced on the basis of the observation period from January 1, 1948 to August 31, 1956, that the zonal component of the geostrophic wind in 500 millibars (U_{g120}) in the Atlantic-European sector (60°W - 60°E) along 55°N exhibits characteristic fluctuations on the days subsequent to isolated maximum sunspot levels that were preceded by a vigorous rise of relative sunspot numbers (R) of $\geq$ 40 units. In this process the circulation factors on the reference date play a decisive part. (Author)

Harvard U., Cambridge, Mass.
SERVICES AIDING THE STUDY AND RECORDING OF METEOROLOGICAL PHENOMENA IN CORRELATION WITH RADAR REFLECTIVITY PATTERNS OF PRECIPITATION AS OBSERVED AT OR ADJACENT TO THE BLUE HILL METEOROLOGICAL OBSERVATORY, MILTON, MASS., by George K. Thompson. Rept. no. 5 (Final) on Contract AF 19(604)4942. 31 Oct 59, 17p. AFCRC-TR-59-400.
Order from LC mi$2.40, ph$3.30 PB 145 561

Imperial Coll. of Science and Tech., London (Gt. Brit.)
RESEARCH ON THE PROPERTIES OF CLOUD SYSTEMS, by F. H. Ledlam and L. I. Miller. Final rept. on Contract AF 61(514)1292. Mar 59, 88p. 29 refs. AFCRC-TR-59-286.
Order from LC mi$4.80, ph$13.80 PB 145 104

In the first part of the report the use of cloud observations in modern forecasting practice is discussed. In the later part of the report methods of forecasting the occurrence of high cloud systems are briefly discussed.

Laboratory of Climatology, Centerton, N. J.
SUMMARY OF CLIMATIC OBSERVATIONS, 1956, by C. W. Thornthwaite and J. R. Mather. Technical rept. no. 4 on Contract Nonr-1617(00). 1957, 112p. Publications in Climatology, vol. 10, no. 2; AD-218 119.
Order from LC mi$6.00, ph$18.30 PB 138 183

The data presented in this report continue the records originally published in Interim Reports of "Micrometeorology of the Surface Layer of the Atmosphere," the Johns Hopkins University, Laboratory of Climatology, Seabrook, New Jersey, January 2, 1948 through June 30, 1952. The text of the report includes only that information considered necessary for an understanding of the data. The reader is referred to earlier reports for additional information regarding the instrumentation and techniques employed.

Little, Arthur D., Inc., Cambridge, Mass.
PRELIMINARY ATTEMPTS TO INFLUENCE CONVECTIVE ELECTRIFICATION IN CUMULUS CLOUDS BY THE INTRODUCTION OF SPACE CHARGE INTO THE LOWER ATMOSPHERE; PAPER PRESENTED AT CONFERENCE ON ATMOSPHERIC ELECTRICITY, WENTWORTH-BY-THE-SEA, N. H., MAY 20-23, 1958, by Bernard Vonnegut and Charles B. Moore. Rept. on Contract Nonr-1684(00). [1958] 29p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 145 609

If electrification of cumulus clouds is initiated by the fair-weather space charge in the air from which they develop, it should be possible to influence their electrification by introducing sufficient amounts of electric charge into the lower atmosphere. In preliminary experiments carried out during the spring and summer of 1957 at Jacksboro, Texas, approximately one milliampere of negative electricity was released from a wire 7 km long and 10 m above the ground. The resultant negative space charge was sufficient to reverse the fair-weather electric field for about 8 km downwind. An electric field meter 7 km downwind showed that when low level cumuli growing from the charged air passed overhead, the field became more strongly anti-fair-weather. These observations indicate that the negative space charge was carried by updrafts into the cloud. Because of lack of adequate instrumentation, we could not determine the effect of the charged air on the subsequent electrical development in the cloud. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
RESULTS OF AN EXPERIMENT TO DETERMINE INITIAL PRECEDENCE OF ORGANIZED ELECTRIFICATION AND PRECIPITATION IN THUNDERSTORMS: PAPER PRESENTED AT CONFERENCE ON ATMOSPHERIC ELECTRICITY, WENTWORTH-BY-THE-SEA, MAY 20-23, 1958, by C. B. Moore, Bernard Vonnegut and Alexander T. Botka. Rept. on Contracts Nonr-1684(00) and AF 19(604)1920. [1958] 57p. 25 refs.
Order from LC mi$3.60, ph$9.30 PB 145 608

Observations of summer thunderstorms developing over Mt. Withington, New Mexico, show that electrification begins early in the cloud's development. Measurements within and above the cloud show that electric charge accumulations similar in polarity to those of the mature storm begin to form before any echo can be seen with an X-band radar and before any electrical perturbations can be detected on the mountain summit beneath the cloud. Measurements of potential gradient were made within the cloud with radiosondes supported on tethered balloons. It was found that the gradient within the cloud was far larger than that outside the cloud and that it reached values as high as 20 v cm^{-1} before the appearance of the radar echo. Measurements made from an airplane flying over the top of the growing cloud showed that here the fair-weather potential gradient reversed before any radar echo could be seen. The rapid rise of the cloud tops and the tension on the line holding the tethered balloon showed that the development of the initial electrical activity was closely related to convective activity. The initial radar precipitation echo within the cloud was frequently in the form of a hollow, inverted cup that usually filled in and became completely reflecting in a few minutes.

Washington U., Seattle.
ARCTIC CIRCULATION STUDIES, by Richard J. Reed. Final rept. on Contract AF 19(604)3063. Sep 59, 61p. 35 refs. AFCRC-TR-59-284.
Order from LC mi$3.90, ph$10.80 PB 145 255

On the basis of a number of synoptic and synoptical-climatological studies we arrive at the following picture of the arctic circulation in summer. A secondary baroclinic zone, distinct from the polar front, develops along the northern shores of Siberia, Alaska and Canada in summer. Cyclones which originate in this zone, and to a lesser extent in the polar frontal zones to the south, frequently invade the central Arctic. The stagnation of these lows near the pole leads to a high frequency of occurrence of low pressure centers and a weak area of low pressure in the mean. There is no evidence for the often assumed semipermanent anticyclone near the pole. The disturbances of the polar region in summer are shown to be similar to typical middle latitude storm systems. The question of the representativeness of present results, which were based entirely on data for the five summers, 1952-1956, is considered, and it is concluded that the characteristics of the circulation during these summers were not significantly different than during a number of years, dating back to 1894, for which expedition data were available.

Frost Science

National Research Labs., Ottawa (Canada).
ON THE TRANSFER OF HEAT FROM A RIVER TO AN ICE SHEET, by W. D. Baines. Oct 59, 19p. 5 refs. Mechanical engineering rept. MH-93.
Order from LC mi$2.40, ph$3.30 PB 145 538

Naval Research Lab., Washington, D. C.
THE ADHESION OF ICE TO LUBRICATED SURFACES, by H. R. Baker, W. D. Bascom, and C. R. Singleterry. Interim rept. 9 Feb 60, 17p. 13 refs. NRL rept. 5429.
Order from LC mi$2.40, ph$3.30 PB 143 939

The adhesion of ice to lubricated steel has been shown to vary over a wide range depending upon the polar organic additive present in the lubricating oil. The adhesion is least for systems showing contact angles of 170° or greater measured through water drops on steel submerged in the oil solutions. The extremely low adhesions observed in such systems arise because water does not readily displace the final thin film of bulk oil from the metal surface to establish true water/solid contact. High water contact angles are associated with strong adsorption of the polar additive at the oil/metal interface and with relatively low adsorption at the oil/water interface. The surface properties and viscosity of the oil itself may affect the rate at which oil displacement occurs and thereby alter ice adhesion under field conditions. Adhesion of ice to lubricated Teflon surfaces varies with contact angle in the same way as that on steel. This supports

the conclusion that effective additives adsorb on the steel to form a low energy surface. The contact angle phenomena observed bear also on emulsification behavior and the performance of water-filtration equipment for aircraft fuels. (Author)

Washington U., Seattle.
ON THE CRYSTAL FABRICS AND MORPHOLOGY OF ARCTIC SEA ICE, by Walter Schwarzacher. Preliminary rept. Technical rept. no. 1 on Drifting Station Alpha, Contract Nonr-477(23). [1959] 6p.
Order from LC mi$1.80, ph$1.80 PB 145 390

Direct observations show that every year sea-ice is formed by freezing on the underside of the floes from December to June whereas during summer melting removes some of the old ice from the surface of the floe.

Geodesy

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
HANDBOOK: A TECHNIQUE FOR PREPARING DESERT TERRAIN ANALOGS, by J. R. Van Lopik and C. R. Kolb. May 59, 184p. 23 refs. Technical rept. no. 3-506; AD-217 639.
Available for $3.00 from US Army Engineer Waterways Experiment Station, Vicksburg, Miss. When supply is exhausted, order from LC as PB 146 038, mi$8.40, ph$28.80

A technique is described whereby desert areas selected for terrain comparison are mapped in terms of general terrain factors, geometry factors, ground factors, and vegetation. Terrain-factor data are synthesized to establish varying degrees of analogy of particular desert areas with portions of any selected base area. This synthesis includes compilation of geometry, ground, and vegetation analog maps--through combination of their component terrain-factor maps. A composite analog map is prepared by superimposing geometry, ground, and vegetation analog maps and stratifying the resulting combinations. Highly analogous desert tracts exhibit, or closely approximate, combinations of terrain-factor mapping units found in the base area, and the degree of analogy decreases directly as the similarity to such combinations decreases. Small areas mapped at large scales can be compared with areally similar tracts or with larger regions mapped at smaller scales. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A GENERAL ANALYTICAL SOLUTION TO THE PROBLEM OF PHOTOGRAMMETRY, by Hellmut H. Schmid. July 59, 83p. 17 refs. Rept. no. 1065.
Order from LC mi$4.80, ph$13.80 PB 145 274

An analytical treatment of the general problem of photogrammetry is developed which only requires that object point, center of projection and corresponding image point are collinear for any one ray present in a specific photogrammetric measuring procedure. The corresponding formulas, expressing the geometrical relation existing between the spatial coordinates of the object, the plate coordinates of the corresponding image and the elements of orientation, are the bases for a rigorous least squares adjustment, whereby both the image-coordinates measured on a comparator, and the given control data may be considered as erroneous. The corresponding system of normal equations, which is shown to be typical for any photogrammetric measuring problem is used to form a system of reduced normal equations, the unknowns of which are either the elements of orientation or the spatial coordinates of the model. The application of matrix calculus not only simplifies the presentation but reduces the "bookkeeping effort", while establishing the corresponding program for electronic computers. A special chapter deals with the problem of incorporating additional geometric conditions as they may exist between any one or all of the unknowns of the solution.

Pennsylvania U., Philadelphia.
THE D-LINE METHOD, by Lester E. Klimm. Rept. for 1 Dec 56-1 Dec 57 on Contract Nonr-551(01). 1 Dec 57. 5p. Annex to Summary of Scientific Results, PB 138 077.
Order from LC mi$1.80, ph$1.80 PB 138 122

The object was to enclose within an objectively-determined boundary on a map all points of a dispersant lying D distance or less from one or more other points of the same dispersant. (See also PB 138 077)

Vision Research Labs., U. of Michigan, Ann Arbor.
THE CONSTRUCTION OF A MODEL TERRAIN SIMULATOR AT A SCALE OF 1:108, by Gilbert B. Lee. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 37p. 14 refs. Rept. no. 2144-342-T; AD-213 985.
Order from LC mi$3.00, ph$6.30 PB 145 374

Steps used in the construction of a terrain model, scale 1 inch equals 9 feet, are described and illustrated. Shop and equipment preparations and technical references used in the completion of a 20 x 20 foot indoor model are included to show the set-up that produced a model which is currently being used in studies of visual surveillance capabilities. A new method of forming the mapped contour detail to its original shape and size, with scale reduced, has been developed which should contribute to a more extensive use of three-dimensional terrain scale models in future visual surveillance research. (Author)

Geology

Air Force Cambridge Research Center, Bedford, Mass.
PROCEEDINGS OF THE ANNUAL ARCTIC PLANNING SESSION [NO. 2] OCTOBER 1959, by Vivian C. Bushnell. Dec 59, 180p. 27 refs. GRD Research Notes no. 29; AFCRC-TN-59-661.
Order from OTS $3.00 PB 161 521

Results of field investigations and laboratory studies associated with the Arctic Terrain Research Program of the Terrestrial Sciences Laboratory are given. The papers included are those presented at the Second Annual Arctic Planning Session sponsored by the Terrestrial Sciences Laboratory. Reports include research accomplished in the Arctic Ocean, studies of ice-free land, studies of the Ellesmere Ice Shelf, investigations of Arctic Lakes, research into the physical and engineering properties of ice, and related topics. (Author) (See also PB 151 839)

Lamont Geological Observatory, Palisades, N. Y.
THE LONG TERM RECORDER, by G. R. Hamilton and R. F. McAllister. Technical rept. no 5 on Contract Nonr-266(37). Jan 59, 26p. CU-59-2-Nonr-266(37).
Order from LC mi$2.70, ph$4.80 PB 145 589

A small battery operated microfilm recorder for geophysical signals with periods longer than one second is described. It is capable of operating for periods of a month or more without attention. Enlargements of typical records and construction blueprints are included. (Author)

Mineralogy

[Washington U., St. Louis, Mo.]
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGMATITE MINERALS, by A. F. Frederickson and Joseph E. Cox, Jr. Supplement to Final rept. for 15 Apr 51-15 Apr 53 on Contract DA 36-039-sc-5513. [1953] 6p.
Order from LC mi$1.80, ph$1.80 PB 138 193-S

Field and laboratory studies show that certain ions have through solid rocks. A tentative outline of the mechanism of transport and physical state of the moving ions is offered. (See also PB 138 193)

Washington U., St. Louis, Mo.
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGMATITE MINERALS, by A. F. Frederickson and Joseph E. Cox, Jr. Final rept. for 15 Apr 51-15 Apr 53 on Contract DA 36-039-sc-5513. [1953] 29p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 138 193

The object of this research is to obtain an insight into the mechanism of crystal growth, and to synthesize certain pegmatite minerals.

Washington U., St. Louis, Mo.
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGAMITE MINERALS, by A. F. Frederickson. Final rept. for 16 Apr 53-15 Apr 54 on Contract DA 36-039-sc-42650. [1954] 137p. 20 refs.
Order from LC mi$6.90, ph$21.30 PB 138 195

Composition and physical state of some of the components of the solutions from which certain mica and other crystals have grown in nature is described. In rocks from Kragerø Norway large mica (biotite) crystals grew in the presence of CO_2- and chlorine-rich waters while the rocks were in the solid state; the micas did not grow from a melt. A technique for growing or "filming" large sheets of a layer lattice or mica-like mineral has been developed.
(See also PB 138 194)

[Washington U., St Louis, Mo.]
RESEARCH RELATED TO THE FORMATION AND GROWTH PEGMATITE MINERALS, by A. F. Frederickson, Joseph E. Cox, Jr. and Paul Yen-hsiung Feng. Quarterly progress rept. no. 2, 15 July-15 Oct 53, on Contract DA 36-039-sc-42650. [1953] 28p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 138 192

Anorthite has a lower "solubility" in pure water at elevated temperatures and pressures than either quartz or albite. Foreign constituents such as metal oxides or hydroxides have a marked depressing effect on anorthite "solubility". The "solubility" curves have a very interesting S-shape indicating that some new phase or state of aggregation must prevail between 250 and 325°C. Construction of a new electrodialysis apparatus is reported. (See also PB 138 193)

[Washington U., St. Louis, Mo.]
RESEARCH RELATED TO THE FORMATION AND GROWTH OF PEGAMITE MINERALS, by A. F. Frederickson, Joseph E. Cox, Jr. and others. Quarterly progress rept. no. 3, 16 Oct 53-15 Jan 54 on Contract DA 36-039-sc-42650. [1954] 45p. 7 refs.
Order from LC mi$3.30, ph$7.80 PB 138 194

Optical data on a portion of the Kragerø (Norway) rocks which furnished sodium for some of the large pegmatites in the region. Silicate films can be made in a very short period of time; uniform in size, thickness, and semitransparent, on a continuous basis, in any thickness desired, as single sheets or laminated films. (See also PB 138 192)

Oceanography

Lamont Geological Observatory, Palisades, N. Y.
HYDROPHONE LOCATION, by Carl Hartdegen. Technical rept. no. 13 on Contract N6onr-27124. Feb 59, 47p. 10 refs. CU-23-59-N6onr 27124-Geol.
Order from LC mi$3.30, ph$7.80 PB 145 252

Two methods of locating a bottom hydrophone in deep water off Bermuda by underwater acoustic methods are described. The first method utilized an explosive ranging technique, the second method utilized a precision echo sounder to locate positions with equal travel times to the hydrophone. Hydrophone position accuracies obtained were 15-20 feet for a location in 456 fathoms (2736 feet) of water. This position ac-

curacy was limited by the accuracy with which the surface sound source could be located rather than by underwater acoustics. (Author)

Washington U., Seattle.
A MODIFICATION OF THE WENNER-SMITH-SOULE SALINITY BRIDGE FOR THE DETERMINATION OF SALINITY IN SEA WATER, by Robert G. Paquette. Supplement to Technical rept. no. 61 on Contract Nonr-477(10). Feb 59, 6p. 1 ref. Reference 59-2, Supplement no. 1.
Order from LC mi$1.80, ph$1.80 PB 145 590

Since Technical Report No. 61 (PB 140 874) was issued in August 1958, a number of improvements have been made in design of the salinity bridge. One significant abnormal behavior has been found occurring during cell filling, and a few errata have been found in the report; therefore, it seems desirable to issue this supplement which contains: 1. Errata, 2. Notes on design and behavior of the salinity bridge.

Physics of the Atmosphere

Air Force Cambridge Research Center, Bedford, Mass.
MEASUREMENTS OF FLUX OF SMALL EXTRA-TERRESTRIAL PARTICLES, by Herbert A. Cohen. Jan 60, 16p. 10 refs. GRD Research notes no. 28; AFCRC-TN-59-647.
Order from OTS $0.50 PB 161 520

Through use of wire grids and highly sensitive microphones, direct measurements of micrometeorite influx and their damaging effects have been made from satellites and rockets. These measurements indicate that 10^{-3} particles/(m^2 sec) is the order of magnitude of flux into the Earth's atmosphere of extraterrestrial particles several microns in size; they also indicate shower periods. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
INTERPRETATION OF A DYNAMICAL APPROXIMATION FOR ISOTROPIC TURBULENCE, by Robert H. Kraichnan. Rept. on Contract Nonr-285(33). Mar 59, 28p. 8 refs. Research Rept. no. HSN-1.
Order from LC mi$2.70, ph$4.80 PB 145 799

Recently parts of a theory of homogeneous turbulence which is based upon a new kind of perturbation method have been described. This method leads to closed statistical equations for the velocity covariance upon making a dynamical approximation which was termed the direct-interaction approximation. The present paper gives a brief review of this theory in which the basic equations will be interpreted dynamically, but not derived. In contrast to the previous treatments, which were devoted primarily to the stationary, isotropic case, this paper is concerned with freely decaying turbulence.

Ionosphere Research Lab., Pennsylvania State U., University Park.
THE FORMATION OF THE D REGION OF THE IONOSPHERE, by M. Nicolet and A. C. Aikin. Scientific rept. no. 125 on Ionospheric Research, Contract AF 19(604)4563 and National Science Foundation Grant G-5939. 1 Nov 59, 43p. 47 refs. AFCRC-TN-60-213.
Order from LC mi$3.30, ph$7.80 PB 145 623

Radiations of solar origin penetrating below 85 km in the terrestrial atmosphere are: (1) X-rays of $\lambda<10$ Å; (2) Lyman-alpha and (3) Wave lengths greater than 1800 Å. These radiations can ionize: (1) molecular nitrogen and oxygen; (2) nitric oxide and (3) metallic ions such as sodium and calcium. Molecular oxygen and nitrogen are also ionized by cosmic rays. The negative ion to electron ratio is important below 70 km and affects the electron distribution below that altitude. Normal ionization conditions are explained by cosmic rays and Lyman-alpha. Solar flare conditions are explained by X-rays. Above 85 km, the behavior of the ionization is related to the E layer. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
VERTICAL TRANSPORT OF ELECTRONS IN THE F REGION, by Sushil Chandra, J. J. Gibbons, and E. R. Schmerling. Scientific rept. no. 124 on Ionospheric Research, Contract AF 19(604)3875. 1 Oct 59, 47p. 18 refs. AFCRC-TN-59-659.
Order from LC mi$3.30, ph$7.80 PB 145 292

The continuity equation of electron density is solved to yield an expression for the vertical transport which can be evaluated from electron-density-true-height profiles. A few numerical computations are presented of the vertical drift-velocities determined for the four I. G. Y. stations - Huancayo, Talara, Panama and Washington. It is shown that the velocity is predominantly downwards during the night and upwards during the day at the equatorial stations. There is an apparent phase reversal from summer to winter at Washington.

National Bureau of Standards, Boulder, Colo.
MEAN ELECTRON DENSITY VARIATIONS OF THE QUIET IONOSPHERE. 2. APRIL 1959, by J. W. Wright and L. A. Fine. Feb 60, 53p. 5 refs. Technical note no. 40-2.
Order from OTS $1.25 PB 151 399-2

The results of this program for one month are illustrated graphically. (See also PB 151 399-1)

National Bureau of Standards, Boulder, Colo.
TABLES FOR THE STATISTICAL PREDICTION OF RADIO RAY BENDING AND ELEVATION ANGLE ERROR USING SURFACE VALUES OF THE REFRACTIVE INDEX, by B. R. Bean, B. A. Cahoon, and G. D. Thayer. 16 Mar 60, 22p. 3 refs. Technical note no. 44.
Order from OTS $0.50 PB 151 403

Radio ray bending, τ, and elevation angle error, ε, have been calculated for a wide range of meteorological conditions at 13 climatically diverse U. S. radiosonde stations. The parameters in the observed linear regression equations of τ and ε upon the surface value of the refractive index are given for heights of 0.1 to 70 kilometers and initial elevation angles of the ray from 0 to 900 milliradians. (Author)

Navy Electronics Lab., San Diego, Calif.
A PROPOSED METHOD FOR INVESTIGATING THE RELATION BETWEEN THE D AND E LAYER HEIGHTS AND STRATOSPHERIC CIRCULATION, by V. R. Noonkester. 16 May 58, 28p. 6 refs. Research rept. 842; AD-212 871.
Order from LC mi$2.70, ph$4.80 PB 145 352

Two statistical methods developed in the field of meteorology were studied and shown to provide means for determining the relation between stratospheric circulation and the height of the D and E layers of the ionosphere. (Author)

ENGINEERING

Aeronautical Engineering

Air Proving Ground Center, Elgin AFB, Fla.
A HUMAN FACTORS STUDY OF THE INTEGRATED VISUAL APPROACH AND LANDING AIDS (IVALA) SYSTEM, by Harold J. Coleman. Dec 59, 100p. 24 refs. APGC-TR-59-52.
Order from LC mi$5.40, ph$15.30 PB 145 136

It was determined that the visual approach and landing aids system provided the visual references necessary for aircraft recovery under all visibility conditions down to reported zero. Using ground-controlled approach as the primary approach facility and Configuration "A" Approach Lighting System, with strobes, for early system identification and alignment, aircraft were brought safely down to a range of 1/4 mile. At this point, pilots were able to establish visual contact with the Narrow Gauge flush-mounted runway lighting which provided the height, roll, pitch, and directional guidance necessary for pilots to complete landings under visibility conditions down to a reported zero. Centerline run-out lights provided the necessary directional guidance for pilots to safely complete high-speed run-outs following landing. Transverse Roll Guidance Bars were found to be an undesirable and unnecessary component of the approach lighting complex.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON MODELS FOR THE PROBABILITY OF FATIGUE FAILURE OF A STRUCTURE, by Emanuel Parzen. Technical rept. no. 45 on Contract N6onr-251(40). 17 Apr 59, 32p. 21 refs.
Order from LC mi$3.00, ph$6.30 PB 145 396

Use of the probability theory to survey some of the problems involved in evaluating structural safety; a review of the probabilistic considerations involved in evaluating the strength of materials, and the construction of so called S-N curves.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STANDARD DESIGNATIONS OF ALLOYS FOR AIRCRAFT AND MISSILES: TRADE NAMES, AERONAUTICAL AND MILITARY SPECIFICATIONS AND PRODUCERS OF STAINLESS STEELS, ALLOY STEELS AND SUPERALLOYS, by J. J. Vagi. 25 Jan 60, 65p. DMIC memo. 42.
Order from OTS $0.50 PB 161 192

Fairchild Aricraft Div., Hagerstown, Md.
POWER REQUIREMENT OF A BLOWING WING WITH SEALED AND SLOTTED TRAILING EDGE FLAPS: MODEL M-246A, by H. B. Helmbold. Rept. on Contract Nonr-2226(00). 13 Mar 59, 28p. 4 refs. Engineering rept. no. R246A-004.
Order from LC mi$2.70, ph$4.80 PB 145 594

Wind-tunnel tests on a blowing NACA 23015 airfoil with a 25% chord slotted flap and with blowing-slot widths of 0.9 and 0.15% chord, at flap-deflection angles from 30° to 70°, have been analysed in Ref. 1. These tests were recently supplemented by extending the range of flap-deflection angles to 0° and by investigating the same model with a sealed flap and with an effective blowing-slot width of 0.7% chord, over the whole range of flap-deflection angles from 0° to 70° (Refs. 2 and 3). The new set of experiments is analysed in the present report. The analysis was restricted to states of flow where the flow was fully attached to the flap.

Goodyear Tire and Rubber Co., Akron, Ohio.
IMPROVED SEAT AND BACK CUSHIONS, by R. K. Whittenberger. Rept. on Aircraft Fatigue on Extended Missions, Contract AF 33(600)27477. Nov 59, 30p. 7 refs. WADC Technical rept. 59-376.
Order from OTS $0.75 PB 161 486

Development of an improved pilot seat and back assembly for the reduction of pilot fatigue is described in detail. The design criteria for these seat and back cushions are included. The study covers both seat design and seating materials; 25 experimental pilot seat cushions and 25 experimental back cushions were produced both contoured and noncontoured, as well as foam rubber and polyurethane foam. The results of this study indicate that polyurethane foams of a proper density and compression resistance can be safely and efficiently used in aircraft pilot seat and back cushions. The combined advantages of lighter weight, solvent resistance, and closer quality control indicate that the polyurethane foams offer a superior body support material. (Author)

Institute of Engineering Research, U. of California, Berkeley.
THE OXYGEN RECOMBINATION PROGRAM, by S. Hoenig. Preliminary rept. no. 1, 15 Oct-30 Dec 57, on Contract Nonr-222(45). 22 Jan 58, 17p. 9 refs. Technical rept. no. HE-150-155; Series no. 20, issue no. 118; AD-162 606.
Order from LC mi$2.40, ph$3.30 PB 137 919

An electrodeless discharge apparatus and the associated gas handling equipment have been constructed for experiments involving oxygen recombination has been developed with particular emphasis on the separation of frictional heat transfer from the true heat input due to recombination. Experiments using the Low Pressure Supersonic Wind Tunnel indicate that at present few if any oxygen atoms survive to enter the test section. (Author)

Marquardt Corp., Van Nuys, Calif.
SHORT TIME, ELEVATED TEMPERATURE, STRESS-STRAIN BEHAVIOR OF TENSILE, COMPRESSIVE AND COLUMN MEMBERS, by Eugene C. Bernett. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)6043. Dec 59, 144p. 12 refs. WADC Technical rept. 59-484.
Order from OTS $2.75 PB 161 492

The short time tension and compression properties of four aircraft sheet materials were evaluated at room and elevated temperatures at strain rates ranging from 0.00001 to 0.1 in./in./sec. Short time compression creep properties were also evaluated and methods are shown how these data can be used to define the behavior of columns at high temperatures. The strain rate has a pronounced effect on the measured tensile strengths. It is shown that creep rates are very rapid at high stress and high temperatures - excessive amounts of deformation can occur in times of the order of one second or less. (Author)

National Research Labs., Ottawa (Canada).
COMPARISON OF SOME EXPERIMENTAL AND THEORETICAL DATA ON DAMPING-IN-ROLL OF A DELTA-WING BODY CONFIGURATION AT SUPERSONIC SPEEDS, by L. T. Conlin and K. J. Orlik-Rückemann. Dec 59, 21p. 3 refs. Aeronautical rept. LR-266.
Order from LC mi$2.70, ph$4.80 PB 145 537

National Research Labs., Ottawa (Canada).
POWERPLANTS FOR VTOL AIRCRAFT: A PROPOSED DUAL-OPERATION SYSTEM USING WING-IMMERSED FANS FOR VERTICAL THRUST, by E. P. Cockshutt and N. Galitzine. Oct 59, 93p. 3 refs. Aeronautical rept. LR-265.
Order from LC mi$5.40, ph$15.30 PB 145 535

National Research Labs., Ottawa (Canada).
A PROBABILITY ANALYSIS OF COINCIDENT GUST AND MANOEUVRE LOADS IN LOW-FLYING AIRCRAFT, by S. D. Baxter, J. Liiva, and R. T. Sewell. 17 Nov 59, 40p. 4 refs. Aeronautical rept. LR-264.
Order from LC mi$3.00, ph$6.30 PB 145 539

Naval Air Test Center, Patuxent River, Md.
A SIMPLE GROSS THRUST METER AND SOME OF ITS APPLICATIONS AT THE NAVAL AIR TEST CENTER, by W. J. Hesse. 24 Mar 54, 72p. 10 refs. Test Pilot Training Div. Technical rept. no. 1-54.
Order from LC mi$4.50, ph$12.30 PB 145 922

A simple gross thrust meter developed by the author in 1951 and in use since that time at the Naval Air Test Center (NATC) is discussed with regard to theory of operation, calibration procedures, and some of its applications to flight test work. It is shown that a thrust indicator is becoming more necessary to properly monitor modern turbojet engine power and that the thrust meter described herein will indicate thrust reliably and accurately. A discussion of the relative importance of gross and net thrust to aircraft operating activities is also presented.

New York U., N. Y.
INVESTIGATION OF CREEP BUCKLING OF COLUMNS AND PLATES. PART I. ELEVATED TEMPERATURE PROPERTIES OF THE TEST MATERIAL Ti-7Al-4Mo TITANIUM ALLOY, by Ralph Papirno and George Gerard. Rept. for June 58-May 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5807. Nov 59, 34p. 3 refs. WADC Technical rept. 59-416, Pt. 1.
Order from OTS $1.00 PB 161 488

As a first phase of an investigation of the creep buckling of columns and plates, materials properties tests were conducted on Ti-7Al-4Mo Titanium Alloy in both the annealed and heat treated conditions. Heat treatment to obtain optimum creep performance was 1450°F-1 hr, FC to 1050°F, AC; 1050°F-24 hr, AC. A new technique for the collection of compression creep data from sheet specimens was developed in which both the short time stress-strain properties prior to creep and the creep data itself are autographically recorded. Short time tests were conducted at room temperature, 750°F, 850°F and 950°F. Compressive creep data were collected at 850°F and 950°F. (Author)

Norair Div., Northrop Corp. [Hawthorne, Calif.]
DECOMPRESSION OF A PUNCTURED PRESSURIZED CABIN, by Sterge T. Demetriades. 1 Sep 59, 35p. 10 refs. Rept. no. NB 59-224.
Order from LC mi$3.00, ph$6.30 PB 145 247

Expressions are developed for the flow velocity, density and pressure, at any point in a cabin which is suddenly punctured, until the instant the reflected rarefaction wave reaches that point. These expressions apply to holes of any size and for ambient pressures of any magnitude. Methods are presented for calculating the forces on bodies in the cabin and on the body of the vehicle due to the flow of gas out of the cabin and for estimating the time necessary for decompression to any lower pressure. These forces may be large compared to all other dynamic and propulsion loads.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
DEVELOPMENT OF CARTRIDGE ACTUATED DEVICE, EJECTOR, T7, by W. Beaz. Aug 58, 34p. 2 refs. Memo rept. no. MR-692; AD-204 520.
Order from LC mi$3.00, ph$6.30 PB 138 272

This report documents the design and development of the T7 drag chute ejector and includes a summary of the T15 delay element development including the Picatinny Arsenal T15 reports in Appendices B and C.

Wichita U., Kansas.
SHROUDED PROPELLER INVESTIGATIONS: AERODYNAMIC CHARACTERISTICS OF A SHROUD WITH CENTERBODY, by Vernon O. Hoehne. Rept. on Contract Nonr-201(01). Feb 59, 47p. 5 refs. Engineering rept. no. 337.
Order from LC mi$3.30, ph$7.80 PB 145 123

The shroud and centerbody components of two shrouded propeller models have been tested in the Walter H. Beech Memorial Wind Tunnel to determine the lift, drag and pitching moment characteristics of a shroud with centerbody. Results are shown as conventional aerodynamic coefficients defined in the same manner as results of earlier tests performed by NACA to permit a limited comparison. Results show that diffusing the after portion of the shroud increases the lift curve slope and maximum lift coefficient, reduces the angle of attack for stall, and moves the center of pressure forward. Increasing the centerbody or hub size relative to the shroud diameter has little effect on the lift characteristics of the unit, but increases the minimum drag coefficient with a non-diffused shroud. The combined effect of hub size and diffusion, however, cause minimum drag to decrease with an increase in hub size. Additional data applying to less prominent geometric variables are also shown in the data. (Author)

Chemical Engineering

American Potash and Chemical Corp., Henderson, Nev.
INDUSTRIAL PREPAREDNESS STUDY ON SYNTHETIC BATTERY GRADE MANGANESE DIOXIDE, by Jerome T. Muench. Quarterly progress rept. no. 7, 29 Dec 57-29 Mar 58, on Contract DA 36-039-sc-72719. [1958] 19p. 3 refs. AD-162 574.
Order from LC mi$2.40, ph$3.30 PB 137 946

Considerable progress was made on the construction of the one ton a day chemical manganese dioxide pilot plant, during this quarter. Painting, insulating and the acquisition and installation of apparatus, the only remaining activities, will require about one month for completion, after the approval of additional funds. Comparative performance tests were made on batteries, fabricated from acid digested and untreated chemical manganese dioxide, after storage for twelve months. From these and previous tests, it is seen that acid digestion results in a considerable improvement in initial high drain and delayed high and low drain capacities. An evaluation was begun on the effect of varying the amount of wetting solution used in chemical manganese dioxide batteries. A maximum amount, consistent with good bobbin strength, improved high drain capacities; while use of a minimum amount of solution seriously reduced low drain capacities. The battery test panels of the Signal Equipment Support Agency, Signal Engineering Laboratory and American Potash and Chemical Corporation were checked and found comparable. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE AEROSOL AND SPRAY FALL-OUT METER, by Robert D. Kracke and Albert Pfeiffer. Oct 59, 29p. 4 refs. CWLR-2317.
Order from LC mi$2.70, ph$4.80 PB 145 632

This report describes the fall-out meter, an instrument used in the evaluation of deposits from aerosol and spray clouds. It consists of a motor-driven rotating or transversely moving platform which carries slides beneath a slit in a cover plate. The fall-out meter relates, in time, deposition of particle concentration in the aerosol or spray cloud above the slit. Simultaneously, it produces a space dilution of the deposited particles. Examples are given of how the fall-out meter may be used to measure horizontal downwind velocity and lateral and vertical expansion rates of aerosol and spray clouds in the field and their particle-size distributions as produced in dissemination chambers. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PHOTOGRAPHIC TECHNIQUE FOR THE DETERMINATION OF SIZES OF LIQUID DROPLETS, by Alfred L. Woolridge. Rept. for May-Aug 58. 24 Feb 59, 10p. CWL Special Pub. 3-6
Order from LC mi$1.80, ph$1.80 PB 145 636

Droplet size samples of certain aerosols are collected on microscope slides coated with a red-dyed plastic film. Droplets of low volatile liquid produce spots which remain wet and continually spread. However, there is an optimum time at which these drops can be measured to obtain the relationship of spot diameter to drop diameter. Where large numbers of samples are involved, measuring the spots within a prescribed period of time becomes a near impossibility. A satisfactory technique has been developed for the rapid photography of field samples for drop size distribution.

Mine Safety Appliances Co., Callery, Pa.
LIQUID METAL TECHNOLOGY, by R. C. Werner. Final rept. for May 49-May 54 on Contract N9onr-85801. 29 Mar 55, 78p. 4 refs. AD-84 713.
Order from LC mi$4.50, ph$12.30 PB 137 517

A review of research on fluid flow, heat transfer, chloride corrosion, mass transfer, wetting of surfaces, instrumentation, pumps, valves, cold traps, thermal shock, welding, leak detection, water reactions, fire fighting, cleaning, accessibility, radioactive leaks, plugging, and life testing in the use of liquid sodium, potassium and their eutectic alloy (NaK).

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D. C.
CARBON DIOXIDE ABSORBENT EVALUATION AND CANISTER DESIGN, by H. W. S. Huseby and E. J. Michielsen. 6 Nov 59, 91p. 6 refs. Research rept. 1-60.
Order from LC mi$5.40, ph$15.30 PB 145 148

A laboratory test apparatus for the evaluation of carbon dioxide absorbents and absorbent canisters was designed including the canisters for the evaluation of absorbents. Future modifications of the apparatus were suggested and will be instituted in the present equipment at the Experimental Diving Unit. Maximum carbon dioxide productions for one and three hour swimming periods were determined with swimming tests in the pressure tanks at the Experimental Diving Unit. Tolerable carbon dioxide concentrations in the breathing media were determined and found to be in the range of 0.5 to 1.0 percent. The report also shows the effect of reducing the absorbent in a canister on the uptake of carbon dioxide. The preliminary evaluation of the double tube canister and the estimation of the volume of pellet Beralyme required for 3 hours operational duration are included.

[Office of Saline Water] Dept. of the Interior, Washington, D. C.
SALINE WATER CONVERSION. Annual rept. no. 3, 1954, of the Secretary of the Interior. Jan 55, 133p.
Order from OTS $2.75 PB 161 510

This report summarizes coordination activities and research and development in: electric membrane processes, vapor compression distillation, solar distillation, critical pressure devices, osmotic processes, solvent extraction, separation by freezing, ultrasonics, and general studies.

Office of Saline Water, Dept. of the Interior, Washington, D. C.
SALINE WATER CONVERSION. Annual Rept. of the Secretary of the Interior for 1955. Jan 56, 91p.
Order from OTS $2.25 PB 161 511

See also PB 161 510

Civil Engineering

Army Engineer Research and Development Labs., Fort Belvoir, Va.
HEATER, SPACE, MULTIFUEL-BURNING, ELECTRIC-MOTOR-DRIVEN, 90,000 BTU/HR, by H. R. Lopez. 29 Dec 59, 51p. Rept. 1598-TR.
Order from LC mi$3.60, ph$9.30 PB 145 661

Development and testing of a 90,000 Btu/hour, multifuel, electric-motor-driven, space heater for use in heating the Complete Assembly Structure (CAS building) which was procured by all branches of the Armed Forces. The tests described are for climatic suitability of the heater under actual arctic conditions, engineering tests, endurance tests, and service tests.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
WELDED-PIPELINE CONSTRUCTION TOOL SETS, by William S. Geurrant. 23 Sep 59, 73p. Rept. 1594-TR.
Order from LC mi$4.50, ph$12.30 PB 145 662

Testing and evaluation of several proposed welded petroleum-pipeline construction tool sets and their components intended for use by troops engaged in the construction of 4-, 6-, 8-, 12-, or 16-inch welded petroleum pipelines.

Bureau of Yards and Docks, Washington, D. C.
CIVIL WORKS CONTRACT ADMINISTRATION. Rev. 1 June 54, 21p. 4 refs. Technical pub. NAVDOCKS TP-Ad-2.
Order from LC mi$2.70, ph$4.80 PB 139 134

This publication outlines duties and responsibilities in the administration of civil works contracts. Major policies and procedures are described in relation to the design and construction of public works and utilities at privately operated establishments. These facilities, because they are Government financed, are designated as civil works. The policies, procedures, and responsibilities, although designed primarily for application to industrial facilities, also pertain to all other types of civil works in which the Department of the Navy has an interest.

Bureau of Yards and Docks, Washington, D. C.
HOUSING FORMULAS. Engineered Performance Standards, Public Works Maintenance. July 59, 110p. NAVDOCKS P-705.1.
Order from LC mi$5.70, ph$16.80 PB 145 004

Contents:
Standard Maintenance:
Venetian blinds
Electrical
Plumbing
Carpentry

Bureau of Yards and Docks, Washington, D. C.
INSPECTION OF CONSTRUCTION CONTRACTS. 15 Apr 54, 447p. 84 refs. Technical pub. NAVDOCKS TP-Ad-5, BUDOCKS INST 4335.1 and CH1.
Order from LC mi$11.10, ph$68.10 PB 139 137

This publication, provides administrative and technical information for the guidance of inspectors of construction contracts under the administration of this Bureau and of other personnel concerned with the administration of such construction contracts. It is designed to enable newly assigned personnel to familiarize themselves rapidly with the Bureau's requirements and methods and to assure uniformity in practices and procedures.

Bureau of Yards and Docks, Washington, D. C.
PHYSICAL SECURITY OF PUBLIC WORKS. 18 July 56, 72p. 8 refs. Technical pub. NAVDOCKS TP-PL-9; BUDOCKSINST 5540.1 and Sup 1.
Order from LC mi$4.50, ph$12.30 PB 139 136

Presented herein are the technical criteria used in the design, planning, construction, and maintenance of public works and public utilities to prevent or minimize the effects of possible covert attack. Specifically, this includes physical security measures developed for protection against sabotage, employing such factors and facilities as education of employees, facility layout, alarm protection, protective lighting, fencing, and damage control in the event of an act of sabotage.

Bureau of Yards and Docks, Washington, D. C.
ROADS, GROUNDS, PEST CONTROL FORMULAS. Engineered Performance Standards, Public Works Maintenance. June 59, supersedes July 57. 196p. NAVDOCKS P-712.1.
Order from LC mi$8.70, ph$30.30 PB 145 007

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Roach control, in vacated housing
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Mowing: fields and parks
Trim hedges and shrubs
Fertilization of lawns
Vegetative planting of Buffalo grass
Vegetative planting of Bermuda grass
Debris clearing
Build hand placed rip rap stone wall
Repair bituminous pavement
Resurface bituminous pavement
Lay stepping stones
Pneumatic hammer operation
Excavate, fill and grade

Bureau of Yards and Docks, Washington, D. C.
ROADS, GROUNDS, PEST CONTROL HANDBOOK. Engineered Performance Standards, Public Works Maintenance. June 59, 382p. NAVDOCKS P-712.
Order from LC mi$11.10, ph$59.10 PB 145 008

Contents:
Section I - Spread Sheets
Section II - Task Times
Section III - Operation Times

Electrical and Electronic Engineering

Advanced Semiconductor Lab., General Electric Co., Syracuse, N. Y.
ACTIVE DIODES OF THE PNPN TYPE. Final rept. for 1 June 58-31 Aug 59 on Contract AF 19(604)3910. 30 Sep 59, 64p. 26 refs. AFCRC-TR-59-359.
Order from LC mi$3.90, ph$10.80 PB 145 533

The bulk of this work is experimental in nature and in large part is concerned with a number of silicon switching devices which make use of "shorted-emitters." A number of types of shorted-emitter switches are described in detail in an appendix. In addition, experimental results are presented on various diffusion schemes used to make the switches of this work. Also, the results of doping with gold to reduce lifetime and increase speed are described and compared with the speed properties of various non gold-doped structures. (Author)

Aeronautical Radio, Inc., Washington, D. C..
INVESTIGATION OF ELECTRONIC EQUIPMENT RELIABILITY. Progress rept. no. 1 on Air Force Reliability Assurance Program. Contract NObsr-64508. 15 Feb 56, 107p. 8 refs.
Order from LC mi$5.70, ph$16.80 PB 145 919

The purpose of this report is to outline the basic program required in the development of prediction techniques, to aid in the standardization of terminology, and to provide a tentative prediction technique for verification experiments on existing systems and for application to new systems now in the system-planning stage. A report prepared so early in the course of a program of this magnitude must necessarily be somewhat speculative in nature. This report describes the frame of reference within which the investigation is being undertaken.

Air Force Cambridge Research Center, Bedford, Mass.
A CONCENTRIC LOOP ARRAY, by Allen C. Schell and Edmund L. Bouche. Apr 59, 28p. 4 refs. AFCRC-TR-59-129; AD-213 840.
Order from LC mi$2.70, ph$4.80 PB 145 302

A newly developed circularly symmetric array shows promise for general pattern synthesis and for electrical scanning. The basic elements of the array are thin-wire concentric circular loops. A loop of circumference $n\lambda$, n being an integer, carries a current standing wave that varies as $\cos n\phi$, where ϕ is the angle of rotation about the axis of the loop. The radiation field in the plane of the loop has a ϕ dependence identical with that of the loop current. By properly exciting a pair of feeds on each of a number of loops it is possible to produce a desired radiation pattern or rotate a beam in the ϕ coordinate. Off-axis radiation can be utilized or minimized, depending upon the application. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
TACTICAL AIR CONTROL SYSTEM, AN/TSQ-13(XD-1) RESEARCH AND DEVELOPMENT TEST 15 APRIL TO 15 DECEMBER 1956, by C. M. Jones, W. L. Arbuckle and others. Jan 58, 149p. 25 refs. AFCRC-TR-58-101(1); AD-146 795.
Order from LC mi$7.20, ph$22.80 PB 145 303

A research and development test of the Tactical Air Control System AN/TSQ-13(XD-1) was conducted. This report evaluates the performance of the electronic equipment used for this test and recommends modifications that will improve the Tactical Air Control System and the present equipments. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
A STUDY OF THE ACCURACY OF THE XN-1 RADAR, by Ned W. Hill, Jr. Rept. on Missile Test Project, Contract AF 08(606)3413. 24 Nov 59, 47p. RCA Data Processing Technical rept. no. 55; AFMTC-TR-59-28.
Order from LC mi$3.30, ph$7.80 PB 145 478

The results of XN-1 accuracy studies under Operational Directive No. 039 are presented and some of the system errors are discussed. (Author)

Andersen Labs., Inc., West Hartford, Conn.
RADIO INTERFERENCE FILTER F-312 (XW-1)/G. Final development rept. for 15 Feb 56-15 Feb 57 on Contract AF 30(635)2908. [1957] 22p. RADC-TR-57-187; AD-131 371.
Order from LC mi$2.70, ph$4.80 PB 145 439

This report presents a description of radio interference filter F-312 (XW-1)/G as delivered on contract AF30(635)2908. The filter is a development model of a capacitor storage signal integrator designed in accordance with exhibit RADC - 1777 for use in direction finding equipment. The unit, designed as a replacement for other more cumbersome equipment, is an effective means of improving the signal-to-noise ratio to the point where a usable output is obtained when the input signal to-noise ratio is 0.066. Certain recommendations are made for further improvement and reduction in the input power requirements. (Author)

Andersen Labs., Inc., West Hartford, Conn.
ULTRASONIC PROPAGATION IN SOLID MATERIALS. Final rept. for 1 July 55-30 Oct 58 on Contract AF 19(604)1423. [1958] 30p. 1 ref. AFCRC-TR-58-188; AD-160 851.
Order from LC mi$2.70, ph$4.80 PB 137 988

A. Investigation of the properties of quartz delay lines and methods of measurement of delay line parameters
B. Development of a variable, wide band, low noise, ultrasonic delay line and associated drive circuitry
C. Development of a radar AM video sweep integrator and system trigger pulse generator

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32( ) by Andrzej B. Przedpelski. Quarterly progress rept. (Engineering) no. 2, Oct 54-15 Jan 55, on Contract DA 36-039-sc-64450. 18 Jan 55, 50p.
Order from LC mi$3.30, ph$7.80 PB 145 338

The change of transistor characteristics with temperature, voltage and current was studied rather extensively to determine its effect on the performance of the individual circuits. A regulated, dual, low voltage, metered, power supply was built to facilitate the testing of the numerous transistors. A tester to determine the value of β was built. This tester plugs directly into the test power supply. A breadboard of the audio amplifier to be used in the final equipment was built and preliminary tests on it were conducted. No particular difficulty was encountered, although problems are expected in the Band C (25 MC to 50 MC) VFO, amplifier and mixer. (Author) (See also PB 145 336)

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32( ) by Andrzej B. Przedpelski. Quarterly progress rept. (Engineering) no. 3, 15 Jan-15 Apr 55, on Contract DA 36-039-sc-64450. 30 Apr 55, 24p.
Order from LC mi$2.70, ph$4.80 PB 145 337

Construction of the final experimental model was started. Various circuit configurations were tried in a breadboard form to establish their effect on transistor temperature stability. The trends were noted and the final circuits will make use of this information. A 25-50 MC VFO breadboard was built using the Germanium Products tetrode RDX-300. Original Philco SBT types looked promising, but the latest types have lower maximum frequency of oscillation and are not satisfactory. A 25-50 MC buffer stage breadboard was built using the RCA 2N33 point contact transistor. At the present time this is the only type giving adequate drive to the mixer and satisfactory isolation. Some difficulties were encountered with Band C (25-50 MC) VFO, buffer and mixer and the VFO stability is still unknown. There seems to be little choice both in transistors which can be used and in circuit configurations, the main problem being the difficulties encountered at the higher frequencies which impose rigidly transistor type and the circuit peculiar to the best utilisation of this type. (Author) See also PB 145 388)

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32( ) by Andrzej B. Przedpelski. Final rept. (Engineering) for 15 Apr-1 Aug 55 on Contract DA 36-039-sc-64450. 1 Aug 55, 40p.
Order from LC mi$3.00, ph$6.30 PB 145 339

A final unit was built. No encapsulation was used to permit change of components. None of the critical components, including transistors, were selected. This policy was established and followed, since, in our opinion, equipment thus built is more representative of a reproducible unit. Final tests were conducted to determine whether the ultimate goal of successfully transistorizing the AN/URM-32( ) Frequency Meter was met. The main scope of the work at this stage consisted mainly of combining all the separately tested circuits (during Phases I and II) into one unit performing all the necessary functions. Some signal levels had to be readjusted to arrive at the best compromise without unnecessarily complicated circuits. No major difficulties were encountered. (Author) (See also PB 145 337)

Arinc Research Corp., Washington, D. C.
IMPROVED TECHNIQUES FOR DESIGN-STAGE RELIABILITY PREDICTION, by H. B. Brown, W. C. Fredrick and H. J. Kennedy. Progress rept. no. 2, v. 1, on Air Force Reliability Assurance Program, Contract AF 33(600)38438. 1 Apr 59, 88p. 7 refs. Publication no. 110-1-136.
Order from LC mi$4.80, ph$13.80 PB 145 918

Comparison of the measured and predicted reliability of the system revealed that the predicted mean time-between-complaints was 1.9 times as great as the observed value. This result is considered encouraging, and indicates that the basic technique is sound. However, analysis of the observed data suggested that a number of modifications in the technique would enable additional characteristics to be predicted and would increase the accuracy of predictions made in the future. In addition, other changes were found to be desirable in order to facilitate the application and evaluation of the technique.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
THE DEVELOPMENT AND ENGINEERING TESTS OF A TRANSISTORIZED HIGH-VOLTAGE POWER SUPPLY FOR INFRARED BINOCULARS, by Isadore Kessler. Summary rept. 25 Sep 59, 23p. Technical rept. 1597-TR; AD-229 029.
Order from LC mi$2.70, ph$4.80 PB 145 276

The report summarizes the development and engineering tests of a 12-kv, d-c power supply for use as the source of high voltage for operating two Type 6929 infrared image tubes in Corps of Engineers infrared binoculars. Tests were conducted to determine: (a) Effect of change of input voltage on output voltage and input current; (b) effect of change in output load current on input current and output voltage; (c) effect on electrical characteristics with continuous operation from one dry battery, size "C" cell; (d) percentage of ripple; (e) effect of operation under extreme temperatures; and (f) audible noise level.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
ENGINEERING EVALUATION REPORT OF THE 100-KW, PRECISE POWER, DIESEL-ENGINE-DRIVEN GENERATOR SET, MODEL 6910, by T. David Cooper, George F. Sams, and Norman B. Dill. 10 Sep 59, 60p. Technical rept. 1593-TR.
Order from LC mi$3.60, ph$9.30 PB 145 361

This two-part technical report covers the engineering tests and evaluation of the 100-kw, precise power, diesel-engine-driven engine-generator sets, Model 6910. The generator sets as originally designed were satisfactory and they met development requirements except (a) overload protection; (b) voltage dip on low power factor load; (c) speed recovery time for application of rated load; and (d) altenator temperature rise. The generator set with governor, generator armature, age regulator, and exciter modified will meet all of the existing requirements for precise power generator sets except those regarding overload protection. Part II concludes that all future generator sets of the type covered by this report should incorporate changes, as outlined herein, to obtain optimum design of exciters and voltage regulators. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
JUNCTION TRANSISTOR MEASUREMENTS AND PRACTICAL STANDARDS, by Bernard Reich. 16 Feb 59, 24p. 5 refs. USASRDL Technical rept. 2014.
Order from OTS $0.75 PB 161 469

An attempt has been made to set forth measurements and circuits required for the specification and evaluation of junction transistors. The report covers the basic measurements required on most transistors, and specific techniques and circuits for VHF and UHF devices. Finally, a sample outline of a portion of a transistor specification is given to demonstrate the acceptance electrical tests. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
LEAKAGE OF ELECTROMAGNETIC ENERGY FROM COAXIAL CABLE STRUCTURES, by K. Ikrath. 1 Apr 58, 51p. 11 refs. USASRDL Technical rept. 1964; AD-201 199.
Order from LC mi$3.60, ph$9.30 PB 145 660

A better understanding of the behaviour of electromagnetic leakage fields emanating from braid shielded coaxial cables is obtained. It is shown that a braid surface EMF per unit length which is linked to the magnetic leakage-flux distribution in the braid apertures tends to support a slowly propagating surface

wave along the cable. At higher frequencies end effects play an important role in the shaping of the leakage radiation fields which acquire the typical tilted multilobe patterns of slow wave radiators. Measures regarding the suppression of leakage through cable braids employing concentration and hysteresis type dissipation of leakage energy in ferrite coatings is suggested. The initiation of an investigation of the practicality of utilizing the phenomena associated with leaky braid shielded cables for the design of slow-wave radiators and surface wave launchers is recommended. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
RADIO TRANSMITTING SET AN/PRN-2, by R. A. Johnson. 1 May 58, 71p. USASRDL Technical rept. 1961.
Order from LC mi$4.50, ph$12.30 PB 145 275

This report includes a discussion of problems which arose during the development of Radio Transmitting Set AN/PRN-2 and Radio Receiving Set AN/PRN-3, together with the results of the engineering tests associated with Radio Transmitting Set AN/PRN-2. These equipments were developed to fulfill a need for marking and locating air-delivered equipment as indicated by the Military Characteristics for Site Marking and Locating Devices. Certain features of Radio Receiving Set AN/PRN-3 and Radio Transmitting Set AN/PRN-2 are at variance with applicable specifications and the Military Characteristics. Of these, some can be reconciled, others must be accepted as they are. Specifications for both the site marker and the site locator have been revised to indicate required modifications. A new contract was placed for additional models of Radio Receiving Set AN/PRN-3 incorporating recommended modifications. Photographs of the equipment resulting from this contract are appended. A purchase request has been prepared for an additional quantity of Radio Transmitting Sets AN/PRN-2 based on the revised specification. These items are required for a special purpose. It is probable however, that at least one of each type can be retained for procurement models if this site marking and locating system is standardized.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A VERSATILE PRINTED CIRCUIT SWITCH FOR APPLICATION IN THE LABORATORY AND IN PRODUCTION, by W. H. Hoffmann, Jr. 15 Aug 58, 31p. USASRDL Technical rept. 1976; AD-205 069.
Order from OTS $1.00 PB 161 458

The switch is readily adaptable to practically all electronic circuitry requirements where printed wiring boards are employed for mounting and interconnecting the component electrical parts. Full details of the switch design are shown and examples of various forms of application demonstrated. Included are concentric shaft and multiple decking arrangements. A kit form of the switch is suitable for general experimental use in the laboratory, and the applicability to mass production and automatic assembly methods is stressed.

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH/INVESTIGATION OF CATHODE EMISSIVE/MATERIALS, by W. E. Danforth and D. L. Goldwater. Scientific rept. no. 6 on Contract AF 19(604)3904. 15 Oct 59, 17p. AFCRC-TN-59-968.
Order from LC mi$2.40, ph$3.30 PB 145 369

Life studies with thorium impregnated matrix cathodes have been carried to 8600 hours at 1.0 amps/sq. cm., 6000 hours at 2.4 amps/sq. cm. and 1250 hours at 3.0 amps/sq. cm. Studies of the rate of evaporation of thorium from tungsten as a function of temperature and coverage are being continued. (See also PB 143 683)

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING. FINAL REPORT ON TASK XXIV. DESIGN OF RESISTOR LOAD-LIFE FACILITY, by P. G. Perry. Rept. on Contract DA 36-039-sc-63136. 15 Aug 55, 105p. AD-115 175.
Order from LC mi$5.70, ph$16.80 PB 137 516

This is a final report on the design of a semiautomatic facility for investigating the load-life characteristics of resistive components. The primary objective of this program is to provide a complete design, in the form of construction drawings, for an assembly of ovens; electrical circuitry, and instrumentation, so arranged and connected as to provide a convenient system for subjecting all types and sizes of resistors to load-life investigations. (See also PB 136 293)

Battelle Memorial Inst., Columbus, Ohio.
RESEARCH SERVICES IN CONNECTION WITH DESIGNS FOR PYROLYTIC-CARBON VARIABLE RESISTORS, by I. Siegel, J. R. Reichelderfer and others. Final rept. for 15 July 53-14 Feb 55 on Contract DA 36-039-sc-56615. 15 Feb 55, 52p.
Order from LC mi$3.60, ph$9.30 PB 137 550

Carbon and borocarbon films were studied for application as variable-resistance elements. The objectives were to determine the characteristics of these materials for lives of 50,000 wear cycles and 1,000,000 cycles. The studies were concerned with potentiometer characteristics such as wear resistance, rotational life, contact noise, and wiper design as well as general characteristics connected with film resistance elements such as substrate composition, base-surface characteristics, environmental stability, load characteristics, and thermal effects on resistance.

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO ELECTRONIC COUNTING EQUIPMENT, by Richard E. Kimes. Quarterly rept. no. 1, 1 July-1 Oct 54, on Contract DA 36-039-sc-63238. 5 Nov 54, 30p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 145 264

The first phase, the background study is essentially complete. Available published data was accumulated and studied. General study included the theory of the transistor device, its various characteristics, various circuits and circuit applications for the device, and the switching circuits developed in the previous contract. Binary circuits studied were point contact binaries, and two important new circuits: the two transistor junction binary which is an analog to the vacuum tube binary, and a non-saturating point contact which operates at high frequency (1 MC). Life characteristics were studied to determine what power, humidity, and temperature conditions were permissible in available transistors. It seems from accumulated data and experience that a junction transistor is a most reliable device. Data on the testing of transistors was also accumulated.

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO ELECTRONIC COUNTING EQUIPMENT, by Hamilton Chisholm. Quarterly rept. no. 2, 1 Oct 54-1 Jan 55, on Contract DA 36-039-sc-63238. 4 Jan 55, 37p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 145 263

The testing of components is a continuation of work begun at the beginning of the contract. Characteristic curves on the transistors in our possession have been completed. In addition, collector junction capacitance and collector current at cut-off for some of the junction type transistors were measured as an aid to the study of binary design. The bulk of the work for this quarter was performed in the design and study of junction transistor binaries, and in the construction and testing of a decade counter. The latter development is based upon the results of the binary study, and upon a somewhat novel method of obtaining decimal count indication from neon lamp indicators. (Author) (See also PB 145 264)

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO FREQUENCY METER FR-67( )/U, AND MANUFACTURE OF EXPERIMENTAL MODELS, by Hamilton Chisholm and Richard Jiu. Interim rept. for 1 Jan-1 Apr 55 on Contract DA 36-039-sc-63238. 15 May 55, 58p. 6 refs.
Order from LC mi$3.60, ph$9.30 PB 145 261

The component tests were concerned mainly with the characteristic behavior of transistors operating in high and low ambient temperatures. The application of point contact transistors to binary circuits and to ring counter type circuits was investigated. On the basis of this work, the point contact transistors were eliminated from further consideration in this development. The transistorized decade counter development using junction type transistors continued with further circuit refinement. (Author) (See also PB 145 262)

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO FREQUENCY METER FR-67( )/U, AND MANUFACTURE OF EXPERIMENTAL MODELS, by Hamilton Chisholm and Robert Evans. Quarterly rept. no. 3, 1 Apr-1 July 55, on Contract DA 36-039-sc-63238. 13 July 55, 33p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 145 262

The decade counter development has reached the pre-production stage following satisfactory completion by the counters of the required electrical and temperature tests. The control circuit development has been divided into two categories. The first category includes all control elements of the frequency meter such as input amplifier, gate, time base oscillator, and reset circuitry. The early designs of these have been breadboarded and tested for electrical function only. The second category includes the rectifier, filter, and regulation circuits of the power supply. Germanium rectifiers have been used with a completely transistorized regulation circuit which satisfactorily fulfills all the electrical requirements of the power supply (Author) (See also PB 145 263)

Boeing Airplane Co. [Seattle, Wash.]
STUDY OF EQUIPMENT COOLING SYSTEMS, by Fred E. Schroeder, Edward E. Towe and others. Rept. for 1 June 58-30 June 59 on Contract AF 33(616)5784. Nov 59, 173p. 39 refs. WADC Technical rept. 59-253.
Order from OTS $3.00 PB 161 484

This report contains the results of a study of cooling systems for electronic equipment for vehicles operating at velocities of Mach 8.0 to 20.0 at altitudes from 80,000 to 200,000 feet. This envelope includes ballistic and glide re-entry but excludes space and orbital flight and sustained-power aerodynamic flight. Since a portion of the flight of ballistic and glide vehicles is above the atmosphere, all materials used for heat sink, pressurization, heat transport and power generation must be carried on board. It is therefore possible to equate all penalties to take-off weight. Comparisons are presented of expendable heat sink materials, pressurization gases, heat transport fluids and several simplified cooling systems. The effect on system weight of such things as compartment insulation, electric load, leakage, flight time, equipment operating temperature and ground operations are shown. In general, water is the best heat sink and systems employing a liquid heat transport medium are lighter than gaseous systems. A system using water as the heat sink, water or liquid ammonia as the transport fluid and vaporized ammonia for pressurization was the lightest system of those analyzed. (Author)

California U., Los Angeles.
TECHNIQUES FOR THE OPTIMUM SYNTHESIS OF MULTIPOLE CONTROL SYSTEMS WITH RANDOM PROCESSES AS INPUTS, by H. C. Hsieh and C. T. Leondes. Rept. on Contract AF 49(638)438. Sep 59, 42p. 5 refs. AFOSR-TN-59-1132.
Order from LC mi$3.30, ph$7.80 PB 145 488

This report considers the general problem of obtaining the optimum multipole system when the inputs to the system are stationary random processes. The system under investigation is linear and time invariant. The input to each terminal shall consist of signal and noise. The synthesis procedure is carried out under the basis that a fixed plant must be compensated in order to perform certain desired tasks. The design criterion employed is the minimum mean-square error between actual outputs and ideal outputs of the system. A set of integral equations shall be obtained, which can be converted into algebraic equations through transformation. By solving these equations and using the method of undetermined coefficients, the transfer functions of the compensation can be uniquely determined. (Author)

Centre de Physique, Electronique et Corpusculaire (France).
DESIGN AND DEVELOPMENT OF 4 MILLIMETER PROTOTYPE CARCINOTRON TUBES WITH MAGNETS. Final rept. on Contract AF 61(514)919. July 59, 105p. 9 refs. W. R. 411; RADC-TR-59-241.
Order from LC mi$5.70, ph$16.80 PB 145 605

A short survey of the theory of operation of the O Carcinotron in the millimeter range is made and the main features of the design of a tube for the watt level is examined. In the second and third parts the results of the study of the main components of the tube; the gun and the slow wave structure, are reported. The technology of the tube is described in the fourth part; the operating characteristics of different experimental tubes are reported in a fifth part, and the results are compared with the theoretical evaluations. (See also PB 129 438)

Case Inst. of Tech., Cleveland, Ohio.
SYNTHESIS BY CANCELLATION OF ZEROS, by Dov Hazony. Scientific rept. no. 9 on Contract AF 19(604)3887. 21 Dec 59, 8p. 1 ref. AFCRC-TN-59-979.
Order from LC mi$1.80, ph$1.80 PB 145 578

A synthesis procedure is developed in which an arbitrary positive real function Z is represented by means of ζ, also a positive real function, terminating a prescribed realizable four terminal network. ζ is of rank four less than the rank of Z. (Author)

Case Inst. of Tech., Cleveland, Ohio.
A VARIATIONAL INTEGRAL FOR PROPAGATION CONSTANT OF A LOSSY TRANSMISSION LINE, by R. E. Collin. Scientific rept. no. 8 on Contract AF 19(604)3887. 19 Oct 59, 18p. 2 refs. AFCRC-TN-59-959; AD-230 085.
Order from LC mi$2.40, ph$3.30 PB 145 287

By assuming that the current on a lossy transmission line flows in the axial direction only a variational integral for the propagation constant can be readily obtained. This variational integral shows that the usual power loss method of evaluating the attenuation constant is valid for general transmission lines. This variational integral also shows that the perturbation of the loss free phase constant is due to the increase in magnetic field energy caused by penetration of the field into the conductors. (Author)

Centre de Physique, Electronique et Corpusculaire (France).
DESIGN AND DEVELOPMENT OF UHF PROTOTYPE CARCINOTRON TUBES WITH MAGNETS. Addendum to Final rept. on Contract AF 61(514)917. Sep 59, 81p. W. R. 448; RADC-TR-59-242.
Order from LC mi$4.80, ph$13.80 PB 145 606

See also PB 145 605

Centre de Physique, Electronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE TCM14 AND TCM16, by G. Wendt. Rept. on Proj. NR-048-140. 1 Dec 58, 24p. WR. 348.
Order from LC mi$2.70, ph$4.80 PB 145 068

Centre de Physique, Electronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE TCM 14 AND TCM 16, by G. Wendt. Rept. on [Project NR-048-140]. 1 Mar 59, 24p. W. R. 383.
Order from LC mi$2.70, ph$4.80 PB 145 585

The present report is concerned with the last results on the tube T C M 14 (tests on a "ceramic" target) and with the first experiments on the design of a tube T C M 16 having a linear gun. (See also PB 145 068)

Chatham Electronics, Livingston, N. J.
RESEARCH STUDY AND DEVELOPMENT OF CLIPPER TUBE, GAS FILLED, by John J. McArtney. Final rept., phase 2, 1 Oct 56-14 Nov 57, on Contract DA 36-039-sc-64621. [1957] 193p.
AD-218 800.
Order from LC mi$8.70, ph$30.30 PB 145 226

General design requisites for clipper tubes are listed, and various structures employing inverted cup anodes and grids are described. The evolution of the tube from its inception down to the "final center fire" design is detailed. The methods used to reduce sputtering are discussed as well as the solution to problems of obtaining fast ionization time. A cathode designed to deliver a peak current of 325 amp (steady state) with occasional fault demand peaks of 1200 amp is shown. This cathode is tentatively rated for an rms current of 6.3 amp and it is believed capable of considerably higher values. The design of a fast heating reservoir, capable of three minutes heating with capacity to supply hydrogen over the anticipated tube life is described. A detailed cross section of the CH 1078 clipper tube is presented together with complete information on constructional details and processing. A tentative clipper diode design has been established. These tubes have undergone limited testing both as hold-off diodes and as clippers. Results to date are encouraging. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
AN AMPLITUDE DISTRIBUTION FUNCTION ANALYZER, by Elliot E. Austein. Scientific rept. no. 3 on Radio Scattering in the Troposphere, Contract AF 19(604)3494. 1 Aug 59, 97p. 18 refs. Research rept. EE 434; AFCRC-TN-59-950.
Order from LC mi$5.40, ph$15.30 PB 145 549

A single-channel, sweep-type, amplitude-distribution function analyzer is described and evaluated. The instrument measures and plots directly on an Esterline-Angus graphic milliammeter a graph of signal amplitude versus the fraction of the time during which the signal lies below that amplitude. The analyzer generates a voltage waveform whose short-time average value is proportional to the time during which the signal lies below a threshold level. The average value is computed by a low-pass RC filter, whose output is monitored continuously by the recording milliammeter. The threshold level sweeps slowly through the amplitude range of the signal and is proportional to the position of the recorder chart in the milliammeter.

David Sarnoff Research Center, Princeton, N. J.
DEVELOPMENT OF PLASMATRON GASEOUS DISCHARGE TUBES, by E. O. Johnson. Final rept. for 7 Sep 51-31 May 54 on Contract DA 36-039-sc-15401. 29 July 54, 224p. 30 refs.
Order from LC mi$9.90, ph$34.80 PB 145 342

A detailed discussion is given of the theory, operation, and construction of two different types of ten-ampere hot cathode gas tubes, which provide high efficiency inverter operation at low supply potentials. One of these, a low drop thyratron, is shown to give the same overall efficiency as the other, a plasmatron, and at the same time be much more practical. The low drop thyratron, to which most of this report is devoted, is shown to derive its unusually low tube drop from the effective use of a type of hot cathode discharge known as the "ball of fire" mode. It is shown that the anode efficiency of the final design tube is close to the theoretical maximum. Inverter operation for both the plasmatron and low drop thyratron operation is considered and typical test results are given. A discussion is given of the theory, operation, and design of hot cathode discharges which can provide noiseless operation and make possible practical grid cut-off of the anode current. The construction and operating details are given for ten inverter tubes of the ten ampere size, two plasmatrons and eight low drop thyratrons, that were delivered to the Signal Corps in fulfillment of the contract tube requirements.

David Sarnoff Research Center, Princeton, N. J.
THERMIONIC EMISSION STUDIES, by G. A. Morton, A. H. Sommer and others. Quarterly rept. no. 1, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-78155. [1958] 22p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 145 236

A survey of the various materials which may have low electron affinities is given. More promising materials include MgO, carbides, nitrides, the halides of the alkali and alkaline earths, and ionic compounds of the rare earths. "Hot electron" emission has been obtained under D. C. operation from Si diodes after a Cs surface treatment.

Edgerton, Germeshausen and Grier, Inc., Boston, Mass.
12 MW CERAMIC HYDROGEN THYRATRON, by Seymour Goldberg and Daniel F. Riley. Final rept. on Contract DA 36-039-sc-73161. 13 June 58, 105p. 23 refs. AD-203 574.
Order from LC mi$5.70, ph$16.80 PB 145 406

This report presents a general description of the design of the 12-megawatt, ceramic-metal envelope hydrogen thyratron, as well as specific data on the design and construction of the seals, cathode, grid, and anode. The development of a vane-type cathode has been one of the major undertakings of the tube-development program. Factors influencing the design of hydrogen reservoirs were investigated. A study was also made of the warmup characteristics of the tube, and the factors influencing warmup. Evaluation of the 1802 tube was carried out according to the conditions stipulated in Signal Corps. Specification SCL-5319. Life tests have demonstrated the ability of the tube to operate at a 50 kc pulse repetition rate and at 5948/1754 condition two for 1000 hours of life. They have further demonstrated life at 5948/1754 condition one for 800-900 hours. The cathode exhaustion problem which limited life at condition one has been relieved. Preliminary shock and vibration tests were also conducted. The more pertinent thyratron processing techniques are described, and data obtained from the hydrogen cleanup investigation are presented. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
THE TIME ELEMENT IN PHOTOELECTRIC EMISSION, by D. F. Holshouser (Doctoral thesis) and H. M. Von Foerster. Final technical rept. on Contract AF 18(600)1018. June 58, 98p. 27 refs. AFOSR-TR-58-67; AD-158 274.
Order from LC mi$5.40, ph$15.30 PB 137 696

It was the purpose of this investigation, not to analyze the mechanisms involved in photoelectric emission, but to actually measure the degree of photoelectric response of transmission-type cesium-antimonide photocathodes to light pulses of 100 μμsec duration, i.e., pulses about one order of magnitude shorter than have been previously reported. Cesium-antimonide was chosen because of its high quantum yield and because of its widespread application.

Electron Tube and Microwave Lab., Calif. Inst. of Tech., Pasadena.
BEHAVIOR OF TRAVELING-WAVE TUBES NEAR CIRCUIT CUTOFF, by Daniel G. Dow. Technical rept. no. 10 on Contract Nonr 220(13). Feb 59, 41p. 6 refs. AD-214 439.
Order from LC mi$3.30, ph$7.80 PB 145 257

A theory is developed which explains the operation of a traveling wave tube when operated near the cut-off frequency of the slow wave circuit, including the effect of two circuit waves instead of the usual one. The theory is normalized in a manner analogous to that used in more conventional analyses, making a relatively small number of curves applicable to a large number of cases. The relationship between this theory and the 3-wave theory usually used in traveling-wave tube analysis is shown, and they are in agreement when the system is operated far from the cutoff frequency. Numerical results are given for a range of parameters which might be useful in traveling wave tube design, and an excellent agreement with published experimental results is shown. (Author)

Electronics Research Lab., U. of California, Berkeley.
ANTENNA ANALYSIS IN GENERAL WITH SPECIFIC REFERENCE TO FREQUENCY INDEPENDENT ANTENNAS, by V. H. Rumsey. Rept. on Contract N7onr-295(29). 25 Feb 59, 31p. Rept. no. 82; IER Series no. 60, Issue no. 230.
Order from LC mi$3.00, ph$6.30 PB 145 497

The general problem of transmission between antennas is solved in terms of field theory formulas for self and mutual impedance. Simple formulas for the radiation patterns of antennas on spheres, cylinders, and cones are derived in terms of the solution for a plane wave incident on a sphere etc. Various uniqueness theorems are obtained together with practical applications. A general eigenfunction expansion for the reaction is derived and used to give the transmission between antennas in a waveguide or near a sphere, as examples. Several forms of Huygens' principle are discussed. It is shown that the field diffracted through a hole in a plane metal screen is the same as the field in free space of a specific combination of electric and magnetic dipoles distributed around the rim of the aperture.

Electronics Research Lab., U. of California, Berkeley.
DELAY TIME IN DOMINANT POLE CIRCUITS, by D. O. Pederson and G. W. Wilson. Rept. on Contract N7onr-295(29). 5 Feb 59, 26p. 5 refs. Rept. no. 80; Series no. 60, Issue no. 228.
Order from LC mi$2.70, ph$4.80 PB 145 495

In many linear active and passive circuits, a dominant pole description can be made of pertinent network functions. That is, the network function can be approximated over a frequency or time interval by one pole or natural frequency. Major effects such as bandwidth or rise time are then easily established. However, information on second order effects such as propagation time through the circuit is eliminated. In this report, investigation is made of the conditions necessary for a dominant pole description and simple formulas are derived to estimate the delay time of a dominant pole circuit. The final results are expressed in terms of the coefficients of the network function; hence, it is not necessary to factor the rational function in order to establish whether a dominant pole condition exists or what the delay time will be.

Electronics Research Lab., U. of California, Berkeley.
A NOTE ON SIMPLIFIED TRANSISTOR EQUIVALENT CIRCUITS, by D. O. Pederson. Rept. on Contract N7onr-295(29). 5 Feb 59, 16p. 3 refs. Rept. no. 81; IER Series no. 60, Issue no. 229; AD-215 555.
Order from LC mi$2.40, ph$3.30 PB 145 496

Through the use of these simpler circuits a great deal of modern network technology can be easily and with physical insight applied to the study and design of transistor circuitry. In this report, certain of these simple equivalent circuits are investigated and/or clarified. In particular, two topics are given most attention: the problem of excess phase and the incorporation of the depletion layer capacitance to obtain a dominant pole response. The starting point will be the equivalent circuits shown in Fig. 1, the familiar T circuit. Attention will be restricted to the medium frequency range $\frac{1}{r_c C_c} < \omega < \omega_a$. In this frequency range, the effects due to base width modulation can be ignored.

Electronics Research Lab., U. of California, Berkeley.
SHUNT-PEAKED TRANSISTOR AMPLIFIERS, by R. S. Pepper and D. O. Pederson. Rept. on Contract N7onr-29529. 13 Apr 59, 27p. 13 refs. Rept. no. 85; IER Series no. 60, Issue no. 234.
Order from LC mi$2.70, ph$4.80 PB 145 696

This paper is concerned with the analysis, comparison, and design of broad-banded, low-pass transistor amplifiers. The configurations studied in this paper, by which broadbanding can be achieved, are common-emitter stages with resistive, series-peaked, or shunt-peaked interstages, and common emitter stages with a parallel RC network in the emitter lead.

Electronics Research Lab. U. of California, Berkeley.
STRIPLINE BETWEEN CURVED BOUNDARIES, by Gerald August. Rept. on Contract N7onr-295(29). 5 Mar 59, 73p. 37 refs. Rept. no. 83; IER Series no. 60, Issue no. 231; AD-218 666.
Order from LC mi$4.50, ph$12.30 PB 145 498

A stripline transmission junction is examined, in which the center strip lies between ground planes which are sections of concentric cylinders. It is concluded that impedance changes are negligible and that transmission through the junction is virtually unaffected for a wide variety of ground plane curvatures.

However, sizeable changes in radiation leakage occur. The relation of flat stripline to curved stripline is treated. The curved stripline of this report is shown to represent a general class of curved striplines. A stripline in the form of a transmission junction, having as variables the center strip width and the ground plane curvature, is investigated over the frequency band 8500 to 9900 mc. Impedance, scattering matrices, and radiation leakage are experimentally determined.

Electronics Systems Lab., Mass. Inst. of Tech., Cambridge.
THE ANALYSIS AND DESIGN OF DIGITALLY-CONTROLLED INSTRUMENT SERVOS, by Ralph Scheidenhelm. Rept. on Contract N61339-301. June 59, 88p. 15 refs. Technical rept. NAVTRADEVCEN 7890-TR-1.
Order from OTS $2.25 PB 161 020

This report analyzes the effects of time-sampling and amplitude quantization of output and error signals on the performance of a second-order instrument servo which is to be controlled by a digital computer. Two configurations are considered. One is a high-performance type, capable of reproducing sine-wave inputs with a low-frequency phase-shift equivalent to a delay of one-half sampling period and a resonance peak of 2 at a frequency of one-fourth the ampling frequency. The second configuration employs a logarithmic level-selection scheme for the computer output signal. This considerably reduces the number of discrete levels in the decoding of the computer signal required to achieve a given resolution and maximum output shaft rate. Application of the design techniques is made to an instrument servo which converts the signals generated in a digital operational flight trainer to the analog pointer positions of the cockpit instruments. (Author)

Electronics Systems Lab., Mass. Inst. of Tech., Cambridge.
A SIMULATOR STUDY OF TWO-DIGITALLY-CONTROLLED INSTRUMENT SERVOS, by Ralph Scheidenhelm and Yngvar Lundh. Rept. on Contract N61339-301. June 59, 72p. 5 refs. Technical rept. NAVTRADEVCEN 7890-TR-2.
Order from OTS $2.00 PB 161 021

In this simulator study, an analog output member controlled by the TX-O digital computer was used for experimental verification of two digitally-controlled instrument servo configuration studied analytically in a previous report. Physical simulation permitted investigation of the effects of quantization in the output signal and decoded computer drive signal. One servo uses a combination of digital and analog compensation to realize a sine-wave response peak of 2 at a frequency of one-fourth of the sampling frequency, and a time delay in following a ramp input of one-half the sampling period. The other servo, which has lower dynamic requirements, employs a selection program which reduces the number of drive signal levels requiring decoding. The selected levels are in logarithmic sequence $\pm$(0, 1, 3, 9, 27---) rather than the usual linear sequence (0, 1, 2, 3, ---). The experimental results confirm the analysis of Report 7890-TR-1. (PB 161 020).

General Electric Microwave Lab., Palo Alto, Calif.
MEASUREMENT AND CONTROL OF HARMONIC AND SPURIOUS MICROWAVE ENERGY, by Gabriel Novick and Vernon G. Price. Final rept. Phase 3 for Mar 58-Apr 59 on Contract AF 30(602)1670. 15 May 59, 86p. 13 refs. Rept. TIS R59ELM112-3; RADC-TR-59-172.
Order from LC mi$4.80, ph$13.80 PB 145 604

The mechanism for the generation of unwanted signals in high power microwave tubes was studied qualitatively and is reported, along with the following several techniques for suppression of these signals (all suggested methods being other than external filtering): (1) by modulator design, (2) by drive signal filtering, (3) by undesired signal monitoring, (4) by mode suppression and integral filter, and (5) by improved tube design. A cold-test model integral filter tube was made, and the incorporation of a harmonic filter in the vacuum envelope was found to be feasible. (Author) (See also PB 142 935)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 1, 1 Jan-1 Apr 51, on Contract DA 36-039-sc-5410. [1951] 18p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 138 157

A search of the literature has been made for phenomena which can be used for the accurate control of frequencies above 150 Mc. Certain phenomena have been considered in some detail. These are: (1) molecular resonances in gases at lower frequencies than have as yet been investigated by the techniques of microwave spectroscopy; (2) nuclear quadrupole resonances in crystalline compounds, particularly iodine compounds; (3) magnetic resonances, both nuclear and electronic. Tentative conclusions have been reached concerning the practicability of applying each of the above effects to the control of a frequency in the range of interest.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 2, 1 Apr-1July 51, on Contract DA 36-039-sc-5410. [1951] 37p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 138 156

Work on nuclear magnetic resonance, begun in the previous period, has been continued and extended. It has been found that the response of available materials in the frequency region of interest is quite weak; therefore a sensitive detection method is necessary. A bridge method has been selected as best fitting the needs of the present project. A bridge for this purpose is being designed; moreover, it appears that the bridge and associated detection circuits may be modified to generate oscillation under control of the magnetic resonance. The use of cavity resonance for frequency control has received additional study. The open-circuited half-wave coaxial

structure has been tentatively selected as most appropriate to the present needs. The properties of circuits suitable for use with cavity resonators are being studied. To this end a brass cavity having a Q of about 800 at 185 Mc. has been constructed. (See also PB 138 157)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 3, 1 July-1 Oct 51, on Contract DA 36-039-sc-5410. [1951] 48p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 138 155

The bridge unit for the detection of nuclear magnetic resonance has been constructed, and associated circuits are nearly complete. Several of the circuits have been tested and found to operate correctly; however, the complete system must be assembled and tested before satisfactory performance is assured. Four open-circuited half-wave coaxial resonators have been designed and their construction is approximately half completed. The designs are quite similar, but differ in such a way as to permit evaluation of different materials and constructional methods. The first objective is to obtain a design which has an intrinsically small and cyclic frequency variation with temperature. Compensation methods to reduce the temperature coefficient further will be sought as a second objective. General relationships have been established between impedance, selectivity and susceptance slope. (See also PB 138 156)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by William A. Edson. Progress rept. no. 4, 1 Oct 51-1 Mar 52, on Contract DA 36-039-sc-5410. [1952] 35p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 138 154

The system for detection of nuclear magnetic resonance has been assembled and tested. In its present form the system differs from that described in Progress Report No. 3 in several respects. The amplifier supplies a stable gain of 110 db, and its center frequency has been changed from 455 kc to 1.5 Mc. The input and output modulators have been redesigned to simplify tuning and impedance matching, and the bridge coupling circuits have been modified to account for the reactive component of the bridge impedance. At present, spurious coupling exists between the input and output modulators. Active steps are being taken to locate and eliminate the cause of this trouble. A resonator-controlled oscillator has been tested and found to have a temperature coefficient of frequency of approximately 2.4 parts per million per degree C. (See also PB 138 155)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by Vernon Crawford and James C. Hogg, Jr. Progress rept. no. 5, 1 Mar-1 June 52, on Contract DA 36-039-sc-5410. [1952] 27p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 138 153

Several spectrometers for the detection of nuclear magnetic resonances over a frequency range near 30 Mc have been constructed and tested. One of these has proved successful, and quadrupole resonances have been observed in sodium chlorate, potassium chlorate, paradichlorobenzene and chloroform. Remedies have been found for a number of conditions which interfere with the detection of resonances. (See also PB 138 154)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by Vernon Crawford and James C. Hogg, Jr. Progress rept. no. 6, 1 June-1 Sep 52, on Contract DA 36-039-sc-5410. [1952] 23p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 152

Modifications of the previously described nuclear quadrupole spectrometer, which operates in the 30 Mc range, have permitted the detection of resonances in sodium chlorate samples with signal-to-noise ratios greater than fifteen-to-one. Moreover, the detector has shown a perceptible tendency to lock in frequency with the quadrupole resonance. A method of partial compensation for the residual temperature coefficient of frequency in stable coaxial resonators has been analyzed, and design procedures have been evolved. (Author) (See also PB 138 153)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, by Vernon Crawford, James C. Hogg, Jr. and William H. Bradley. Progress rept. no. 7, 30 Sep-1 Dec 52, on Contract DA 36-039-sc-5410. [1952] 30p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 138 151

A quarter-wave coaxial resonator has been constructed and tested. While the performance of this unit with respect to sensitivity to vibration is superior to previously constructed half-wave units, its temperature coefficient of frequency is inferior, being approximately three parts per million per degree centigrade. Responses from the nuclear quadrupole resonances of sodium bromate have been observed at 150 Mc and 179 Mc. These responses have the highest signal-to-noise ratio of any responses observed on this project. A modified spectrometer and sample holder promises to enable observation of nuclear quadrupole resonances up to 300 Mc. A correlation between quadrupole coupling constants and electronegativity difference has been observed. (See also PB 138 152)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MEGACYCLES, by Vernon Crawford and James C. Hogg, Jr. Final rept. on Contract DA 36-039-sc-5410. 31 Jan 53, 134p. 7 refs.
Order from LC mi$6.90, ph$21.30 PB 138 150

The theories of magnetic and quadrupole resonances are presented, as are the experimental results obtained with several quadrupole spectrometers. Correlation between quadrupole coupling constants and electronegativity difference has been observed, and a basis for prediction of hitherto unobserved resonances has been established. Quadrupole resonances were observed at a number of frequencies between 30 Mc and 179 Mc, but no successful method of frequency control by this means has been devised. The design and construction of stable coaxial resonators is described, and experimental results obtained with one unit. The direct relationship between selectivity, or Q, and susceptance slope is demonstrated. (Author) (See also PB 138 151)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Vernon Crawford and Donald W. Fraser. Progress rept. no. 3, 1 Aug-1 Nov 53, on Contract DA 36-039-sc-42590. [1953] 43p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 138 186

During the present quarter the principle of temperature compensation, previously applied to coaxial cavities resonating at 300 megacycles, has been extended to resonators designed for the 600-megacycle range. Variations in construction from the earlier models have been included. Considerable investigation of cavity-controlled oscillators has been conducted. An analytical investigation of the input admittance of a loop-coupled cavity has been made. Curves of input conductance, susceptance, and phase angle are presented as tools which are useful in the design of cavity-controlled oscillators. Further investigation on the high overtone responses of quartz crystals have been carried out. Unmounted crystal blanks have yielded weak responses in the 200 to 300-mc region. (See also PB 138 185)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Donald W. Fraser. Progress rept. no. 4, 1 Nov 53-1 Feb 54, on Contract DA 36-039-sc-42590. [1954] 41p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 138 187

There have been four objectives emphasized during the period of this report. Measurements to determine the characteristics of 600-mc coaxial-cavity resonators have been conducted, theoretical and experimental attention has been devoted to a series-tuned cavity-controlled oscillator, consideration has been given to a method of automatic frequency control utilizing the high-order overtone response of a quartz crystal and some time has been directed toward a literature study of novel means of frequency control. The three 600-mc cavities completed during the previous quarter have been subjected to careful scrutiny.

A cavity-controlled oscillator consisting of an internally-mounted tube and a small series capacitor is undergoing theoretical and experimental study. Some attention has been given to the automatic frequency-control problem. A limited literature search brought up several novel methods of frequency control in the lower UHF region. (See also PB 138 186)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 mc AND HIGHER) by Donald W. Fraser. Progress rept. no. 5, 1 Feb-1 May 54, on Contract DA 36-039-sc-42590. [1954] 40p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 138 188

Two primary objectives have been emphasized during the period of this report. The first has been the continued development of coaxial-cavity resonators of minimum temperature sensitivity, the second has been an effort to determine optimum methods of construction of cavity-controlled oscillators in the 500-to 1000-megacycle region. Three models of cavities have been developed. The first, using a brass outer conductor and a silver-plated Pyrex inner conductor, is temperature-compensated. It is provided with an arrangement which permits resonator tuning without affecting the hermetic sealing which permits resonator tuning without affecting the hermetic sealing which is required to eliminate the effects of humidity on frequency stability. A second cavity, utilizing a Vycor center conductor, is uncompensated and nontunable. The third utilizes a center conductor which is constructed of Invar and which is rigidly secured to a brass end-plate. Of the three cavities, the first two have demonstrated results which are considered to be satisfactory. Continued attention has been devoted to cavity-controlled oscillators using a small series capacitor. Experiments to determine the effect of characteristic impedance and of physical size of the cavity have been conducted. An oscillator which has demonstrated frequency stabilities of better than one-half part per million and is tunable over a 20 per cent frequency range near 500 mc has been constructed. (See also PB 138 187)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 mc AND HIGHER) by Donald W. Fraser and Edward G. Holmes. Progress rept. no. 6, 1 May-1 Aug 54, on Contract DA 36-039-sc-42590. [1954] 48p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 138 189

During the period of this report, continued efforts have been directed toward improvement of series-capacitor cavity-controlled oscillators. Three hermetically sealed assemblies of this type have been constructed. Each of these three oscillators has a

nominal center frequency of 600 megacycles but may be tuned over an approximate 60-megacycle band by adjusting the series capacitor. Some consideration has been given to the practicability of stabilizing oscillators by synchronization processes, and limited tests have been conducted in the UHF region. It has been demonstrated that synchronization of conventional UHF oscillators is feasible at frequencies up to 800 megacycles using either the fundamental, second harmonic or third harmonic of the synchronizing voltage. In the field of automatic frequency control a reactance-tube oscillator combination using a half-wave coaxial cable as a tank circuit shows promise of extending the frequency range of conventional reactance tubes into the upper VHF region. (See also PB 138 188)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Donald W. Fraser and Edward G. Holmes. Progress rept. no. 7, 1 Aug-1 Nov 54, on Contract DA 36-039-sc-42590. [1954] 38p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 138 190

A primary objective during the period of this report has been the accurate determination of the frequency stability of several cavity-controlled oscillators which operate in the 500-800-mc region. A secondary objective has been the determination of the heat-transfer characteristics of coaxial cavities constructed in entirety of the nickel-steel alloy, Invar. A third, and minor, objective has been a re-examination of the possible utilization of ceramic materials in electrical resonators. Investigations of ceramic bases in electrical resonators have been pursued, and new methods of attaching conductive coatings have been pursued, and new methods of attaching conductive coatings have been tested. (See also PB 138 189)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Donald W. Fraser and Edward G. Holmes. Final rept. for 1 Nov 54-30 Apr 55 on Contract DA 36-039-sc-42590. [1955] 155p. 18 refs.
Order from LC mi$7.50, ph$24.30 PB 138 191

This report contains all the important aspects of the seven previous progress reports and coordinates a number of subjects which previously appeared isolated and detached. In addition, experimental and theoretical work which was accomplished in the final quarter is presented. Primary attention has been devoted to the design, construction, and testing of coaxial-cavity resonators, and particular emphasis has been placed upon methods of rendering these cavities insensitive to temperature variations. A description of several resonators which have attained low temperature sensitivity by means of compensation or by use of materials of low expansivity is presented. The remainder of the report is devoted to a compilation and coordination of numerous topics which appeared in somewhat isolated forms in various progress reports. (See also PB 138 190)

Haloid Co., Rochester, N. Y.
PERFORMING RESEARCH ON NEW APPROACHES TO PRINTED CIRCUITRY. Final rept. for 1 Mar 56-15 Nov 57 on Contract AF 19(604)1736. 30 Nov 57, 85p. 10 refs. AFCRC-TR-58-103; AD-146 803.
Order from LC mi$4.80, ph$13.80 PB 137 520

Two independent methods for producing printed circuits and components were developed. Both utilized the idea of placing layers of conductive and resistive materials on ceramic substrates and of subsequently selectively etching these layers to produce the components. In one method, the conductive, resistive, and, sometimes dielectric, layers were deposited by vacuum evaporation techniques; in the other, a combination of chemical deposition techniques, such as hot spraying and electroplating, were employed. Selectivity in the etching process was of 2 kinds: (1) differential etching solutions were employed (etching solutions capable of attacking and removing the top layer of a double-layer blank but incapable of attacking the underlying layer), and (2) the geometrical patterns in the etched layers were controlled by means of a xerographically applied chemical resist. Up to 300°C, conductive lines, resistors, and soldered connections were formed either by vacuum evaporation or chemical deposition. The chemical deposition method had an advantage over the vacuum deposition technique in yielding circuits capable of operating in excess of 300°C without employing protective coating. Capacitors formed by vacuum deposition were not capable of operation in excess of 200°C; the prospect of producing capacitors capable of operating at higher temperatures appeared to be good. Above 300°C, only the chemical deposition method for forming printed circuits and components was promising. Conductive lines, connectors, and resistors formed by this method were capable of prolonged operation, without hermetic sealing, at 500°C.

Hughes Aircraft [Labs.] Culver City, Calif.
DUAL MODE BEACON ANTENNA WITH POLARIZATION DIVERSITY, by H. H. Hougardy. Scientific rept. no. 3508/5 on Contract AF 19(604)3508. Aug 59, 27p. 6 refs. AFCRC-TN-60-100.
Order from LC mi$2.70, ph$4.80 PB 145 565

The theoretical analysis and experimental results for an annular aperture antenna with a beacon-type pattern and polarization diversity are presented. The antenna considered consists of a dual orthogonal mode ring waveguide which has crossed-slot radiating elements cut in one of the planar faces. Either right- or left-handed circular polarization characteristics are realized by the use of a single ring of slots. With two rings arrayed, polarization of any type can be obtained. (Author)

Hycon Eastern, Inc., Cambridge, Mass.
THEORY OF TWO-LEVEL MASERS, by J. L. Burkhardt, J. W. Culvahouse and others. Final rept. on Contract Nonr-2254(00). 3 Feb 58, 217p. 37 refs. M-431; AD-152 793.
Order from LC mi$9.60, ph$33.30 PB 138 136

Classical and quantum-mechanical treatments of paramagnetic resonance in isolated atoms and in assemblies of such atoms are presented. Interactions of paramagnetic ions with crystalline fields are discussed in detail. Relaxation times are introduced phenomenologically and later treated more thoroughly in terms of the dipole-dipole and ion-phonon interactions. Power transfer between paramagnetic material and electromagnetic field is calculated in both macroscopic and microscopic terms. The circuit properties of various amplifier configurations are then derived, and expressions are given for gain, bandwidth, noise figure, stability, etc. From the theory presented, it becomes clear that a reflection-cavity-with-circulator system will give better performance in every respect than a transmission-cavity.

ITT Labs., Nutley, N. J.
AN EVALUATION OF THE STABILITY AND ACCURACY OF A BREADBOARD MODEL OF A CESIUM GAS CELL ATOMIC FREQUENCY STANDARD, by M. Arditi. Final engineering rept. for 1 Apr-31 Dec 58 on Contract Nonr-2553(00). Feb 59, 239p. 74 refs. ITT Technical memo no. 747.
Order from LC mi$10.20, ph$36.30 PB 145 079

A description is given of a breadboard model of a cesium gas cell atomic frequency standard which has been evaluated for stability and accuracy. Short-time stability of ± 2 to 4 parts in 10^{10}, long-time stability of ± 1 part in 10^{10}, and accuracy of ± 3 to 4 parts in 10^{10} have been measured. Performances an order of magnitude better are predicted. The design of the gas cell lends itself quite easily to packaging. However, some development is still necessary to improve the life of the light source over its present value of about 100 hours. (Author)

Linfield Research Inst., McMinnville, Oreg.
RESEARCH ON FIELD EMISSION CATHODES, by E. E. Martin, F. M. Charbonnier and others. Research on Particle Physics of Electronic Components, Contracts AF 33(616) (304, 3247, 3851, and 5404). Jan 60, 143p. 51 refs. WADD Technical rept. 59-20.
Order from OTS $2.75 PB 161 526

Design data are presented which allow simple prediction of the electrical performance of field emission cathodes from a knowledge of cathode geometry, work function, and position relative to the tube anode. A theoretical treatment of energy exchange phenomena associated with the emission is given; resistive heating of the tip by the emitted current, heating and cooling effects due to emission of electrons at other than the Fermi energy, and cooling of the tip by both thermal radiation and conduction down the emitter shank are considered; experimental verification of this theory confirms the possibility of drawing current densities in excess of 10^7 amp/cm^2, even for cw emission. Use of the field emission cathode in voltage regulation and rectification circuits, electron optical applications, and microwave devices is discussed. Factors affecting the electrical stability of the emission are outlined, and techniques which, through improvement of emitter environment, have resulted in betterment of stability by five orders of magnitude and stable 1000 hour emission of several milliamperes of dc current are reported. Properties of a number of emitting surfaces are discussed. The electrochemistry of tungsten and its application in the fabrication of field emission tips are treated. Associated techniques are reported which include: the working of alumino-silicate glasses, methods used for achievement of ultra-high vacuum, controlled re-orientation of tungsten crystals by floating zone melting and the use of electric field to inhibit geometric deformation of heated field emitters. (Author) (See also PB 151 552)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and A. Botka. Quarterly rept. no. 1, 15 Jan-15 Apr 57, on Contract DA 36-039-sc-73143. 15 Apr 57, 13p. 22 refs. AD-133 401.
Order from LC mi$2.40, ph$3.30 PB 145 402

Methods are to be studied for reducing inelastic wall collisions, with particular emphasis on the development of reflective wall coatings for atomic frequency standards. The existing knowledge of the interaction of adsorbed atoms with surfaces is reviewed. An optical experiment for studying the destruction of the alignment of alkali atoms in wall collisions is suggested.

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL, COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and others. Quarterly rept. no. 2, 15 Apr-15 July 57, on Contract DA 36-039-sc-73143. 15 July 57, 56p. 90 refs. AD-141 515.
Order from LC mi$3.60, ph$9.30 PB 145 403

The progress of experimental and theoretical work carried out under this contract is reviewed. Computations on the separation of closely spaced spectral lines, and on a new method of atomic orientation by optical pumping, are presented. A bibliography on surface interactions is appended. Included is a report entitled Atomic Orientation by Optical Pumping. (Author) (See also PB 145 402)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and others. Quarterly rept. no. 3, 15 July-15 Oct 57, on Contract DA 36-039-sc-73143. 15 Oct 57, 25p. 7 refs. AD-153 112.
Order from LC mi$2.70, ph$4.80 PB 145 404

Further work was done on methods for reducing inelastic wall collisions. Of the methods for producing the interaction of aligned alkali metal atoms with a surface, optical pumping of a buffered vapor appeared the most promising from the simplicity of the apparatus required and the speed with which definite results could be obtained. It was felt that Dehmelt's experiment (Phys. Rev. 105:1487, 1957) could be adapted for the purpose of studying surface relaxation. Changes were made, however, to Dehmelt's original experiment. One change involved redesign of the gas cell increasing the wall temperature by 30° to 50°C over the sodium reservoir temperature. By varying the sodium vapor pressure, the contribution of electron exchange to the spin relaxation of the sodium can be separated from other forms of relaxation. Another change involved filtering out one of the 2 D-lines of the pumping radiation to make the pumping process more or less independent of the buffer-gas pressure. To achieve a uniform illumination of the entire gas volume, the ratio of wall area to volume of the gas cell was maximized by employing a cylindrical container with a 4:1 ratio of length to diameter. (See also PB 145 403)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS, by A. G. Emslie, W. Franzen and H. Lerch. Quarterly rept. no. 4, 15 Oct 57-15 Mar 58, on Contract DA 36-039-sc-73143. 15 Mar 58, 31p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 145 405

This report discusses modifications that have been made in the apparatus for the study of wall relaxation of aligned alkali metal atoms. The progress of experimental work is discussed, and a detailed analysis of two different methods for measuring relaxation times is presented. (Author) (See also PB 145 404)

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry, and C. A. Stevens. Quarterly rept. no. 1, 1 Sep-30 Nov 56, on Contract DA 36-039-sc-72833. [1956] 24p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 145 227

Regions of frequency-dimension space additional to those of previous contract work for flat rectangular AT-cut quartz plates have been examined for identification and plotting of modes which could be compared with Mindlin's theory, and for those modes good agreement is shown.

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins and R. W. Perry. Quarterly rept. no. 2, 1 Dec 56-28 Feb 57, on Contract DA 36-039-sc-72833. [1957] 20p. 5 refs. AD-138 885.
Order from LC mi$2.40, ph$3.30 PB 145 228

The instrumentation necessary for working at much higher frequencies is being developed while studies are continuing on the normalized frequency-dimension curves and the vibration distribution patterns for flat circular AT-cut plates. Flat plates, fully electroded, are being used to insure that the various orders of modes will most likely be present as strongly as possible, and to test the theory for flat-plate piezoelectric crystals. Some of the modes were identified, and the functions for them compared with theoretical prediction. Three methods for mode identification are being used (1) the passive probe pressure pattern technique, (2) finely divided powder or liquid patterns, and (3) a photo-etch method of applying precisely shaped and aligned electrodes to the major crystal faces. The series resistance of a mode shows a high correlation with the amplitude of the spectral response observed on the crystal response spectrometer. The resistance of the fundamental thickness shear as measured on the crystal impedance meter gives a good indication of the degree of coupling, especially with flexural modes, to which it is subjected. New and precise tools and fixtures are being built for use with the higher frequency, very thin crystals required for the higher reaches of d/h ratios. (See also PB 145 227)

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry and others. Quarterly rept. no. 3, 1 Mar-31 May 57, on Contract DA 36-039-sc-72833. [1957] 28p. 2 refs. AD-139 174.
Order from LC mi$2.70, ph$4.80 PB 145 229

Studies were continued on the normalized frequency-dimension curves and the vibration distribution patterns for flat circular AT-cut plates. The region just below the diameter/thickness (d/h) value of 20 was investigated. Charts of experimental normalized frequency-dimension data are presented with theoretical predictions of first-order asymmetric curved for the same region superimposed. Other orders, not predicted, also appear in the experimental plots and illustrate how the fundamental thickness-shear mode is almost never free of coupling to some flexure or other. A probe diagram and photographs of powder patterns of 2 modes illustrate the methods of identifying modes. Masks were made to stimulate axially symmetric modes (selective mode excitation). A high degree of correspondence was shown in comparing modes between the amplitude of the response on the crystal response spectrometer and the series resonant conductance read with the CI meter. The degree of coupling experienced by the fundamental thickness shear with flexural or other modes is reflected in the measurements of its series resonant resistance. The new microprobing device for use with very thin piezoids was completed. (See also PB 145 228)

Lowell Technological Inst. Research Foundation, Mass.
STUDIES OF PIEZOELECTRIC RESONATORS, by C. R. Mingins, R. W. Perry and others. Final rept. for 1 June-31 Dec 57 on Contract DA 36-039-sc-72833. [1957] 41p. 3 refs. AD-200 872.
Order from LC mi$3.30, ph$7.80 PB 145 230

Experimental studies have been carried out on fully plated, flat, circular AT-cut piezoids to trace the curves of normalized frequency as a function of normalized diameter. These curves are shown for a part of the intermediate range of d/h, which lies between 20 and 50, and the Mindlin first order asymmetric curves from approximate theory for the same region are shown for comparison purposes. Features of agreement and disagreement are pointed out. Reference is made to similar plots and comparisons which appeared in the quarterly reports for the d/h region below 20. Methods of identifying modes are described and illustrated. Examples of precisely designed electrode shapes and orientations are shown. They are applied by a photographic method, using jigs for exact alignment. Measurements on mode series resonant resistance and amplitude are discussed. New instruments and fixtures were described for the experiments in mode analysis of very high precision in the range of very small crystal thickness, and for making very small and closely controlled changes in the diameter of thin plates. (Author) (See also PB 145 229)

[Mallory, P. R., and Co., Inc., [Indianapolis, Ind.]
DEVELOPMENT OF POWER SUPPLY PP-( )/GRC: AC POWER SUPPLY FOR STANDARDIZED SERIES OF FM RADIO SETS, by E. D. Aldred. Final rept. for 15 May 56-15 May 57 on Contract DA 36-039-sc-72315. [1957] 51p. 5 refs. AD-143 696.
Order from LC mi$3.60, ph$9.30 PB 145 475

The report presents circuits used in the power supply, discusses the operation of the circuits and the power supply as a whole, and gives results obtained in a series of laboratory tests on the completed supply. Regulation and filtering of several output voltages were important considerations. Regulation of voltages having wide load variations was provided by magnetic amplifier regulators. Silicon diodes were used to reduce rectifier heat loss and aging and to provide more efficient magnetic amplifier operation. By utilizing these two relatively new devices, the heat generated in the power supply has been greatly reduced and the maintenance free life should be greatly extended. It is anticipated that this power supply should have a maintenance free life of 5,000 to 10,000 hours when operated at full load under usual operating conditions. (Author)

Melpar, Inc., Falls Church, Va.
AN ELECTROMECHANICALLY SCANNABLE TROUGH WAVEGUIDE ANTENNA, by H. H. Hibbs. Final rept. on Contract AF 19(604)4056. 1 Oct 59, 47p. 16 refs. AFCRC-TR-59-358.
Order from LC mi$3.30, ph$7.80 PB 145 559

The feasibility of electromechanically scanning a trough waveguide array has been demonstrated. The antenna consists of a trough waveguide array feeding a parabolic cylinder reflector. The trough waveguide is made to radiate by the use of periodic asymmetric base blocks. The array is scanned by mechanically changing the height of periodic structures located in the trough waveguide on the center fin. A total scan angle in excess of 20 degrees has been achieved with a beamwidth in the plane of scan equal to 3 degrees. A beamwidth of 10 degrees is obtained in the plane perpendicular to the plane of scan.

Michigan U. [Research Inst.] Ann Arbor.
REFLECTIONS IN A FERRITE FILLED WAVEGUIDE, by C. B. Sharpe and D. S. Heim. Technical rept. no. 72 on Contract DA 36-039-sc-63203. May 57, 27p. 6 refs. 2262-157-T; AD-141 658.
Order from LC mi$2.70, ph$4.80 PB 137 648

A solution is obtained for the electric field at the air-ferrite interface (Z = 0) in a rectangular waveguide filled with ferrite in the semi-infinite half (Z > 0) magnetized in the direction of the electric field. The field is expressed in terms of a Neumann series obtained by iteration of a singular integral equation which satisfies the boundary conditions at the interface. The equivalent circuit for the junction is also presented. (Author)

Microwave Engineering Labs., Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Perry H. Vartanian. Quarterly progress rept. no. 1 (Scientific rept. no. 1) 10 June-9 Sep 58 on Contract AF 19(604)4071. 9 Oct 58, 20p. AFCRC-TN-58-396; AD-160 853.
Order from LC mi$2.40, ph$3.30 PB 137 990

The objective of the study program is to increase the amplifying bandwidth of the paramagnetic maser. This will be accomplished particularly through the use of slow-wave structures. The study is limited to the use of the single crystal, chromium doped sapphire, commonly called ruby, because of its chemical stability characteristics. A cavity maser using paramagnetic ruby has been built and operated at 2600 mc with a 10 kmc pump. Gains of 28 db with 100 kc bandwidth were measured. Studies of slow-wave structures for a traveling-wave maser have been started and the required characteristics formulated. (Author)

Microwave Engineering Labs., Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts. Quarterly progress rept. (Scientific) no. 5, 10 June-9 Sep 59, on Contract AF 19(604)4071. 9 Oct 59, 41p. 18 refs. AFCRC-TN-59-799.
Order from LC mi$3.30, ph$7.80 PB 145 548

The objectives of the study program are to investigate means of increasing the amplifying bandwidth of the solid state maser, particularly by means of slow-wave structures. In addition an initial survey will be made, involving no developmental work, of means to extend the maser to higher operating frequencies. (See also PB 143 973)

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH, by M. Chodorow. Scientific rept. no. 15 for 1 Apr-30 June 59 on Contract AF 19(604)1930. Sep 59, 18p. M. L. rept. no. 639; AFCRC-TN-59-756; AD-230 920.
Order from LC mi$2.40, ph$3.30 PB 145 574

Coupled cavity theory. Plasma physics studies. Nonlinear propagation in ferrite media. (See also PB 143 205)

Microwave Lab., Stanford U., Calif.
ON THE BOUNDARY VALUE PROBLEM OF WAVEGUIDE WINDOWS, by Max Paul Forrer. Technical rept. on Contracts Nonr-225(26, 48) and N6onr-25123. Mar 59, 123p. 15 refs. M. L. rept. no. 575; AD-215 820.
Order from LC mi$6.30, ph$10.80 PB 145 117

The mode conversion theory is generalized to the case of arbitrary dielectric obstacles, and applied to the problem of the vicinity of dielectric waveguide windows of general shape. Results are compared with experimental measurements to determine the validity of the approximate methods used. The mathematical method is that of a normal mode expansion of the electromagnetic fields. The contribution of individual waveguide modes to the total field may be determined by successive approximations. The theory is applied to several specific window geometries where a perturbation procedure is used, based on an expansion of the fields in powers of (ϵ - 1). The comparison between theory and experiment is done by way of the) reflection coefficient. First-order solutions are accurate for windows of low dielectric constant ($\epsilon < 4$) and small length. Improvements obtainable by second-order approximation are illustrated. For windows of high dielectric constant ($\epsilon \approx 10$) and a length of the order of a guide wavelength, there is strong modal interaction, so that the first-order solutions are only qualitatively correct. Accurate results for this case must be obtained by numerical integration of the coupled differential equations of several modes. This problem is well adapted to programming on a computer. The phenomenon of ghost-modes in dielectric windows is discussed. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
BROADBAND HIGH POWER COAXIAL LINE COUPLERS, by Stanley Greenblatt and John W. E. Griemsmann. Final rept. on Contract AF 30(602)1735. 4 Sep 58, 58p. 2 refs. Rept. R-689-58; PIB-617; RADC-TR-58-140; AD-148 960.
Order from LC mi$3.60, ph$9.30 PB 145 399

A hybrid (3 db) coaxial coupler fed from standard 1-5/8" line at 600 mc/sec. was designed, constructed, and a first model tested. The operating principle is similar to that of the "short-slot" coupler in rectangular waveguide and utilizes dielectric to achieve two modes of different phase velocity. Performance tests on the initial model indicate bandwidth and duplexing capabilities comparable to those of the waveguide "short-slot" coupler. An analysis was also made of a 3 db contra-directional coupler which requires no use of dielectric and for which greater bandwidths appear to be feasible both for the coupler and the associated duplexing network. In addition, a branched-guide type duplexer utilizing multiple interior T. R. tubes was analyzed. For the designs considered the bandwidth is less than that available for duplexers using the 3 db couplers. (Author)

National Bureau of Standards, Washington, D. C.
EXPENDABLE MODULES AS BASES FOR DISPOSAL-AT-FAILURE MAINTENANCE, by R. O. Stone, P. Meissner and K. M. Schwarz. Feb 60, 84p. 19 refs. Technical note no. 41.
Order from OTS $2.25 PB 151 400

This report compares the costs to procure, support and maintain an equipment designed with expendable modules to the costs to procure, support, and maintain a similar equipment designed with repairable modules. It was found that the total costs in either case were approximately equal. Modules of various electrical sizes (from 1 to 12 tubes) have been compared from the standpoint of total over-all procurement cost, in order to determine an optimum module size. On the basis of calculations made, it has been concluded that the optimum module which would lead to lowest over-all procurement cost and at the same time be of aid in the solution of logistic and maintenance problems would be one containing from 4 to 8 tubes. This is true for both disposal-at-failure and repairable modules.

Naval Ordnance Test Station, China Lake, Calif.
THE NOTS PCM TIMING SYSTEM: AN OVERALL DESCRIPTION, by J. B. Moffett. 26 Aug 59, 67p. 17 refs. NOTS TP-2316.
Order from LC mi$3.90, ph$10.80 PB 145 382

The underlying principle of the PCM timing system is pulse transmission of data; precise timing and control functions are derived by digital techniques and sent to test-range instrument sites via a 9-channel pulse-code-modulated UHF radio link. This report, one of a series on the entire timing system, is an introduction to the system as a whole. (Author)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 1, 1 Feb-30 Arp 53, on Contract DA 36-039-sc-42670. [1953] 21p.
Order from LC mi$2.70, ph$4.80 PB 145 194

Design of a new constant temperature oven and a review of pertinent literature, including ten quarterly progress reports.

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 9, 1 Feb-30 Apr 55, on Contract DA 36-039-sc-42670. [1955] 171p.
Order from LC mi$8.10, ph$27.30 PB 145 202

The optimum process employed included semi-polished quartz plates, no ion bombardment, etching at .04F^2, bakelite silver cement BC-6035, vacuum bake 1 hour at 150°C, Nalco #14 flux, no frequency adjustment spots, helium gas, preaging for 24 hours at 125°C. Much attention has been given to the derivation and application of an "aging prediction formula". (See also PB 145 201)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Final rept. for 1 Feb 53-31 July 55 on Contract DA 36-039-sc-42670. [1955] 227p.
Order from LC mi$9.90, ph$34.80 PB 145 203

Review of the project covering a period of 30 months. The standard metal HC-6/U holder itself can be the source of serious negative frequency deviations. Every unit must be hermetically sealed. Quartz plates above about 5 Mc should be polished, or at least semi-polished, and only lightly etched. There must be no trace of moisture or other contamination on the quartz plate surfaces during the plating, either by sputtering or evaporation. These crystal units should be charged to atmospheric pressure with a gas such as helium, which lends itself to effective leak tests by means of a mass spectrometer. The use of frequency adjustment spots over a base plating may cause high unit resistance at overtone frequencies. All crystal units should be pre-aged by a baking cycle, 24 hours at 125°C. Adequately fabricated crystal units should show no measurable effect from the standard humidity test or altitude test. An indication of crystal unit aging properties may be obtained by submitting test units to 5 full days at +75°C and measuring the total frequency variation. The above conclusions were the result of testing 492 crystal units for aging characteristics in constant temperature ovens maintained at 75°C to a stability of better than $\pm$0.01°C. (See also PB' 145 202)

Radio Corp. of America, Harrison, N. J.
EVALUATION TESTS OF CERAMIC PENCIL TRIODE RCA DEVELOPMENTAL TYPE A15054Q, by J. J. Thompson and T. J. Henry. Final rept. for 10 June 57-10 June 58 on Contract DA 36-039-sc-74811. 10 July 58, 76p. 1 ref.
Order from LC mi$4.50, ph$12.30 PB 145 235

Evaluation data on one hundred tubes for electrical and mechanical tests and life are presented in the form of graphs and tables. The methods of test and conditions used are given for each test. Data on power gain and noise factor at 500 and 1000 megacycles are given; and the methods, conditions, and circuits used are discussed in detail with block diagrams and drawings. Results of input-admittance measurements at 500 Mc are shown in tables and graphs. Vibration data are reported in chart form, and results of shock and bending tests are given. Life test results at 175°C ambient temperature for 500 hours are shown in tables and graphs. A specification in Military Form for the A15054Q is presented and discussed. (Author)

Raytheon Mfg. Co., Waltham, Mass.
CERAMIC-METAL SEAL OUTGASSING STUDY, by R. J. Dyer and M. Weiss. QK608 Final rept. for 1 Apr-31 Dec 56 on Contract AF 19(604)1826. [1957] 37p. AFCRC-TR-57-162; AD-117 021.
Order from LC mi$3.00, ph$6.30 PB 145 438

A study was made of gases evolved from Raytheon ceramic-metal seal assemblies at temperatures up to 700°C for test assemblies brazed with the following solders: silver-copper eutectic, 80% gold - 20% copper, pure silver and pure copper. The gases evolved were hydrogen, carbon monoxide, water vapor and carbon dioxide. The quantities and kinds of gases produced during bakeout of the test assemblies apparently did not depend on the type of solder used.

RCA Service Co., Camden, N. J.
THE PREDICTION AND MEASUREMENT OF AIR FORCE GROUND ELECTRONIC EQUIPMENT RELIABILITY. Final engineering rept. on Contract AF 30(602)1623. 15 Aug 58, 179p. 9 refs. R-2-58; RADC-TN-58-307; AD-148 977.
Order from LC mi$8.10, ph$27.30 PB 145 924

A method was developed for reliability prediction in advance of equipment production. The objective was approached through a 3-phase study of representative equipments in 3 broad classes: radar, communications, and navigation. Results of the three-phases are briefly summarized. The predictions provided estimates of equipment mean-time-to-failure that agreed reasonably well with both laboratory tests and field observations. The predictions of failure contribution by major part classes proved accurate, within the statistical limits imposed by the amount of data, for 7 out of 10 part classes. The largest difference between obtained and predicted failures was in the tube category. Electrical, electronic, and electromechanical parts and components accounted for 98% of the true equipment failures used to estimate field reliability.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
AN ANALOG PROBABILITY DENSITY ANALYZER, by Hugh E. White. Master's thesis. Rept. on Contract DA 36-039-sc-64637. 29 Apr 57, 30p. 16 refs. Technical rept. 326; AD-156 601.
Order from LC mi$2.70, ph$4.80 PB 145 268

The development and construction of an analog analyzer for determining the first-order probability density function of signal amplitudes of frequencies between 30 cps and 20 kc is described. Values of probability density are determined by averaging a derived random variable that is unity when the signal

is in the amplitude interval that is being analyzed and is zero at all other times. It is generated by a diode level-selector circuit that gates a 60-mc carrier to a bandpass amplifier. This level selector eliminates many of the problems of frequency response and drift that are associated with the amplitude discriminators of the conventional level selector. The amplitude range of the signal comprises 50 intervals that are analyzed sequentially and the complete probability density function is plotted by a pen recorder. The frequency response and drift stability of the analyzer are experimentally evaluated, and examples of experimental probability density functions are given. Block diagrams and descriptions of both digital and analog systems that have been previously developed for determining probability density functions are presented. Definitions and some properties of probability density functions are reviewed. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
A THEORY OF SIGNALS, by Robert E. Wernikoff. Rept. on Contract DA 36-039-sc-64637. 31 Jan 58, 103p. 32 refs. Technical rept. 331; AD-158 737.
Order from LC mi$5.70, ph$16.80 PB 145 265

An experiment is presented in which an attempt is made to arrive at a mathematical description of physical signals that embodies, more realistically than the usual functional representation, our limitations in performing measurements. The object is to achieve a closer relation between the structure of the mathematical description and the finite-resolution properties of the detector that characterizes any real measurement process. An algebra of signals is obtained, appropriate to the model in which essentially frequency-limited signals interact with linear, time-invariant systems, and observations are made by means of a linear, finite-resolution oscilloscope. The properties of this algebra are studied, and a metric that indicates which operators give physically indistinguishable outputs is defined. The algebra is used to study problems in uniform and nonuniform sampling, the discrimination of two events from one in noisy, radar-like systems, and the conditions under which a signal is indistinguishable from its short-time average. A general procedure for linear, least-peak-error prediction is obtained. In the limit as the detector resolution becomes perfect, the present model is shown to tend smoothly to the usual functional model. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A PROPOSED TECHNIQUE FOR IMPROVING THE INTELLIGIBILITY OF VOICE RADIO TRANSMISSIONS IN THE PRESENCE OF AURORAL FLUTTER FADING, by O. G. Villard, Jr. and K. C. Yeh. Scientific rept. no. 3 on Contract AF 19(604)1830. 14 Oct 58, 13p. AFCRC-TN-58-644.
Order from LC mi$2.40, ph$3.30 PB 145 571

Stanford Research Inst., Menlo Park, Calif.
GROUND ILLUMINATION PATTERN OF SIGNALS REFLECTED FROM A METEOR TRAIL, by Edel M. Young and L. W. Yabroff. Scientific rept. no. 13 on Contract AF 19(604)1517. Dec 59, 82p. 3 refs. AFCRC-TN-59-997.
Order from LC mi$4.80, ph$13.80 PB 145 563

Given a transmitter location and arbitrarily oriented meteor trails, the ground-illumination pattern of the reflected signal is calculated. A physical model has been used, consisting of a trial of finite length and a radial distribution of electrons (forming a cylinder) according to Eshleman's theory. Equations are developed showing the reflection of a signal from a chosen trail to the earth's surface. Several graphs of calculated examples of ground illumination patterns are presented.

Stanford Research Inst., Menlo Park, Calif.
PROCEDURAL EFFICIENCY FOR INTERMITTENT COMMUNICATIONS SYSTEMS, by Bruce M. Sifford. Scientific rept. no. 14 on Contract 19(604)1517. Dec 59, 27p. 4 refs. AFCRC-TN-59-998.
Order from LC mi$2.70, ph$4.80 PB 145 564

Operational procedures are analyzed and formulas are derived for computing procedural efficiency of communication systems operating with an intermittent propagation mode and utilizing a feedback channel. Results show that an optimum transmission block length may exist which will maximize this efficiency. Some sample systems are evaluated and suggestions for possible improvements made. Systems where the feedback link operates on a parallel channel (dual-channel) are compared with a system where the feedback link time-shares the channel with the forward link (single-channel). Actual measured single distributions, obtained on the Bozeman-Palo Alto meteor-burst link, are used in the evaluations.

Stanford Research Inst., Menlo Park, Calif.
SYNTHESIS OF MODULATED CORRUGATED SURFACE-WAVE STRUCTURES, by J. T. Bolljahn. Scientific rept. no. 4 on Contract AF 19(604)3502. Nov 59, 22p. 3 refs. AFCRC-TN-59-973.
Order from LC mi$2.70, ph$4.80 PB 145 575

An exact procedure is described for the design of a surface that will support a prescribed group of surface waves simultaneously. The surfaces resulting from the application of this procedure are found to be modulated (i.e., to contain periodic waves in the direction of propagation) and to have surface impedance values that vary periodically in the direction of propagation. Finite-length surfaces of this type are hence reminiscent of Simon's "cigar antenna." Several surface designs are presented, and some general properties of the surfaces and the composite waves they support are discussed. Certain limitations on the design procedure are described.

Stanford Research Inst., Menlo Park, Calif.
A WIDE-BAND TRANSVERSE-SLOT FLUSH-MOUNTED ARRAY, by E. M. T. Jones and J. K. Shimizu. Scientific rept. no. 2 on Contract AF 19(604)3502. Sep 59, 27p. 6 refs. AFCRC-TN-59-975.
Order from LC mi$2.70, ph$4.80 PB 145 576

This report describes the design analysis and measured performance of an antenna composed of an H-plane array of parallel waveguides having quarter-wavelength-thick transverse slots extending completely across the array. Each relatively wide nonresonant slot in this array radiates only a small amount of power, and the dimensions of the slots are relatively uncritical. The radiated H field from this antenna lies parallel to the transverse slots. The cosine of the angle between the direction of maximum radiation and the plane of the antenna is equal to the velocity of light divided by the phase velocity of propagation along the array.

Tennessee U. Engineering Experiment Station, Knoxville.
AN ACOUSTIC ANALOG OF CIRCULAR ANTENNA ARRAYS, by T. A. Lewis and J. D. Tillman. Scientific rept. no. 3 on Contract AF 19(604)4967. 1 Dec 59, 52p. 21 refs. AFCRC-TN-59-996.
Order from LC mi$3.60, ph$9.30 PB 145 580

Contained in this report is the presentation of a method of experimentally investigating the radiation of these circular antenna arrays by means of an analogous acoustic array. The absence of appreciable mutual coupling between the elements of the acoustic analog array is shown to provide an advantageous simplification of the experimental investigation of the arrays, and is further shown to provide a means of studying the effects of an error in magnitude of excitation in a single element of the array. Experimental radiation patterns were taken for certain circular acoustic arrays, and their results were presented. The results indicate that the use of the acoustic analog was justified. (Author)

Transistor Applications, Inc., Boston, Mass.
RESEARCH DIRECTED TOWARD THE STUDY, ANALYSIS AND DESIGN OF TRANSISTOR CIRCUITS, by A. W. Carlson. Scientific rept. no. 2, Dec 58-Oct 59, on Contract AF 19(604)4089. Oct 59, 77p. 17 refs. AFCRC-TN-59-989.
Order from LC mi$4.50, ph$12.30 PB 145 283

This report is concerned with the investigation of the high current mode of transistor operation first described by Thornton and Simmons (A New High Current Mode of Transistor Operation, I. R. E. Transactions on Electron Devices Vol. ED-5, January 1958, pp. 6 - 10). It is concluded that this is an avalanche multiplication phenomenon which allows the collector voltage to become less than the open base breakdown voltage when operated with reverse base current. With large reverse base currents the injected emitter current is concentrated in the center in a transistor of radial symmetry to result in high current density. At high current density, minority carriers traversing the collector depletion region at terminal velocity increase the charge density to effectively lower the breakdown vo voltage. This concept and an approximate calculation of the injected emitter current density distribution enables sketching the transistor characteristics and explanation of other aspects of the phenomenon. (Author) (See also PB 139 422)

Navy Electronics Lab., San Diego, Calif.
AN AUTOMATIC START-STOP-PHASE UNIT FOR FACSIMILE RECORDERS, by J. R. Coates. 4 June 58, 5p. Research and Development rept. 849; AD-212 873.
Order from LC mi$1.80, ph$1.80 PB 145 351

A start-stop-phase device was developed, with simplified circuitry, for utilizing the signals transmitted on the National Weather Analysis Center facsimile line to permit automatic unattended operation of a facsimile recorder. The device was operated, part time, for several weeks in a type AN/FXH-3(XN-1) recorder without failure or malfunction. (Author)

Ohio State U. Research Foundation, Columbus.
PHYSICAL ELECTRONICS AT MILLIMETER WAVELENGTHS, by T. C. Pang and M. O. Thurston. Rept. on Research on Physical Phenomena Affecting the Characteristics of Electronic Components, Contract AF 33(616)5924. Dec 59, 17p. 3 refs. WADC Technical rept. 59-494.
Order from OTS $0.50 PB 161 493

Theoretical and experimental studies of possible new slow-wave structures for electron tubes are presented. The structures considered are formed on the surface of p-type silicon by means of solid state diffusion of an n-type impurity. The properties of these structures are dependent on the dc bias applied between the diffused structure and the bulk silicon. The techniques employed in producing intricate structures to close tolerances are discussed in detail. The results of cold tests are compared with the calculated behavior for simple geometries. An application of simple distributed structures in the measurement of the microwave properties of semiconductors is considered. Other side effects observed with distributed structures are also discussed. (Author)

Olin Mathieson Chemical Corp., New Haven, Conn.
INVESTIGATION ON MEANS OF IMPROVING THE PERFORMANCE AND MINIATURIZATION OF LECLANCHE BATTERIES, by Raymond I. Cowles and Richard C. Evans. Final rept. for 1 May 56-30 Apr 57 on Contract DA 36-039-sc-71241. 31 May 57, 35p. 6 refs. AD-137 911.
Order from LC mi$3.00, ph$6.30 PB 145 534

A miniature multiple-cell battery was developed with long-life characteristics. Consideration was given to the loss of moisture and penetration or perforation of the chemically inert film which serves as cathode and divider between cells. In the development of duplex electrodes, the use of Fassler film eliminated the

bulky conductive cloth as an inert cathode. This permitted an increase in size of the mix cake and therefore, an increase in capacity. Batteries made with Fassler or Pertrix Graphite film as the inert electrode showed no significant improvement over those made with conductive cloth on initial, 2- or 3-mo normal capacity tests, but showed marked improvement on 6-mo normal (high-drain) and 3-mo tropical tests. The control batteries were dead while those made with film had lost about half of their initial capacities. In comparing Fassler film with conductive cloth, potted batteries may show a more significant advantage over the conductive cloth since the factor of moisture loss will be eliminated. The use of 2.5% $(NH_4)_2Cr_2O_7$ as an inhibitor was superior to other concentrations of dichromate as well as to $HgCl_2$ after 6-mo normal storage. The potting technique was made more practical through the use of epoxy tubing.

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 8, 1 Nov 54-31 Jan 55, on Contract DA 36-039-sc-42670. [1955] 141p.
Order from LC mi$7.20, ph$22.80 PB 145 201

Many units tested employed indium bonding in place of cement. Such units show evidence of unstable frequencies and erratic resistance values; units having sputtered gold platings appear less stable than equivalent units with electrodes formed by evaporated gold. (See also PB 145 200)

Radio Corp. of America, Lancaster, Pa.
ELECTRON TUBE MATERIALS, GASES, AND GETTERS, by J. C. Turnbull. Quarterly progress rept. no. 1, 15 Oct 58-15 Jan 59, on Contract DA 36-039-sc-78226. 15 Feb 59, 33p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 145 237

Mass spectrometric equipment for determining the outgassing of metals such as nickel and iron after initial high temperature degassing at temperatures as low as 600°C. Early work indicates the possibility that diffusion is the limiting process in the evolution of gases from nickel and iron at lower temperatures.

Thomas, A. S., Inc., Cambridge, Mass.
STUDY OF GAIN LIMITATIONS AND PATTERN SYNTHESIS OF TRAVELING WAVE ANTENNAS, by A. S. Thomas. Final rept. M 56-1 on Contract AF 19(604)1714. 30 Nov 58, 100p. 13 refs. AFCRC-TR-58-198; AD-206 651.
Order from LC mi$5.40, ph$15.30 PB 138 262

Phase and/or amplitude modulation resulting in a spatial spectrum of $\sin\xi/\xi$ distributions has been investigated. The phase is considered as a Fourier series with each sine or cosine term of the series giving an infinite but rapidly converging series of $\sin\xi/\xi$ distributions. Each $\sin\xi/\xi$ distribution is due to a relative wavenumber in the spectrum where the relative wavenumber (δ) is defined so that $\delta>1$ is the slow wave region. Distributions of δ_i, the instantaneous relative wavenumber along the array, giving high gain endfire arrays have been obtained and fall into three classes: (1) Input to end tapers; - the relative wavenumber is high at the input and approximately one at the end of the array; (2) Ends to center tapers; - the relative wavenumber is high at the ends and approximately one at the center; and (3) Periodic tapers; - the relative wavenumber decreases to approximately one and then increases, decreases, etc.

Westinghouse Electric Corp., Baltimore, Md.
PULSE TRANSMISSION STUDY, by G. K. McAuliffe, R. Filipowsky, and E. I. Muehldorf. Final rept. on Contract AF 19(604)4082. June 59, 123p. 386 refs. AFCRC-TR-59-166.
Order from LC mi$6.30, ph$19.80 PB 145 569

The use of higher order alphabets for digital transmission is investigated. It is found that, for a practical system, higher order alphabets permit a more efficient approach than binary alphabets towards the maximum transmission rate. Electrical waveforms which are suitable for higher order alphabets were investigated. A set of four harmonic orthogonal waveforms is given. These waveforms are composed of sine and cosine components. The signal space occupancy for these waveforms was investigated in the low pass band and the carrier band. A most general waveform is one which is modulated in amplitude and frequency, here called FAM-waveform.

Ordnance, Missiles, and Satellite Vehicles

Air Force Missile Test Center, Patrick AFB, Fla.
ASKANIA CINE-THEODOLITE ACCURACY STUDIES CONDUCTED UNDER OD-039, by Jerome L. Sibol. Rept. on Missile Test Project, Contract AF 08(606)1156. 11 Sep 59, 33p. 2 refs. RCA Data Processing Technical rept. 52; AFMTC-TR-59-21.
Order from LC mi$3.00, ph$6.30 PB 145 551

A field test designed to determine Cine-theodolite accuracies is outlined. The mathematics of two methods of calibrating Cine-theodolites from these field test data are presented, and a comparison of the two calibration techniques is made by using Ballistic Camera data as a comparison standard. The results of several comparison studies are listed. Recommendations are made based on the results of the tests. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
A GENERAL LEAST SQUARES ADJUSTMENT FOR COMPUTING BALLISTIC MISSILE ATTITUDE, by George H. Rosenfield. Rept. on Missile Test Project, Contract AF 08(606)3413. Sep 59, 83p. 15 refs. RCA Data Processing Technical rept. no. 53; AFMTC-TR-59-22.
Order from LC mi$4.80, ph$13.80 PB 145 562

A rigorous least squares adjustment is presented for computing the three elements of ballistic missile attitude: pitch, yaw, and roll, utilizing images recorded by one or more photogrammetric cameras. The solution directly computes absolute attitude using a missile image exposed on a single photographic frame. Camera orientation, coordinates of selected points on the missile, and film measurements are required in the reduction. A minimum of three points are required for a solution from one camera. An outline of the computational program and a numerical example is presented to facilitate programming for electronic computation. The general computations are also specialized for computing roll from one camera; and pitch and yaw from two cameras. Application of the procedure to attitude reduction from both fixed and tracking cameras is also presented. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
REAL TIME DATA HANDLING SYSTEM FOR THE EXTENDED ATLANTIC MISSILE RANGE, by Jerome P. Keuper and A. -E. Hoffmann-Heyden. Oct 58, 81p. RCA Quality Analysis TN no. 29; AFMTC-TN-58-14; AD-207 350.
Order from LC mi$4.80, ph$13.80 PB 145 736

This report attempts to answer certain questions raised by RCA-MTP Target Acquisition and Display Engineering in regard to the design of a real-time data handling system. These questions are primarily concerned with the FPS-16 radars and their proposed associated computers. No attempt has been made to design or set forth a technical exhibit for the computers. It is expected, however, that the information contained in this report will considerably support this end. (Author)

Antenna Systems Lab., U. of New Hampshire, Durham.
PARAMETRIC AMPLIFICATION TECHNIQUES FOR USE IN SATELLITE TRACKING SYSTEMS, by Albert D. Frost and Donald W. Melvin. Scientific rept. no. 2 on Contract AF 19(604)3892. 1 Nov 59, 21p. AFCRC-TN-976.
Order from LC mi$2.70, ph$4.80 PB 145 284

In an effort to improve the reception of low level radio frequency signals encountered in satellite and space vehicle tracking, work has been carried out on the investigation and development of a number of specialized forms of parametric amplifiers. Units described in this report together with preliminary design and performance characteristics include a strip circuit adaptation of the resonant quarter-wave form of amplifier and an antenna-amplifier in which the resonant elements are integrated within a half-wave dipole antenna. (Author)

Army [Rocket and Guided] Missile Agency [Redstone Arsenal] Ala.
THE EFFECTS OF VARIATIONS OF NOSE CONE BLUNTNESS ON THE TURBULENT HEAT TRANSFER TO THE CONICAL PORTION OF A SPHERICAL-NOSED CONE, by Robert R. Fisher and Charles C. Wood. 20 May 58, 25p. 4 refs. Rept. no. DSD-TR-3-58; AD-200 004.
Order from LC mi$2.70, ph$4.80 PB 145 494

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPERIMENTAL FIRINGS IN AN ARGON-SULFUR-HEXAFLUORIDE MIXTURE OF VARIABLE GAMMA – DRAG CHARACTERISTICS AND SHOCK WAVE ANGLES OF 30° AND 70° CONE CYLINDERS FIRED IN A-SF_6 MIXTURES OF $\gamma = 1.4$ AND $\gamma = 1.17$, by M. R. Lewis and D. B. Sleator. Nov 57, 29p. 10 refs. Memo rept. no. 1047; AD-155 135.
Order from LC mi$2.70, ph$4.80 PB 145 658

This mixture has been used to simulate air in the study of the drag characteristics of projectiles. These two gases may be proportioned to have any desired value of γ from 1.10 to 1.67. Physical and thermodynamic properties of these mixtures are given.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INSTRUMENTATION FOR TRACKING SATELLITE IONOSPHERIC PAYLOADS. July 1959, 21p. Technical note no. 1267.
Order from LC mi$2.70, ph$4.80 PB 146 004

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ORBIT MEASUREMENTS OF AN ARTIFICIAL EARTH SATELLITE (SPUTNIK II) FROM PHOTOGRAPHS TAKEN WITH A TRACKING BALLISTIC TELESCOPE SYSTEM, by Dirk Reuyl. Nov 57, 16p. 9 refs. Technical note no. 1156.
Order from LC mi$2.40, ph$3.30 PB 146 076

A brief resume is given of optical methods for the measurement of artificial earth satellites. Observations of the third stage rocket of Sputnik I and Sputnik II with tracking ballistic telescope systems, based on SMT and IGOR instruments, are described. Measurements were made of Sputnik II records obtained with the SMT system during the dawn passage on 7 November, 1957. The accuracy of the resulting azimuth and elevation values is given by a mean error of about 10 seconds of arc for a single observation, or 4 seconds of arc for the weighted means of all observations. (Author)

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK: MASTER GRAPHS. Contract AF 04(647)59-3. [Apr 60] 16p.
Order from OTS $0.50 PB 161 093-3

See PB 161 093

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF A GREASEPROOF LINEAR FOR SPECIFICATION MIL-C-3955 FIBER CANS, by Howard M. Weiner. July 58, 8p. Technical rept. 2517; AD-201 208L.
Order from LC mi$1.80, ph$1.80 PB 145 450

Six materials and combinations of materials were evaluated in laboratory tests as possible replacements for the greaseproof lining material now used in Specification MIL-C-3955 fiber cans. Four of these materials (1, 2, 3, and 6) were judged to be satisfactory. Two of the four (1 and 2) were eliminated from the program because of difficulties anticipated in laminating them to fiber cans. Rolls of materials 3 and 6 were forwarded to the Ordnance Packaging Office Rossford Ordnance Depot, Toledo, Ohio, to be evaluated as liners for experimental fiber cans. (Author)

General Electric Co. [Schenectady, N. Y.]
AEROELASTIC EFFECTS ON HINGE MOMENT AND NORMAL FORCE OF THE FINS, by R. B. Chamberlin. 8 Jan 54, declassified 28 May 58. 4p. 2 refs. Hermes A-3B Aerodynamic Data Memo 21D.
Order from LC mi$1.80, ph$1.80 PB 145 427

This memorandum presents the change in the hinge moment and normal force coefficients due to aeroelastic effects. The incremental coefficients are to be added algebraically to the corresponding rigid-fin coefficients presented in A-3B Aerodynamic Data Memos #21B, 8B, and 8C.

General Electric Co. [Schenectady, N. Y.]
ANALYSIS OF STATIC STABILITY MARGIN OF HERMES A-3BE1, by Paul G. Cushman and Otto Klima, Jr. 20 Mar 53, declassified 28 May 58. 4p. 5 refs. Hermes A-3B Aerodynamic Data Memo no. 5C.
Order from LC mi$1.80, ph$1.80 PB 145 410

[General Electric Co., Schenectady, N. Y.]
ANALYSIS OF THE APPLICATION OF HEATERS TO THE PEROXIDE FLOW-CONTROL DRIVE MECHANISM, HA-3A, by Eric Johansson and William W. Fischer. 24 July 52, 2p. Hermes Heat Transfer Memo. no. 42.
Order from LC mi$1.80, ph$1.80 PB 145 469

Final temperatures attained for various heater powers are shown in Table I for four sets of conditions. Free and forced convection are considered as are two ambient temperatures. Experimental confirmation within 10% of the calculated values was obtained with the one set of conditions tested. For free convection the time constant (time required for case to reach 63% of final temperature) was 44 min., and for forced convection was 10 min.

General Electric Co. [Schenectady, N. Y.]
CENTER OF PRESSURE FOR COMBINED PITCH AND YAW ATTITUDE, by Helen C. Engvold and Robert B. Chamberlin. 1 May 53, declassified. 2p. Hermes A-3B Aerodynamic Data Memo. no. 14-H.
Order from LC mi$1.80, ph$1.80 PB 145 421

The effect of angle of attack in the pitch plane on center of pressure in the yaw plane for small side slip angles (less than 5°) is presented versus Mach number in the attached figure.

General Electric Co. [Schenectady, N. Y.]
COEFFICIENT OF HINGE MOMENT FOR ONE FIN AS A FUNCTION OF COMBINED ANGLES OF ATTACK AND SIDESLIP, SUBSONIC MACH NUMBERS, by Kathryn A. Parker. 8 Mar 54, declassified 28 May 58. 4p. Hermes A-3B Aerodynamic Data Memo no. 21F.
Order from LC mi$1.80, ph$1.80 PB 145 428

[General Electric Co., Schenectady, N. Y.]
A COMPARISON OF CALCULATED AND MEASURED NOZZLE TEMPERATURES FOR RUN #7 OF 31" DIAMETER MOTOR, by Allen E. Galson and William W. Fischer. 27 Aug 52, declassified 28 May 58. 9p. Hermes Heat Transfer Memo no. 33.
Order from LC mi$1.80, ph$1.80 PB 145 464

It is the object of this memorandum to compare test data obtained by means of thermocouples to transient temperature values calculated by a numerical method of analysis.

General Electric Co. [Schenectady, N. Y.]
COMPARISON OF EFFECTIVENESS OF PIPE-INSULATION WITHIN THE HA-3A MISSILE, by W. W. Fischer and Helen Bass. 21 May 53, 4p. Hermes Heat Transfer Memo. no. 24A, supplement to Memo. no. 24.
Order from LC mi$1.80, ph$1.80 PB 145 461

[General Electric Co., Schenectady, N. Y.]
COMPARISON OF TRANSIENT TEMPERATURE CALCULATION METHODS APPLIED TO UNCOOLED NOZZLES, by Bruch F. McClintic and W. W. Fischer. 19 Feb 52, 8p. Hermes Heat Transfer Memo. no. 25.
Order from LC mi$1.80, ph$1.80 PB 145 462

This memo presents methods of estimating transient temperatures at any axial or radial location in an uncooled convergent-divergent nozzle. The accuracy of various methods are compared and a suitable method selected for engineering use.

General Electric Co. [Schenectady, N. Y.]
COMPLETE MISSILE COEFFICIENTS OF NORMAL FORCE CENTER OF PRESSURE, by R. B. Chamberlin and Margaret A. Lavelle. 26 Dec 52, declassified. 5p. 2 refs. Hermes A-3B Aerodynamic Data Memo. no. 14D.
Order from LC mi$1.80, ph$1.80 PB 145 417

General Electric Co. [Schenectady, N. Y.]
DAMPING-IN-ROLL MOMENT, by Otto Klima, Jr. and Patricia A. Gill. 16 Mar 53, declassified. 2p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 28.
Order from LC mi$1.80, ph$1.80 PB 145 433

The attached figure presents the damping-in-roll moment as a function of Mach Number. The damping-in-roll moment is based on the calculation for the Hermes A-3AE1 and A-3AE2 (Aero. Data Memo. #35). Corrections were made to the "A" curves to account for the difference in fin size.

[General Electric Co., Schenectady, N. Y.]
DEVIATIONS FROM THE NOMINAL ANGLES IN SPACE DUE TO MANEUVERS AND WINDS DURING DESCENT FLIGHT, by Robert B. Chamberlin. 27 Aug 52, declassified. 2p. 2 refs. Hermes A-3B Aerodynamic Data Memo no. 24.
Order from LC mi$1.80, ph$1.80 PB 145 430

General Electric Co. [Schenectady, N. Y.]
DRAG AND AXIAL FORCE COEFFICIENTS, by Margaret A. Lavelle and Otto Klima, Jr. 2 Apr 53, declassified 2 Mar 54. 8p. 7 refs. Hermes A-3B Aerodynamic Data Memo. no. 3A.
Order from LC mi$1.80, ph$1.80 PB 145 409

The revision is (1) a change in configuration (the fin root shord is now 58" instead of 60"). (2) additional wind tunnel test data at M=1.72, 4.5 and 5.0. (3) NACA transonic free flight results of a one-fifth scale Hermes A-3A adjusted to be applicable to Hermes A-3B. (4) more recent methods for estimating base pressure drag. Calculations for this memorandum are in DFB #53-AO-655.

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF LARGE PITCH ANGLES IN STATIC STABILITY IN THE YAW PLANE FOR SMALL ANGLES OF SIDESLIP AT SUBSONIC MACH NUMBERS. 15 Jan 53, declassified. 3p. Hermes A-3B Aerodynamic Data Memo no. 14E.
Order from LC mi$1.80, ph$1.80 PB 145 418

General Electric Co. [Schenectady, N. Y.]
EFFECTS OF PITCH ANGLES OF ATTACK ON CENTER OF PRESSURE IN THE YAW PLANE FOR SMALL SIDESLIP ANGLES AT MACH NUMBER 1.25, by R. B. Chamberlin. 18 May 53, declassified 3p. 1 ref. Hermes A-3B Aerodynamic Data Memo. no. 14G.
Order from LC mi$1.80, ph$1.80 PB 145 420

[General Electric Co., Schenectady, N. Y.]
EFFECTS OF PITCH ANGLES OF ATTACK ON CENTER OF PRESSURE IN THE YAW PLANE FOR SMALL SIDESLIP ANGLES AT MACH NUMBER 4.50, by Otto Klima, Jr. and Patricia A. Gill. 18 Mar 53, declassified. 3p. Hermes A-3B Aerodynamic Data Memo. no. 14F.
Order from LC mi$1.80, ph$1.80 PB 145 419

General Electric Co. [Schenectady, N. Y.]
ESTIMATED DIFFERENTIAL-PRESSURE DISTRIBUTION OVER FIN FOR MAXIMUM FIN LOADING CONDITION, by J. L. Diggins and R. B. Chamberlin. 21 Apr 53, declassified 28 May 58. 4p. 3 refs. Hermes A-3B Aerodynamic Data Memo no. 17.
Order from LC mi$1.80, ph$1.80 PB 145 423

[General Electric Co., Schenectady, N. Y.]
ESTIMATED LOAD DISTRIBUTION ON THE FIN, by Robert B. Chamberlin. 12 Sep 52, declassified. 3p. Hermes A-3B Aerodynamic Data Memo no. 11C.
Order from LC mi$1.80, ph$1.80 PB 145 415

[General Electric Co., Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE BEHAVIOR OF THE NOSE COMPARTMENT HA-3B MISSILE, by R. G. Fraser and William W. Fischer. 21 July 52, declassified 5p. Hermes Heat Transfer Memo. no. 36.
Order from LC mi$1.80, ph$1.80 PB 145 466

The temperatures prevailing within the nose compartment are shown in Figure 1. These temperatures were computed for a missile erected at W. S. P. G. on a clear summer day with essentially no wind.

[General Electric Co., Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE BEHAVIOR OF TAIL SECTION HA-3A, ROUNDS 1-8, PRE-LAUNCH TESTING, by Douglas J. Van Vranken and William W. Fischer. 27 Aug 52, declassified. 7p. Proj. Hermes Heat Transfer Memo. no. 39.
Order from LC mi$1.80, ph$1.80 PB 145 468

General Electric Co., [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE VARIATION OF THE LUBRICATING OIL STORAGE SYSTEM, HA-3A, by William W. Fischer. 23 July 52, 8p. Hermes Heat Transfer Memo. no. 35.
Order from LC mi$1.80, ph$1.80 PB 145 465

It is the object of this memorandum to estimate how rapidly the HA-3A missile lubricating oil changes temperature under typical pre-launch conditions. These data are desired since, 1) the viscosity of the "Foreshot Fluorolube" varies greatly with temperature especially below 50° F and 2) the flow metering device is an orifice. Therefore only small temperature changes are tolerable within the limits of accuracy desired in the oil flow rate.

[General Electric Co., Schenectady, N. Y.]
EXPERIMENTAL SUBSONIC STABILITY AND TRIM CHARACTERISTICS OF A CONFIGURATION WITH CLIPPED DELTA FINS AND TRAILING-EDGE-BAR CONTROLS, by Harold L. Bloom. 21 May 53, declassified 28 May 58. 11p. 4 refs. Hermes Aerodynamic Research and Development Data Memo. no. 4.
Order from LC mi$2.40, ph$3.30 PB 145 459

Subsonic wind-tunnel tests were carried out on model $N_{50}T_{58}$ with various deflections of the trailing-edge-bar controls, and on the body alone. This model may be considered as a possible eventual alternate configuration for the Hermes A-3. The results reported in this memo merely extend the speed range at which aerodynamic data are available.

General Electric Co. [Schenectady, N. Y.]
EXPERIMENTAL SUBSONIC TRAILING EDGE BAR CONTROL FORCE, by H. L. Bloom. 8 Apr 53, declassified 28 May 58, 4p. 3 refs. Hermes Aerodynamic Research and Development Data Memo. no. 3.
Order from LC mi$1.80, ph$1.80 PB 145 458

[General Electric Co., Schenectady, N. Y.]
HA-3A LOX TANK PRESSURE AND LOX DISCHARGE FROM CUT-OFF TO IMPACT, by Eric Johansson and William W. Fischer. 6 Aug 52, declassified, 28 May 58. 8p. Hermes Heat Transfer Memo no. 37.
Order from LC mi$1.80, ph$1.80 PB 145 467

Results are presented in figures 1 and 2. Figure 1 gives weight of LOX remaining plotted against time of flight. Figure 2 gives absolute pressure and gauge pressure in LOX tank plotted against time of flight. At 87 seconds all but 0.34 cubic feet = 24 lbs. of LOX are vented. This 24 lbs. remains in the head of the tank and vent line throughout the flight.

General Electric Co. [Schenectady, N. Y.]
HINGE MOMENT, NORMAL FORCE, AND CENTER OF PRESSURE OF THE FINS EXCLUDING FIN EFFECT ON THE BODY, by Helen C. Engvold and Otto Klima, Jr. 27 Apr 53, declassified. 5p. 27 refs Hermes A-3B Aerodynamic Data Memo no. 21B.
Order from LC mi$1.80, ph$1.80 PB 145 425

[General Electric Co., Schenectady, N. Y.]
HINGE MOMENTS FOR PERIOD OF MAXIMUM MANEUVER DURING DESCENT PORTION OF FLIGHT, by Nancy Thomas and Otto Klima, Jr. 9 Sep 52, declassified. 6p. 2 refs. Hermes A-3B Aerodynamic Data Memo no. 21A.
Order from LC mi$1.80, ph$1.80 PB 145 424

The "most probable" hinge moment during the descent portion of any of the five trajectories for the A-3B will not exceed 450 foot pounds per fin. The "most extreme" values will not exceed 1050 foot pounds per fin. These are considerably less than the 1900 foot pounds per fin which is the value used in the design the fin control system. The effect of gusts has not been considered in this study.

General Electric Co. [Schenectady, N. Y.]
INDUCED ROLL DURING LAUNCHING ($\alpha_X = 90^o$, $\phi_V = 22\ 1/2^o$) by Margaret A. Lavelle and Otto Klima, Jr. 20 Apr 53, declassified. 2p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 15A.
Order from LC mi$1.80, ph$1.80 PB 145 422

The roll moment caused by the nonsymmetrical attitude of the fins to the wind as shown in the accompanying figure is calculated assuming fin I to be at an angle of attack of 22 1/2° and the resultant moment from the remaining fins to be zero. This appears to be a conservative assumption.

[General Electric Co., Schenectady, N. Y.]
MAXIMUM AIR LOAD AND ACCELERATIONS OF THE NOSE CONE, by Robert B. Chamberlin. 27 Aug 52, declassified. 2p. 3 refs. Hermes A-3B Aerodynamic Data Memo. no. 11B.
Order from LC mi$1.80, ph$1.80 PB 145 414

[General Electric Co., Schenectady, N. Y.]
MAXIMUM BODY LOADS AND TRIM LOADS, by R. B. Chamberlin. 21 July 52, declassified 28 May 58. 5p. 14 refs. Hermes A-3B Aerodynamic Data Memo. no. 11 A.
Order from LC mi$1.80, ph$1.80 PB 145 413

General Electric Co. [Schenectady, N. Y.]
MAXIMUM AIR LOADS AND ACCELERATIONS OF THE NOSE CONE, by Robert B. Chamberlin. 21 Jan 53, 2p. 4 refs. Hermes A-3B Aerodynamic Data Memo no. 11D.
Order from LC mi$1.80, ph$1.80 PB 145 416

[General Electric Co., Schenectady, N. Y.]
MINIMUM STATIC STABILITY MARGIN OF THE HERMES A-3B (XSSM-A-16), by R. H. Norris. 11 Aug 52, declassified 28 May 58, 6p. 8 refs. Hermes A-3B Aerodynamic Data Memo. no. 5B.
Order from LC mi$1.80, ph$1.80 PB 145 411

This memorandum supersedes A-3B Aero. Spec. Memo #5A. It differs from that memo mainly by showing the effect of the considerable increase in the allowance for elastic effect. This allowance has now been calculated whereas previously it was merely a tentative proposal.

[General Electric Co., Schenectady, N. Y.]
PREDICTION OF TRANSIENT SKIN TEMPERATURE OF NOSE CONE (STATIONS 10 AND 25) by E. Giles and W. W. Fischer. 5 Sep 52, declassified 28 May 58, 3p. Hermes A-3B Aerodynamic Data Memo no. 26.
Order from LC mi$1.80, ph$1.80 PB 145 432

The object is to make available the necessary skin temperature information needed to design the HA-3B missile nose cone. Metal skin temperature as well as an indication of the surface temperature of a flush insulator are determined.

[General Electric Co., Schenectady, N. Y.]
PRESSURE DISTRIBUTION OVER THE CONICAL SECTION OF THE HERMES A-3B NOSE, by Nancy Thomas and Otto Klima, Jr. 29 July 52, declassified. 2p. 5 refs. Hermes A-3B Aerodynamic Data Memo no. 25.
Order from LC mi$1.80, ph$1.80 PB 145 431

General Electric Co. [Schenectady, N. Y.]
REVISION OF NORMAL FORCE COEFFICIENTS FOR 58" FINS INCLUDING THE FIN EFFECT ON THE BODY, by Robert B. Chamberlin and Helen C. Engvold. 9 Apr 53, declassified. 2p. 2 refs. Hermes A-3B Aerodynamic Data Memo no. 8C.
Order from LC mi$1.80, ph$1.80 PB 145 412

This memorandum supersedes the subsonic and transonic data for $^{d}C_N$ presented in figure I of Aero. Data Memo. #8B.

General Electric Co. [Schenectady, N. Y.]
ROLL MOMENT CAUSED BY NON-SYMMETRICAL ATTITUDE AND BY RUDDER DEFLECTION, by Margaret A. Lavelle and Otto Klima, Jr. 3 Apr 53, declassified. 7p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 29.
Order from LC mi$1.80, ph$1.80 PB 145 434

[General Electric Co., Schenectady, N. Y.]
SELECTION OF HEAT TRANSFER COEFFICIENT FOR HA-2 NOZZLE, by Bruce F. McClintic and W. W. Fischer. 5 Mar 52, declassified 28 May 58. 8p. 10 refs. Hermes Heat Transfer Memo. no. 26.
Order from LC mi$1.80, ph$1.80 PB 145 463

General Electric Co. [Schenectady, N. Y.]
STABILITY AND TRIM CHARACTERISTICS FOR SEVERAL CONFIGURATIONS OF COMPLETE MISSILES, by Harold L. Bloom. 27 Feb 53, declassified 28 May 58, 20p. 11 refs. Hermes Aerodynamic Research and Development Data Memo no. 2.
Order from LC mi$2.40, ph$3.30 PB 145 457

This memo presents the calculated supersonic stability and trim characteristics for three highly swept delta-fin configurations utilizing the "bar" type of aerodynamic control.

General Electric Co. [Schenectady, N. Y.]
SUPERSONIC TRAILING-EDGE-BAR CONTROL FORCE, by John O. Powers. 26 Dec 52, declassified. 4p. Hermes Aerodynamic Research and Development Data Memo. no. 1.
Order from LC mi$1.80, ph$1.80 PB 145 456

This memorandum deals with the control force attainable through the use of trailing-edge-bar controls. The control forces presented herein are to be used primarily for the computation of missile maneuvering characteristics.

[General Electric Co., Schenectady, N. Y.]
TEMPERATURE TEST OF RANGE AND AZIMUTH UNIT, HA-3A, by Glen E. McIntosh. 7 Aug 52, 2p. Hermes Heat Transfer Memo. no. 43.
Order from LC mi$1.80, ph$1.80 PB 145 470

[General Electric Co., Schenectady, N. Y.]
TRAJECTORY CORRECTION CAPABILITIES DURING DESCENT FLIGHT, by Robert B. Chamberlin. 27 June 52, declassified 28 May 58. 6p. 4 refs. Hermes A-3B Aerodynamic Data Memo no. 22.
Order from LC mi$1.80, ph$1.80 PB 145 429

General Electric Co. [Schenectady, N. Y.]
WIND TUNNEL TEST RESULTS OF SEVERAL MISSILE CONFIGURATIONS, by Harold L. Bloom. 28 Jan 54, declassified 28 May 58. 51p. 10 refs. Hermes Aerodynamic Research and Development Data Memo. no. 5.
Order from LC mi$3.60, ph$9.30 PB 145 460

This memorandum summarizes the results of further wind-tunnel tests on missile configurations embodying highly swept fins and/or trailing-edge-bar controls. The wind tunnel tests were conducted originally under a Hermes A-3-configuration development study. The purpose of the later tests discussed herein is to extend the amount of information on trailing-edge-bar controls and highly swept fins to additional Mach numbers and variously shaped wing, body, and control configurations.

General Electric Co. [Schenectady, N. Y.]
WIND VELOCITY REQUIRED TO OVERTURN HERMES A-3B ON LAUNCHING STAND, by Patricia A. Gill and Otto Klima, Jr. 15 May 53, declassified. 1p. 1 ref. Hermes A-3B Aerodynamic Data Memo no. 30.
Order from LC mi$1.80, ph$1.80 PB 145 407

Illinois U., Urbana.
A STUDY OF THE KINEMATICS OF BUOYANT-BODY WATER EXIT, by M. E. Clark and J. M. Robertson. Rept. on Contract Nonr-1834(10). Apr 59, 86p. 13 refs. T. & A. M. Rept. no. 145.
Order from LC mi$4.80, ph$13.80 PB 145 376

The hydroballistics of buoyant prolate ellipsoids passing through a water-air interface has been studied. A kinematic, experimental approach has been used in this study due to the inherent difficulties of theoretical analysis and of dynamic measurements. An elementary momentum analysis is shown to predict significant velocity changes associated with the added mass and density of the exiting body. Further analytical consideration of free surface occurrences suggests the significance of the Froude number in characterizing the behavior.

Institute for System Research, U. of Chicago, Ill.
THE COMBINED NON-LINEAR EFFECTS OF EARTH OBLATENESS AND ATMOSPHERIC DRAG ON A NEAR-EARTH SATELLITE, by Trinidad J. Jaramillo. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Oct 59, 111p. 38 refs. WADC TR-59-513.
Order from OTS $2.50 PB 161 494

Sets of equations are presented which may be used in calculating the positions of an earth satellite moving under the influence of an attracting oblate earth and air drag, assuming the air density to decrease exponentially with height. The six elements of the initial elliptical orbit are expressed in terms of the initial conditions at burnout point, and equations are derived for obtaining the errors induced in the elements by the errors inherent in the initial conditions. Because of oblateness and air drag, these six orbital elements are not constants, but vary with time.

Institute for System Research, U. of Chicago, Ill.
OPTIMUM RE-ENTRY INTO THE EARTH'S ATMOSPHERE BY USE OF A VARIABLE CONTROL FORCE, by Francis J. Marshall. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Oct 59, 136p. 83 refs. WADC TR-59-515.
Order from OTS $2.75 PB 161 495

The objective of this study is to obtain general design information for a vehicle performing the following task: The vehicle carrying cargo sensitive to both heat and deceleration is initially in orbit about the earth. The vehicle then descends through the atmosphere to the earth's surface at a preselected time and place in a recoverable or non-recoverable manner. A variable control force is available during the descent. The approach is a mathematical one based primarily, but not exclusively, on the Calculus of Variations. The end product is an optimum control force program implying an optimum trajectory or a feasibility statement. The mechanics of re-entry are examined and a compact list of design requirements is obtained.

Integrated Range Mission, White Sands Missile Range, N. Mex.
SATELLITE ACQUISITIONS AND REQUIREMENTS FOR OPTIMUM OPTICAL TRACKING, by Donald L. Grigsby. Mar 59, 36p. 3 refs. Special rept. no. 12.
Order from LC mi$3.00, ph$6.30 PB 146 234

Part I of this report gives a method of finding the satellite's location in its orbit, its time of arrival, altitude at this point, and angle of elevation from a tracking position; the latitude and longitude of the satellite subpoint; and its great circle distance and azimuth from this tracking position. From Part II it is possible to obtain the optimum times and locations of the satellite for optical tracking. Further work gives a method of effecting accuracy as well as obtaining orbital elements from raw data. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL AND MATHEMATICAL TECHNIQUES FOR DETERMINING THE DYNAMIC RESPONSE TO PRESSURE GAGES, by Chester G. Hylkema and Ralph B. Bowersox. Rept. on Contract DA 04-495-ORD-18. 6 Oct 53, 30p. 13 refs. Memo. no. 20-68.
Order from LC mi$2.70, ph$4.80 PB 145 921

The high-frequency limitations of pressure gages is of paramount importance in some measurements, particularly with unstable combustion of rocket motors. Because of the difficulty or impossibility of generating sinusoidal pressure variations at high pressures, the high-frequency response cannot be directly determined; in consequence, it is necessary to use aperiodic functions such as a unit step or pulse for test purposes. The advent of digital computers makes it feasible to translate the time responses to these aperiodic functions to their frequency-phase equivalent and thereby determine the frequency-phase characteristics of the pressure-measuring system. This translation involves the evaluation of the Fourier integral which evaluation can be carried out by a stepwise integration directly from the experimental time-response data. Some standard types of responses can be translated to frequency-phase equivalents more directly. The experimental equipment for generating pressure variations include a resonant-tube sinusoidal generator for low pressures, a burst-diaphragm step generator giving a rise time less than 1 millisec, a shock tube giving a rise time less than 100 microsec, and a closed bomb. (Author)

Naval Ordnance Lab., White Oak, Md.
ELECTRO-THERMAL EQUATIONS FOR ELECTRO-EXPLOSIVE DEVICES, by Louis A. Rosenthal. 15 Aug 59, 52p. 2 refs. NAVORD Rept. 6684.
Order from LC mi$3.60, ph$9.30 PB 145 628

A basic equation that relates the wire bridge temperature of an electro-explosive device to the applied power is introduced. Techniques for measuring the important thermal parameters are presented together with experimental observations. The equations which describe the temperature rise as a function of time for constant current, condenser discharge, and constant voltage firing are developed. (Author)

Naval Ordnance Test Station, China Lake, Calif.
ARMING AND FIRING DEVICE EX 16 MOD O FOR THE SUBROC FLIGHT-INTERRUPTER SYSTEM, by Jack Davidson. 6 Oct 59, 24p. NOTS TP-2336; NAVORD rept. 6601; AD 229 404.
Order from LC mi$2.70, ph$4.80 PB 145 126

The design, development, and test of an arming and firing device--a component of the command flight-interrupter system for the SUBROC missile--are reported. (Author)

Naval Ordnance Test Station, China Lake, Calif.
IMPACT. THERE'S MORE TO IT THAN MEETS THE EYE, by Marvin E. Backman. Nov 59, 9p. 3 refs. Technical Article 1; NOTS TP-2367.
Order from LC mi$1.80, ph$1.80 PB 145 626

The scientist can determine the penetration, vibration, and wave motions that occur during the event called "impact" even when high-speed photographic equipment is not available or is inadequate. By applying certain equations, it is possible for him to make calculations that are more precise than a photographic record of the event. (Author)

Naval Research Lab., Washington, D. C.
STELLAR MAGNITUDE OF LOW-REFLECTANCE SPHERICAL SATELLITES, by S. Neuder. Interim rept. 15 Feb 60, 8p. 4 refs. NRL rept. 5431.
Order from LC mi$1.80, ph$1.80 PB 143 940

Black finishes on orbiting satellites would have certain advantages from the standpoint of passive temperature control, but would make optical acquisition and tracking difficult. In order to evaluate the difficulty, a series of preliminary model studies has been carried out on black-finished spheres. Collimated light, with 1/2-degree divergence, illuminated the small-scale model, and the light reflected from the model was measured as a function of phase angle using a photomultiplier detector. The equivalent stellar magnitude of a similarly finished 20-inch sphere illuminated by sunlight, and viewed from a distance of 200 miles has been computed as a function of phase angle for a number of surfaces. The largest magnitudes (smallest intensities) were +9 to +10.3 for a soot-covered sphere. Other blacks yield magnitudes of between +8 and +9 for phase angles up to about 90 degrees. For larger angles there is a decrease of as much as 2.5 magnitudes. From additional measurements on both white-painted and black-finished spheres it was found that drilling holes into 40 percent of a sphere's surface increases the magnitude from about half a magnitude or less at small phase angles to 1.5 magnitudes or more at large angles. (Author)

Rodman Lab., Watertown Arsenal, Mass.
FEASIBILITY OF EMPLOYING COLD FORMED TUBES FOR RECOIL CYLINDER APPLICATIONS, by A. Ayvazian. Apr 59, 15p. 2 refs. Technical rept. no. RPL-31/8.
Order from LC mi$2.40, ph$3.30 PB 145 378

Mechanical properties, machining tests, and pressure tests revealed that cylinders produced by this special cold forming process can be utilized for recoil applications.

Solid Propellant Information Agency, Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
STATIC CALIBRATION OF PRESSURE AND FORCE GAGES. Rept. on Contract NOrd-7386. Aug 58, 32p. 7 refs. Practices Recommended by JANAF Solid Propellant Rocket Static Test Panel. AD-205 867.
Order from LC mi$3.00, ph$6.30 PB 145 584

This Recommended Practice deals only with apparatus for generating accurately-known static pressures and the application of this apparatus for the purpose of calibrating pressure transducers. Pressure range of interest is from 10 psig to 20,000 psig. Use of the Recommended Practice is to assure accuracies of 0.1% in static pressure calibration (accuracies approaching 0.01% are attainable but at greatly increased cost in equipment, skill, and care). It does not cover devices and procedures for determining output of various pressure transducers; this subject is so varied and broad that it cannot be included.

Watertown Arsenal Labs., Mass.
DYNAMIC RESPONSE OF A NONLINEAR SUSPENSION SYSTEM, by J. J. Connor, Jr. Dec 59, 26p. 2 refs. Technical rept. no. WAL TR 850/12.
Order from LC mi$2.70, ph$4.80 PB 145 089

An approximate analysis of the dynamic response of a nonlinear torsional suspension system resulting from a sinusoidal ground profile variation is carried out. This system is similar in configuration to one being considered for the Vigilante undercarriage. In the analysis, the actual structure is first idealized considerably in order to reduce the number of generalized coordinates. Then, Hamilton's Principle is applied to determine the nonlinear Equilibrium and Constraint Equations. An Electronic Differential Analyzer is employed to evalute the variations in response of the idealized system with wavelength of the ground contour and rigidity of the torsion bar. Because of the numerous simplifications, the results are not directly applicable to the actual structure. However, they can be utilized as a guide in the preliminary design of the rear wheel suspension system for the Vigilante undercarriage. (Author)

Westinghouse Electric Corp., Baltimore, Md.
TRAJECTORY PROBLEMS IN CISLUNAR SPACE. Technical note on Contract AF 49(638)490. 31 Dec 59, 44p. 5 refs. AFOSR-TN-59-1284; AD-230 878.
Order from LC mi$3.30, ph$7.80 PB 145 477

Sanitation and Safety Engineering

Armour Research Foundation, Chicago, Ill.
EVALUATION OF DEEP TUNNEL SHELTERS, by K. E. McKee and R. W. Sauer. Final rept. on Contract CD-SR-58-55. Nov 58, 96p. 46 refs.
Order from LC mi$5.40, ph$15.30 PB 145 971

This report contains the results of an evaluation to determine the vulnerability to nuclear detonations of deep tunnel shelter systems below major cities. The final presentation gives the combination of weapon yield and depth of tunnels associated with various levels of damage. The vulnerability is considered for both the proposed shelter system and for individual tunnels. Primarily, attention is given to the shelters proper, although some consideration is given to the entranceways and utilities. (Author)

Naval Research Lab., Washington, D. C.
EFFECTIVENESS OF WATER MISTS FOR PROTECTION FROM RADIANT HEAT IGNITION, by H. E. Moran, Jr. Final rept. 16 Feb 60, 17p. 6 refs. NRL rept. 5439.
Order from OTS $0.50 PB 161 106

Wood specimens were exposed to radiant heat in simulation of fire spread between structures. The heat was modified in some tests by the interposition of a screen of water mist. Measurements were made of the intensity of exposure (radiant heat flux at the wood), the time required for ignition, the ignition temperature of the wood, and the effectiveness of the screening mist. The tests indicated that about 0.0005 gallon of water per square foot of screened area can reduce the radiant heat flux by 10 percent; this protection can be increased by using a larger amount of water. Substantial protection can be provided with much less water than is required by conventional fire fighting methods. The relationship between time for ignition and radiant heat flux varied considerably in repeated tests. This variation was attributed to sensitiveness of ignition to small changes in environment as well as to nonuniformity in the wood specimens. It was estimated that the lowest radiant heat capable of causing ignition is slightly below 0.55 cal/cm^2-sec. Ignition temperature was found to decrease uniformly with decreasing heat flux until it reached a limiting value of approximately 265°C. A partly empirical formula was derived for estimating the attenuating properties of a mist from its drop size distribution and water content. (Author)

Ship Building

George Washington U., Washington, D. C.
AN EXAMINATION OF CRUISER USAGE DATA: PART 1, by Mina Haskind Gourary. Rept. on Logistics Research Project, Contract Nonr-761(05). Dec 58, 18p. 2 refs. Serial T-96/58.
Order from LC mi$2.40, ph$3.30 PB 145 281

In a previous report, the author investigated the distribution of demands for ships' parts for destroyers, and compared them with data for submarines obtained by other members of the Logistics Research Project. Both destroyers and submarines are ships without central storerooms. The results suggested that the present allowance list should be expanded in range and contracted in depth in order better to satisfy the demands.

George Washington U., Washington, D. C.
EVALUATION OF DATA FOR THE USS TIRU (SS 416) by J. S. Hamilton. Rept. on Logistics Research Project, Contract Nonr-761(05). 5 Feb 59, 82p. Serial T-98/59.
Order from LC mi$4.80, ph$13.80 PB 145 591

Naval Ordnance Test Station, China Lake, Calif.
DEVELOPMENT OF FILMLESS TECHNIQUE FOR RECORDING DEFECTS IN SHIP WELDS, by J. I. Bujés. Feb 57, 41p. 2 refs. Ship Structure Committee serial no. SSC-104.
Order from LC mi$3.30, ph$7.80 PB 137 557

Direct-reading or filmless technique in radiography using a 300 mC Cobalt-60 source and a Geiger counter as a detector on a 1-in. thick steel welded test plate. At present, the scintillator is the most useful detector of gamma radiation.

Washington U. [Seattle].
WELDED REINFORCEMENT OF OPENINGS IN STRUCTURAL STEEL MEMBERS, by D. Vasarhelyi and R. A. Hechtman. Progress rept. no. 1 on Contract NObs-50238. 15 Dec 51, 124p. 32 refs. Ship Structure Committee serial no. SSC-39.
Order from LC mi$6.30, ph$19.80 PB 137 556

The opening was many times as effective in decreasing the energy absorption of the plates as their ultimate strength. The energy absorption to failure varied from only 9 to 26 percent of the value for the plain plates. The best performance with respect to their strength and energy-absorbing capacity were those plates with circular openings or with square openings with rounded corners.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

American Meat Inst. Foundation, Chicago, Ill.
IMPROVING THE QUALITY OF FROZEN-DRIED STEAKS THROUGH APPLICATION OF PROTEOLYTIC ENZYMES, by C. Edith Weir. Rept. no. 12 (Final) 1 Apr 56-30 Oct 58, on Contract DA 19-129-qm-576. [1958] 27p. 3 refs. QFCIAF File no. A-321; AD-227 761.
Order from LC mi$2.70, ph$4.80 PB 145 762

A description and discussion are made of the effects of twelve proteolytic enzymes upon muscle fiber and connective tissue structure and panel evaluations for tenderness and amount of residue infrozen-dried raw beef. Enzymes from fungal and plant origin differed in activity, fungal amylase and Rhozyme P-11 affecting the muscle fibers and bromelin, ficin and papain attacking the collagen and elastic fibers as well. Similar studies were conducted on steaks, cooked, and enzyme treated and cooked, before freeze-drying. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
EMERGENCY FOOD VALUE OF ALASKAN WILD PLANTS, by Horace F. Drury and Stanley G. Smith. July 57, 49p. 7 refs. Technical note AAL-TN-57-16.
Order from LC mi$3.30, ph$7.80 PB 146 197

This report is directed not to the scientist, for whom it would be too incomplete, nor to the student, for whom it would be too detailed, but to the instructor who must know more than he will have to teach and yet who does not have the time to become a botanist. Additional information may be obtained from the Heller report, "Wild Edible and Poisonous Plants of Alaska," and from A. E. Porsild's "Edible Plants of the Arctic." Both of these publications contain drawings and much valuable information not included in this report.

Ohio State U. Research Foundation, Columbus, Ohio.
ION-PROTEIN INTERRELATIONSHIPS AFFECTING THE QUALITY OF DEHYDRATED MEAT, by M. K. Hamdy and Fred E. Deatherage. Rept. no. 12 (Final) for 1 June 56-31 May 58 on Contract DA 19-129-qm-613. [1958] 37p. 35 refs. QFCIAF File no. A-316.
Order from LC mi$3.00, ph$6.30 PB 145 764

Freeze-dehydration did not affect the pH of control or modified meat 2 and 15 days post-mortem. Fresh control and modified meat was characterized after freeze-drying using a plate temperature of 43°C and a chamber pressure of 1500μ Hg. When the meat was freeze-dried using a plate temperature of 22-30°C and pressure of 300-400μ Hg., the water-holding capacity was improved in the rehydrated modified meat and also the eating quality. Rehydration of previously modified freeze-dried meat in a solution containing 0.2 M NaCl, 0.01 M KCl and 0.05 M Na-ascorbate favorably affected flavor, texture, and water-holding properties. Cooking prior to freeze-dehydration adversely affected the final product. Irradiation of ham using a dose of 2 x 10^6 rep had no effect on pH, water, or T. C. A. soluble protein fractions, and on the calcium and magnesium in both the water extract and the juice released upon cooking. Water-holding properties of the ham, at various temperatures, were unfavorably affected by irradiation.

Quartermaster Corps, Washington, D. C.
COFFEE FOR THE ARMED FORCES: MILITARY DEVELOPMENT AND CONVERSION TO INDUSTRY SUPPLY, by Franz A. Koehler. 1958, 136p. QMC Historical Studies Series II, No. 5.
Order from LC mi$6.90, ph$21.30 PB 145 106

The monograph attempts to show how industry in 1955-56 succeeded in displacing the military roasting plants and in itself becoming the source of roasted-and-ground coffee supplied to the Armed Forces.

Wilson and Co., Inc., Chicago, Ill.
DEVELOPMENT OF FREEZE-DEHYDRATED PRECOOKED BEEF PRODUCTS, by A. C. Edgar, J. S. Forsyth, and E. R. Packham. Rept. no. 6 (Final) for 28 Apr 57-30 June 58 on Contract DA 19-129-qm-845. [1958] 24p. QFCIAF File no. A-322.
Order from LC mi$2.70, ph$4.80 PB 145 763

The results of all previous reports are summarized. The development work which describes the ingredient specifications, formulae, and manufacturing instructions is outlined. Information dealing with the utilization of carcass and with the economics of the eight products developed is presented as the conclusion of the project. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Army Engineer Research and Development Labs., Fort Belvoir, Va.
AIRBORNE CRANE-EXCAVATOR, by James K. Knaell. Rept. for Mar-Sep 58. 27 July 59, 50p. Rept. 1589-TR; AD-228 121.
Order from LC mi$3.30, ph$7.80 PB 145 277

The structural and functional adequacy of the airborne (Airdroppable) crane-shovel and its ability to fulfill certain military characteristics was investigated. The airborne crane-shovel is a single-gasoline-engine-driven, pneumatic-tired, 4 x 4 drive machine that is full revolving and capable of craning, clamshell, dragline, and shovel operations. Lifting tests indicated that the airborne crane meets the 7-ton lifting-capacity requirement. Strain gage tests indicated structural elements are not over-stressed when maximum loads are lifted. All attachment changes except shovel front can be performed by 2 men with hand tools. The 3/8-cubic-yard buckets (Machinery, Fabrications and Accessory Equipment, are more suitable than the 1/2-cubic-yard size for military earthmoving operations. The rear outrigger box requires modification to prevent damage during shovel operation. A 2-speed transmission incorporating a low gear is required to enhance mobility. The unit can be towed cross country and at convoy speeds with a standard 2 1/2-ton, 6 x 6, Ordnance truck. Simulated air-drop tests indicated that chances for a successful airdrop are favorable. Self-propelled speed of 9.5 mph was considered the optimum safe travel speed.

Naval Civil Engineering Lab., Port Hueneme, Calif.
DEVELOPMENT OF THE RUSH ROLL, A MOBILE STRUCTURE USED AS A ROADWAY OR FLOATING PONTOON BRIDGE, by P. J. Rush. Final rept. 23 Nov 59, 41p. Technical rept. 046.
Order from LC mi$3.30, ph$7.80 PB 145 158

The Rush Roll is a mobile, 6-foot-diameter, segmented cylinder of corrugated steel pontoons weighing 6,000 pounds which can be towed by jeep. It unfolds into a four-trussed structure 13 1/2 feet wide and 17 1/2 feet long that can be rapidly joined with other rolls creating any length roadway or pontoon bridge, or outboard powered rafts. Results of field assembly, structural proof-loading and mobility experiments on land and sea are given. (Author)

Engines and Propulsion Systems

Aerojet-General Corp., Azusa, Calif.
CHEMICAL FRAGMENTS AS ULTRA-ENERGY PROPELLANTS, by D. L. Wulff, Lillian H. Baum, and J. M. Fluornoy. Abstracts bulletin no. 4, Contract AF 18(603)110. Nov 59, 60p. 234 refs. Aerojet TN-33; AFOSR-TN-59-1249.
Order from LC mi$3.60, ph$9.30 PB 145 649

Investigations of certain high-energy chemical systems as potential propellants for rocket propulsion have necessitated an extensive review of the literature concerned with chemical fragments, embracing the related subjects of production, identification, stabilization, and determination of properties. The ultra-energy substances include charged (ions) and uncharged (free radicals) molecular fragments. It is the purpose of this bulletin to help make the information accumulated in the Aerojet-General file of reference abstracts generally available. (See also PB 133 987)

Avco Research Lab. [Everett, Mass.]
THE PRODUCTION OF HIGH TEMPERATURE GAS BY MAGNETIC ACCELERATION, by G. S. Janes and R. M. Patrick. Rept. on Contract AF 49(638)61. Mar 58, 15p. 1 ref. Research rept. 27; AFOSR-TN-58-439; AD-205 519.
Order from LC mi$2.40, ph$3.30 PB 137 579

A study was made of gaseous magnetohydrodynamics under conditions where the ions Larmor radius is of the order of a millimeter while the mean free path for collisions is larger, of the order of a centimeter. This requires a temperature of 10^6°K at particle densities of a few time 10^{16} per cc. Physical phenomena in this region are interesting for fusion power applications and have more recently exhibited possible applications in space flight propulsion. (Author)

James Forrestal Research Center, Princeton, N. J.
BASIC RESEARCH IN PHYSICAL AND CHEMICAL KINETICS RELATED TO PROBLEMS OF COMBUSTION AND PROPULSION, by R. H. Wilhelm. Final rept. on Contract AF 33(038)23976. 4 Nov 59, 18p. 28 refs. TR-59-174.
Order from LC mi$2.40, ph$3.30 PB 145 685

The program of work was as follows: (a) Studies of fast reactions utilizing presently known techniques as well as devising possible new ones. (b) Studies of reactions of hydrocarbons with N_2O_5 using vapor phase reaction between methane and N_2O_5. (c) Studies of decomposition of solid nitrates of amines and their reactions with NO_2. (d) Further studies of energy exchange in collision processes. (e) Studies of kinetics related to reactions of ozone with organic compounds. This will include use of liquid and high-concentration gaseous ozone. (f) Studies of flame stabilization giving consideration: (1) to flames with known kinetics beyond those already studied; (2) to investigation of effect of a surface of controlled temperature and composition on stability limits of flames.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMBUSTION STUDIES OF AMMONIA-OXYGEN ROCKET MOTORS USING A TEMPERATURE-MEASURING PROBE, by Dwight I. Baker. Rept on Contract NOas-52-455-C. 21 Oct 52, declassified. 48p. 9 refs. Progress rept. no. 24-1.
Order from LC mi$3.30, ph$7.80 PB 146 207

A probing method was developed so that radial temperature surveys could be made in rocket-motor combustion chambers. Temperature was determined pneumatically by bleeding combustion products through a water-cooled probe which contained two sonic-flow nozzles in series. Heat was extracted from the bled gas between the two nozzles. A simplified thermodynamic theory was employed to derive an expression for chamber temperature as a function of pressures upstream from the two nozzles, a probe constant, and temperature upstream from the downstream nozzle. Values of temperature as high as 5300°F (105% of theoretical) were determined for certain test conditions. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TEMPERATURE SURVEYS OF ROCKET-MOTOR COMBUSTION CHAMBERS, by Dwight I. Baker. Rept. on Contract NOas-52-466-C. 28 Nov 52, 26p. 3 refs. Progress rept. no. 24-5.
Order from LC mi$2.70, ph$4.80 PB 146 208

Surveys of temperature and local heat flux were made within NH_3-LO_2 rocket-motor combustion chambers using pneumatic double-sonic-nozzle probes. The temperature surveys were correlated with external measurements of specific impulse, good agreement being obtained for most tests. A modified temperature-measuring probe was developed for use with the gasoline--liquid oxygen propellant system. (Author)

Purdue U., Lafayette, Ind.
A REVIEW OF THE PUBLISHED LITERATURE PERTAINING TO THE ANNULAR, TWO-PHASE FLOW OF LIQUID AND GASEOUS MEDIA IN A PIPE, by D. A. Charvonia. Rept. on Contract Nonr-1858(25). Dec 58, 151p. 55 refs. Proj. Squid Technical rept. PUR-32-R.
Order from LC mi$7.50, ph$24.30 PB 145 067

Rocket Research Lab., Ohio State U. Research Foundation, Columbus.
RESEARCH ON COMBUSTION PHENOMENA AT HIGH PRESSURES, by Rudolph Edse, William A. Strauss, and Michael C. Fong. Rept. for 1 Jan-31 Dec 58 on Contract AF 33(616)5439. Jan 59, 29p. 11 refs. WADC Technical note 59-328.
Order from OTS $0.75 PB 161 480

The burning velocities of the ammonia-oxygen and the ammonia-air flames increase and decrease respectively as the pressure is increased from 1 to 14.0 atmospheres. The effect of ethyl nitrate on the burning velocity of gas mixtures is a function of the system to which the ethyl nitrate is added. When the nitrogen in rich ethylene-oxygen-nitrogen and acetylene-oxygen-nitrogen mixtures was replaced by carbon monoxide the burning velocity was increased.

machine Parts and Mechanisms

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
A METHOD FOR THE SELECTION OF VALVES AND POWER PISTONS IN HYDRAULIC SERVOS, by Fletcher C. Paddison and Walter A. Good. Rept. on Contract NOrd-7386. Apr 54, 52p. 6 refs. CM-717A.
Order from LC mi$3.60, ph$9.30 PB 145 730

An analysis was made of hydraulic servo systems to determine a method of selecting transfer valves and power pistons that will give the optimum oil-pressure distribution within a servo. Two valve types were considered.

Naval Ordnance Test Station, China Lake, Calif.
THE NOISES OF TWO SPUR-GEAR TRANSMISSIONS, by M. Wm. Rosen. 27 July 59, 55p. NOTS TP-2293; NAVORD rept. 6569.
Order from OTS $1.50 PB 161 464

Two conventional but precision-quality planetary gear trains have been driven to 20,000 and 27,500-rpm speeds, with as much as 70 hp. Measurements were systematically made of the total acoustic energy radiated and also of the unit intensities over the frequency spectrum 0 to 30,000 cps. Total energies of up to 1/4 watt pure acoustic power were generated. Intense vibrations were radiated at frequencies corresponding with the tooth-mesh period. A law of acoustic energy was discovered for these two machines, a law which may possibly be valid for all gear trains.

Manufacturing Equipment and Processes

Budd Co., Philadelphia, Pa.
IMPROVED METHODS OF FABRICATING WELDED SANDWICH STRUCTURES: PILOT PRODUCTION LINE OPERATION AND WELD QUALITY CONTROL FOR BUDD INTEGRATED CORE PANELS, by J. E. Burton. Final rept. on Contract NOas-58-622c. 31 Oct 59, 230p.
Order from LC mi$9.90, ph$34.80 PB 145 366

A 'SUMMARY' chart of manhours required to fabricate Integrated Core Panels. Pilot line fabrication, equipment and processes are described and illustrated. Weld quality control procedures and structural test evaluation of panels produced on the pilot line are presented along with recommendations for the reduction of the overall cost of quality control.

Hoffman, P. R., Co., Carlisle, Pa.
TECHNICAL REPORT. Final rept. for Apr 49-Oct 51 on Contract W36-039-sc-38267. [1951] 14p.
Order from LC mi$2.40, ph$3.30 PB 145 217

Development of a quartz cutting saw to cut quartz bars or mothers into slices or wafers for the manufacture of quartz crystal blanks capable of cutting simultaneously with up to twenty (20) blades, with parallel sides on ZZ' rotation within the tolerance of plus or minus three minutes and plus or minus ten minutes on XX' rotation.

Office of Ordnance Research, Durham, N. C.
PROCEEDINGS OF THE ORDNANCE CONFERENCE [NO. 4] ON OPERATIONS RESEARCH HELD AT HEADQUARTERS, U. S. ORDNANCE MISSILE COMMAND 1-3 APRIL 1959. [1959] 175p. 29 refs. Rept. no. OORR 59-3.
Order from LC mi$8.10, ph$27.30 PB 145 381

Contents:
Some aspects of experimental design in operations research
Mathematical models and the utilization of these models
Computer played war games
Aspects of operations research in missile system testing
Discounted least squares
A practical application of the waiting line theory for the optimum allocation of machine repair operators
Linear programming applied to economic selection of materials for furnace charges
An optimal method for product development
Variations of the "Tolerance-Limit Test" problem
Analysis of demand rates
A computer simulation of small combat actions
Army logistics research
Future operations research problems in ordnance logistics
(See also PB 139 625)

Rodman Lab., Watertown Arsenal, Mass.
ECONOMIC ANALYSIS FOR TURNING WITH CERAMIC TOOLS, by Roy Mennell. Dec 59, 63p. 36 refs. Rept. no. RPL 23/11.
Order from OTS $1.75 PB 161 466

By constructing a cost model based on an empirical description of tool-life data and including the variables of machining speed, feed, machine life, type of machine, and tool material, it is possible to determine the conditions which give the least machining cost. Included in the analysis are restrictions of available lathe speed and horsepower which must be considered because present production equipment is designed for conventional carbide tools utilizing smaller speeds and less horsepower. A method of discounting all costs of a chain of equipment, similar to accepted equipment investment analysis, is described for obtaining the cost for the use of the equipment per minute of operation.

Stanford U., Calif.
A POSTSCRIPT TO "DYNAMIC PROBLEMS IN THE THEORY OF THE FIRM", by Harvey M. Wagner. Technical rept. no. 72 on Contract N6onr-251(33). 23 Mar 59, 11p. 3 refs.
Order from LC mi$2.40, ph$3.30 PB 145 389

A previous paper discussed the combined use of traditional economic constructs and dynamic programming for solutions to several inter-temporal problems in the theory of the firm (that produces a single commodity). As a specific application of these techniques, a method was presented for solving a dynamic version of the economic lot size model. The purpose of this postscript is (i) to demonstrate the algorithm suggested for the dynamic economic lot size model is also applicable to situations in which the cost curves (which may differ from period to period) have non-increasing marginal costs as a function of output, e.g., due to quantity discounts, and (ii) to describe a forward algorithm for solving optimal pricing and output problems in which the cost curves have non-decreasing marginal costs as a function of output.

MATERIALS

Army Chemical Warfare Labs., Army Chemical Center, Md.
SIXTH MATERIALS REVIEW, by Arthur Lyem. Nov 59, 93p. 255 refs. CWL Special Publication 4-11.
Order from OTS $2.25 PB 161 463

The purpose of this periodic review is to present information on important technical and scientific high lights regarding materials research here and abroad, principally in the polymer and plastics field. The information recorded herein is intended to serve as a timely and convenient reference for development personnel seeking information relative to engineering materials of actual or potential interest in creating more efficient or economical end items. Thus, technical literature surveys culminating in the "Materials Review" will promote dissemination of selected information concerning recent world-wide technological advancements which may help to guide future exploitations of synthetics and other new materials and techniques. (See also PB 161 014)

Automation Instruments, Inc., Boulder, Colo.
INVESTIGATION OF METHODS FOR DETERMINING ACTUAL FLAW SIZE IN MATERIALS BY NON-DESTRUCTIVE ULTRASONIC TECHNIQUES, by Gerald J. Posakony and Merle R. Loetz. Rept. for 15 May 58-15 May 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5714. Dec 59, 64p. WADC Technical rept. 59-302.
Order from OTS $1.75 PB 161 530

The investigation of methods to determine actual flaw size in materials by ultrasonic non-destructive techniques has led to the development of breadboard equipment capable of displaying additional flaw information. By electronic networks, the ultrasonic reflections are displayed into a three-dimensional view of the internal structure of a flat metal part. Three dimensional pictures are included to show the resultant of the single and multiple transducer techniques. Various frequencies and materials are evaluated to establish preliminary applicability of the processes. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
NOTES ON MECHANICAL TESTING TECHNIQUES AT VERY LOW TEMPERATURES, by James E. Campbell. 19 Feb 60, 8p. 14 refs. DMIC memo. 43.
Order from OTS $0.50 PB 161 193

Several techniques have been developed for evaluating the mechanical properties of materials at temperatures in the range between -423 F (-253 C) and -452 F (-269 C), the boiling points of liquid hydrogen and liquid helium. The various techniques are discussed briefly.

Illinois U., Urbana.
STUDIES OF THE STABILITY OF HIGH TEMPERATURE RESISTANT CERAMIC COATING GLASSES, by William R. Bratschun, C. N. Williams, and Dwight G. Bennett. Rept. on Contract AF 18(603)28. July 58, 39p. 8 refs. Dept. of Ceramic Engineering rept. no. 82; AFOSR-TN-58-828; AD-202 913.
Order from LC mi$3.00, ph$6.30 PB 138 167

Chemical and physical mechanisms were studied which were believed responsible for the instabilities of the glassy phase of composite glass-metal systems when subjected to elevated temperatures over prolonged periods of time. Two prominent types of glass devitrification behavior were (1) cyclic development, disappearance and reappearance of various diffraction peaks, (2) diffraction peaks which persisted throughout the heat treating period. Single oxide additions of CaO, ZnO, TiO_2, Bi_2O_3 and CoO_2 to the simple glass all delayed the initial appearance of the devitrification products.

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
JOINING OF REINFORCED PLASTICS WITH METAL FASTENERS, RESEARCH AND DEVELOPMENT REPORT, by A. Rufolo. Research and Development rept. (Final). 12 Dec 57, 39p. 14 refs. Lab. Project 4860-Q-14; AD-203 360.
Order from LC mi$3.00, ph$6.30 PB 145 356

The problem of construction by joining plastic laminates is attacked by developing a riveting technique and the collecting of design data on holding strength of screw type fasteners. The report includes a field instruction manual for driving aluminum rivets in plastics, and a design manual giving holding strength of screws in polyester glass laminates. (Author)

Office of Naval Research, Washington, D. C.
SYMPOSIUM ON MATERIALS RESEARCH IN THE NAVY, HELD IN PHILADELPHIA, PENNSYLVANIA, MARCH 17-19, 1959, [1959] 383p. 135 refs. ONR-5, Volume 2; AD-217 823.
Order from OTS $5.00 PB 161 471

Contents: Modern materials research; Dynamics of polarization reversal process in ferroelectrics; Concepts of electronic equipment and parts reliability; Structural interplay; Fracture of ultra-high-strength steel electro-plated with Cd; Fracture toughness of materials for aircraft and missiles;

Crack propagation in hydrogen embrittled steel; Minimization of adverse effects of chrome plating on fatigue life of AISI 4340 steel and correlation of fatigue and elastic limits; Materials problems in aircraft structural fatigue; Ballistic method for determining dynamic yield strength of metals; Elevated-temperature mechanical properties of an austempered low alloy steel during continuous heating; Elevated temperature effects on structural specimens; Environmental effects in high-temperature creep and fatigue; Size effect on the tensile properties of large bars of AISI4340 steel; Material problems in space technology; High-temperature strain gages for structural testing; Electron probe microanalyzer for materials research; Weldability of ultra-high-strength steels; Determination of wear behavior of plated Ti alloy; Reference radiographs for Naval aircraft casting procurement; Navy dry film development; Sliding friction and wear under high velocity and bearing pressures; Photodetector parameters; Annealing procedures and results for evaporated InSb films; Zone concept of crystal growth; Properties of garnets; Detecting intergranular corrosion susceptibility in Al alloys. (See also PB 161 470)

Office of Naval Research, Washington, D. C.
SYMPOSIUM ON MATERIALS RESEARCH IN THE NAVY, HELD IN PHILADELPHIA, PENNSYLVANIA, MARCH 17-19, 1959. [1959] 414p. 110 refs. ONR-5, Volume 1; AD-217 822.
Order from OTS $6.00 PB 161 470

Contents: Toxicology in relation to Navy material problems; Reliability as applied to materials research and selection; Development of urethane plastic foams and inorganic ceramic foams for precision radomes; Reinforced plastics for rocket motors and re-entry heat shields; Development in reinforced plastics at the Naval Ordnance Laboratory; The phosphinic nitrides - potential high-temperature polymeric dielectrics; Effects of elevated temperatures on electrical properties of thermosetting plastics; Laminated fabrics structural material of airship envelopes; Foreign woods of interest to the Navy for shipbuilding applications; Reliability of Navy aircrew safety and survival equipment mechanical systems - Material selection and manufacturing processes; Deterioration; Response of aircraft skin materials to radiation from high-temperature sources; Choice of rubbers for gaskets in nuclear radiation fields; Nuclear radiation effects in magnetic core materials and permanent magnets; Corrosion mechanisms in the reaction of steel with water and oxygenated solutions at room temperature and 316°C; Recent contributions of chemistry in the prevention and control of corrosion in the Navy; Deterioration of plasticized polymeric materials; Environmental deterioration of rigid plastics; A discussion of some of the problems of thermoelectric efficiency and coefficient of performance; Thermal properties of cadmium antimonide; Some aspects of the luminescence of glass and its applications.

Ceramics and Refractories

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
REFRACTORY MATERIALS, by R. I. Jaffee and D. J. Maykuth. 26 Feb 60, 35p. 45 refs. DMIC memo. 44.
Order from OTS $0.50 PB 161 194

Technical requirements for materials in advanced applications have become so broad that it is now essential to consider nonmetallic as well as metallic materials. The cutoff in melting point between refractory and nonrefractory materials will be selected at 1800 C. This has been done to include as refractory materials: chromium as a metal, molybdenum disilicide as an intermetallic compound, and titanium dioxide as an oxide. 122 refractory materials considered include graphite, 12 refractory metals, 18 carbides, 13 oxides, 12 nitrides, 17 silicides, 19 borides, 22 sulfides, and 8 intermetallic compounds.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
METHODS OF BLENDING AND MOLDING GLASS-FLAKE LAMINATES, by Paul H. Rothschild. Apr 59, 9p. Technical notes no. 29; AD-216 493.
Order from LC mi$1.80, ph$1.80 PB 146 158

Several experimental techniques for coating glass flakes with resin were tried. The addition of reactive diluents to reduce the viscosity of the resin proved the most satisfactory. The use of a roll mill offered most promise as a method of blending the resin and flakes, though more work is needed to develop this technique.

New York State Coll. of Ceramics, Alfred U.
METAL FIBER REINFORCED CERAMICS, by J. J. Swica, W. R. Hoskyns and others. Rept. for 1 Sep 58-31 Aug 59 on Ceramic and Cermet Materials, Contract AF 33(616)5298. Jan 60, 50p. 5 refs. WADC Technical rept. 58-452, Pt. 2.
Order from OTS $1.25 PB 161 481

The principal geometric variables involved in ceramic-refractory metal fiber composites were evaluated using thermal shock resistance as the most important criteria. Several different ceramic-metal fiber composites were investigated. Using the alumina-molybdenum and alumina-mullite-molybdenum fiber systems, the comparative properties of the two basic types of composites were demonstrated. Composites were developed which had flexural strengths exceeding 30,000 psi following four thermal shock cycles. (Author) (See also PB 151 610)

Fuels, Lubricants, and Hydraulic Fluids

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
CALCULATION OF DETONATION PARAMETERS FOR GASEOUS MIXTURES, by Bernard T. Wolfson and Robert G. Dunn. Rept. on Research and Combustion Kinetics. May 59, 101p. 28 refs. WADC Technical note 57-309; AD-131 024.
Order from OTS $2.50 PB 161 477

A simplified and straight forward yet precise method for the calculation of all detonation parameters for gaseous mixtures is presented. The equations upon which the calculation procedure is based were derived directly from the conservation equations without approximations and involve only nondimensional quantities. The use of the method of calculation developed is illustrated by means of sample calculations. The agreement between values calculated by this method and experimental values is quite satisfactory. The calculation method developed is readily adaptable to computations by automatic computing machines as well as by manually-operated machines. (Author)

Atlantic Research Corp., Alexandria, Va.
INVESTIGATION TO DETERMINE BUILDUP OF A STATIC ELECTRIC FIELD CHARGE IN A ROLLING FLUID TRANSPORTER, by John H. Morgenthaler. Final rept., phase III, on Contract DA 44-177-TC-461. 28 Sep 59, 17p. Proj. 9-47-16-000, 104MT.
Order from LC mi$2.40, ph$3.30 PB 145 238

The purpose of the work of Phase III was to evaluate the potential hazard during filling and emptying of rolling fluid transporters with JP-4 fuel at flow rates in excess of 15 gpm. Attempts were made to detect static-electrical discharges during filling and emptying of rolling fluid transporters with 350 to 400 gallons of fuel. Flow rates ranging from 15 to 20 and from 25 to 35 gpm were used during the filling and emptying operations, respectively. Fuel temperatures were between 75 and 80°F in the runs at ambient temperature, and between 30 and 35°F in the cold runs. No evidence of any static-electrical discharges during filling or emptying of the rolling fluid transporter was obtained under the conditions of these tests which appear reasonably to simulate field operations. (Author) (See also PB 143 323)

Atlantic Research Corp., Alexandria, Va.
RESEARCH ON SOLID-PROPELLANT COMBUSTION, by Raymond Friedman, Joseph B. Levy, and Keith E. Rumbel. Final technical rept. for July 55-Oct 59 on Contract AF 18(600)1502. 30 Nov 59, 19p. 13 refs. AFOSR-TR-59-192; AD-230 724.
Order from LC mi$2.40, ph$3.30 PB 145 684

The goal of the present research program has been to gain understanding of the combustion mechanism of solid propellants containing ammonium perchlorate as oxidizer. This goal has been pursued by the study of the self-deflagration of pressed pellets of ammonium perchlorate. The results and progress of this program have been described in three technical notes.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
FIRST YEAR OF BULK PROPELLANT SURVEILLANCE UNDER MILITARY STANDARD 1231 (ORD), by Norman E. Beach. Dec 59, 32p. 7 refs. Technical memo. no. ACS-4-59; AD-230 722.
Order from LC mi$3.00, ph$6.30 PB 145 709

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELASTOMERIC-BINDER AND MECHANICAL-PROPERTY REQUIREMENTS FOR SOLID PROPELLANTS, by Thor L. Smith. Rept. on Contract DA 04-495-ORD-18. 7 Jan 59, 18p. 12 refs. Memo. no. 20-178; AD-211 650.
Order from LC mi$2.40, ph$3.30 PB 145 078

A summary is presented of the many factors that must be considered in selecting new elastomeric binders for castable composite propellants and in improving the properties of propellants under development. A brief description is given concerning methods of preparing and using composite propellants, and the mechanical properties required of cast-in-place case-bonded grains are discussed qualitatively. Methods of evaluating some time-dependent tensile properties are described, and some illustrative data are given. Finally, the properties desired of an ideal elastomeric binder are presented together with some relations between the mechanical properties of unfilled binders and propellants. The influence of ballistic-property requirements on the choice of binders and on propellant mechanical properties is also considered. (Author)

Little, Arthur D., Inc. [Cambridge, Mass.]
A TEMPERATURE REGULATED IGNITION SOURCE, by John Preston and Leland E. Ashman. Rept. on Contract AF 18(603)109. 1 Jan 59, 24p. 4 refs. [AFOSR]-TN-59-30; AD-209 202.
Order from LC mi$2.70, ph$4.80 PB 145 622

Since the current to maintain a wire at a constant temperature depends largely upon the environment of the wire, the current and the temperature are a means of measuring the properties of that environment. The temperature controller described here is capable of heating a fine wire--of the order of a few mils in diameter--to some temperature between 700°C and the melting temperature, and holding the temperature constant to within a few degrees. The detector is a photomultiplier that monitors radiation from the center of the wire; changes in radiation result in compensating changes in the current. The controller responds within a millisecond to sudden changes in the environment of the wire. This rapid response is useful for detecting the onset of ignition in reactive gases and perhaps for measuring the thermal properties of nonreactive gases. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
ON THE ASSUMPTIONS UNDERLYING DROPLET VAPORIZATION AND COMBUSTION THEORIES, by F. A. Williams. Technical note on Contract AF 49(638)412. Nov 59, 49p. 11 refs. LMSD-288098; AFOSR-TN-59-1148.
Order from LC mi$3.30, ph$7.80 PB 145 845

A study is undertaken to determine the range of validity of the assumptions that (a) the liquid temperature is constant and equal to the boiling temperature for a burning droplet, (b) the instantaneous vaporization rate of a droplet at a given size is the same as that of a constant-diameter sphere of the same size, and (c) the duration of the initial unsteady period is much less than the total vaporization time of a droplet.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
HIGH TEMPERATURE EVALUATION PROCEDURES FOR LUBRICANTS. PART I. DESIGN DEVELOPMENT AND INSTRUMENTATION OF A 1000°F OXIDATION CORROSION BATH AND 400°F VISCOSITY BATHS, by Vernon A. Lauer and Donald C. Trop. Rept. for Feb 58-Apr 59 on Avaition Lubricants. Aug 59, 23p. 3 refs. WADC Technical note 59-160, Pt. 1.
Order from OTS $0.75 PB 161 506

The design, development and instrumentation is described of a high temperature aluminum block bath capable of attaining and controlling temperatures up to 1000°F ±5°F. Two high temperature viscosity baths capable of attaining and maintaining 400°F and 700°F respectively are also described. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE QUANTITATIVE ANALYSIS OF N-PHENYL-ALPHA-NAPHTHYLAMINE AND 5-ETHYL-10, 10-DIPHENYLPHENAZASILINE IN ALIPHATIC TRIESTER BASE STOCK FLUID, by Lee D. Smithson and James T. Thompson. Rept. for July-Sep 59 on Materials Analysis and Evaluation Techniques. Jan 60, 20p. 2 refs. WADC Technical rept. 59-666.
Order from OTS $0.50 PB 161 502

A quantitative ultra-violet method has been developed for determining the quantity of two antioxidant additives (n-phenyl-alpha-naphthylamine and 5-ethyl-10, 10-diphenylphenazasiline) when blended with an aliphatic triester base stock fluid. The method has been applied to engine tested samples. (Author)

Leather and Textiles

Navy Electronics Lab., San Diego, Calif.
VISIBILITY OF SIGNAL FLAGS, by A. Morris and J. M. Hood, Jr. Research and Development rept. for May 56-Dec 57. 17 Oct 58, 11p. 1 ref. NEL/Report 864; AD-213 904.
Order from LC mi$2.40, ph$3.30 PB 145 627

A study was made to determine the factors contributing to the visibility of standard signal flags as seen through standard optical devices under various atmospheric conditions. The prevailing condition of illumination was found to be the major contributing factor to such visibility. The use of optical aids is limited by ship size, since the effectiveness of high magnification is hindered by unsteadiness of small ships. A pilot study employing 7X50 binoculars with miniature signal flags gave recognition ranges in agreement with previously reported ranges for full-scale flags. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
AN EVALUATION OF NEW FIBER BLENDS IN ARMY SUMMER UNIFORM FABRICS, by C. J. Monego and S. J. Kennedy. May 59, 73p. 16 refs. Textile Series rept. no. 108.
Order from OTS $2.00 PB 161 331

This report presents the results of a detailed laboratory and field study on nine tropical-type blended fabrics which were developed for this test through close cooperation between fiber producers and fabric manufacturers. The development of each fabric was based on the fabric manufacturer's previous experience with that particular blend on the civilian market, and only those blends which had achieved a marked consumer preference were considered. The results of this study show that the 60/40 polyester/wool blend performed well in laboratory tests and ranked higher than the other fabrics in field tests.

MATHEMATICS

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE PROBABILITY INTEGRALS OF THE RANGE AND OF THE STUDENTIZED RANGE. PROBABILITY INTEGRAL AND PERCENTAGE POINTS OF THE STUDENTIZED RANGE; CRITICAL VALUES FOR DUNCAN'S NEW MULTIPLE RANGE TEST, by H. Leon Harter, Donald S. Clemm and Eugene H. Guthrie. Rept. on Transformations in the Analysis of Variance. Oct 59, 314p. 15 refs. WADC Technical rept. 58-484, Volume II.
Order from OTS $5.00 PB 161 517

A description is given of the computation and use of tables of the probability integral of the studentized range, percentage points of the studentized range, and critical values for Duncan's new multiple range test, all based upon samples from a normal distribution. The following tables are included: (1) a table (to six decimal places or six significant figures, whichever is less accurate) of the probability integral of the studentized range, $Q = w/s$, with varying intervals (small enough to make the table interpolable) for samples of size $n = 2(1)20(2)40(10)100$, with degrees of freedom $\nu = 1(1)20, 24, 30, 40, 60$, and 120 for the independent estimate s of the population standard

deviation; (2) a table (to four decimal places or four significant figures, whichever is less accurate) of the percentage points of the studentized range corresponding to cumulative probabilities P=0.001, 0.005, 0.01, 0.025, 0.05, 0.1 (0.1) 0.9, 0.95, 0.975, 0.99, 0.995, and 0.999 for the same values of n and ν, also for $\nu = \infty$; and (3) a table (to four decimal places or four significant figures, whichever is less accurate) of the critical values for Duncan's new multiple range test at significance levels α=0.1, 0.05, 0.01, 0.005, and 0.001, corresponding respectively to protection levels P=$(0.9)^{n-1}$, $(0.95)^{n-1}$, $(0.99)^{n-1}$, $(0.995)^{n-1}$, and $(0.999)^{n-1}$, for the same values of n and ν (including $\nu = \infty$). (Author) (See also PB 161 037)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE ADMISSIBILITY OF PITMAN'S ESTIMATOR FOR TWO LOCATION PARAMETERS, by Charles Stein. Technical rept. no. 25 on Contract Nonr-225(21). 6 Feb 59, 26p. 4 refs; AD-211 079.
Order from LC mi$2.70, ph$4.80 PB 145 597

Applied Mathematics and Statistics Lab., Stanford U., Calif.
APPLICATIONS OF ALMOST PERIODIC COMPACTIFICATIONS, by K. Deleeuw and I. Glicksberg. Technical note no. 9 on Contract AF 49(638)294. 28 Dec 59, 63p. 20 refs. AFOSR-TN-59-1174.
Order from LC mi$4.50, ph$12.30 PB 145 552

Almost periodic compactifications of operator semigroups are constructed and applications to the theory of weakly almost periodic functions and to ergodic theory are given. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A BIVARIATE TCHEBYCHEFF INEQUALITY FOR CERTAIN CONVEX SETS, by Albert W. Marshall and Ingram Olkin. Technical rept. no. 26 on Contract Nonr-225(21). 20 Mar 59, 30p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 145 598

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE ISOMETRIES OF H_1, by Karel Deleeuw. Technical note no. 8 on Contract AF 49(638)294. 30 Nov 59, 28p. 9 refs. AFOSR-TN-59-1111.
Order from LC mi$2.70, ph$4.80 PB 145 516

All of the linear isometries of H_1 onto itself are shown to be induced by conformal maps of the unit disk. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
MULTIPLIERS OF COMMUTATIVE BANACH ALGEBRAS, by Ju-Kwei Wang. Technical note no. 10 on Contract AF 49(638)294. 29 Dec 59, 39p. 9 refs. AFOSR-TN-59-1288.
Order from LC mi$3.00, ph$6.30 PB 145 507

Applied Mathematics and Statistics Lab., Stanford U., Calif.
PARTIAL DIFFERENTIAL EQUATIONS WITH MORE THAN TWO INDEPENDENT VARIABLES IN THE COMPLEX DOMAIN, by P. R. Garabedian. Technical rept. no. 82 on Contract Nonr-225(11). 19 Mar 59, 69p. 12 refs.
Order from LC mi$3.90, ph$10.80 PB 145 596

In this paper we shall be primarily concerned with linear partial differential equations of the second order whose coefficients are analytic. We shall be interested in properties of the solutions of such equations which can be studied by means of an analytic continuation into the domain of complex values of the independent variables. The case of two independent variables has been thoroughly investigated from this point of view, and our contribution here will therefore be to problems involving three or more variables. The significance of such a study lies in the hope it offers of extending to several variables some of the theories for partial differential equations in two variables which depend on conformal mapping or on the introduction of characteristic coordinates,

Applied Mathematics and Statistics Lab., Stanford U., Calif.
UNIFORM BOUNDEDNESS FOR GROUPS, by Irving Glicksberg. Technical note no. 11 on Contract AF 49(638)294. 30 Dec 59, 19p. 5 refs. AFOSR-TN-60-33.
Order from LC mi$2.40, ph$3.30 PB 145 790

Certain analogues of the uniform boundedness results for Banach spaces are established for locally compact abelian groups. (Author)

California U., Berkeley.
A COMPARISON THEOREM FOR ELLIPTIC EQUATIONS, by M. H. Protter. Technical rept. no. 1 on Contract AF 49(638)398. Sep 58, 7p. 3 refs. AFOSR-TN-58-842; AD-203 332.
Order from LC mi$1.80, ph$1.80 PB 138 166

Hartman and Wintner (Proc. Amer. Math. Soc. vol. 6 (1955) p. 862ff.) obtained a Sturmian comparison theorem for self-adjoint second order linear elliptic equations of the form

$$\sum_{i,j=1}^{n} \frac{\partial}{\partial x_i}\left(a_{ij}\frac{\partial u}{\partial x_j}\right) + fu = 0 \qquad a_{ij} = a_{ji}$$

in a bounded domain D with boundary Γ. It is the purpose of this note to extend their result to general second order linear elliptic equations.

California U., Berkeley.
A NOTE ON CERTAIN POLYNOMIAL ALGEBRAS, by Emery Thomas. Technical rept. no. 12 on Contract AF 49(638)79. Jan 60, 11p. 4 refs. AFOSR-TN-59-937.
Order from LC mi$2.40, ph$3.30 PB 145 556

This note considers polynomial algebras defined over integral domains of characteristic 2. For each algebra a derivation β is defined and the main theorem gives a splitting of the algebra relative to β. The theorem is then applied to several examples from Algebraic Topology: namely, to the mod. 2 cohomology algebras of the Grassmann complexes, and to a subalgebra W of the Thom algebra N of non-oriented differentiable manifolds. (Author)

California U., Berkeley.
SECOND ORDER ELLIPTIC EQUATIONS IN SEVERAL VARIABLES AND HOLDER CONTINUITY, by Charles B. Morrey, Jr. Technical rept. no. 5 on Contract Nonr-222(62). Mar 59, 37p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 254

In this paper are discussed the Hölder continuity of the solutions of equations of the form

$$\int_G [v_{,\alpha}(a^{\alpha\beta}u_{,\beta} + b^{\alpha}u + e^{\alpha}) + v(c^{\alpha}u_{,\alpha} + du + f)]dx = 0$$

for all $v \in H^1_{2,0}$ on G where it is assumed that the $a^{\alpha\beta}$ are bounded and measurable and satisfy the uniform ellipticity condition, the coefficients b^{α} and $c^{\alpha} \in L_{2p}$ and $d \in L_p$ for some $p > \nu/2$ (ν being the number of x variables), the $e^{\alpha} \in L_2$ and $f \in L_1$, and e and f satisfy certain integral growth conditions.

California U., Los Angeles.
COMPUTER EVALUATED TABLES FOR THE SIMPLIFICATION OF BOOLEAN FORMULAS, by Aviezri Fraenkel (Weizmann Inst. of Science). Rept. on Contract Nonr-233(52). Mar 59, 23p. 5 refs. Dept. of Engineering rept. no. 59-16.
Order from LC mi$2.70, ph$4.80 PB 145 118

There exist 2^{2^n} n-variable Boolean functions. The two tables presented herein, involve the cases n = 3 and n = 4 respectively. Each table gives $N_1 = N_1$ (n, k, e, t) and $N_2 = \sum_t N_1$, where k is the number of units in the truth table representation of functions, e is a generally triple-number quantity, expressing the number of elements in the set of prime implicants; the number of elements in an equivalent simplest disjunctive normal formula; and the number of equivalent distinct simplest disjunctive normal formulas. (The number of elements of a formula is defined to be the total number of occurrences of variables or their negations in the formula.) t is a parameter which states presence or absence of units at some fixed places of truth tables. The two tables were computed by means of a simplification method described elsewhere, which was programmed on a digital computer. The complete tables were printed out directly from the output equipment of the computer.

Carnegie Inst. of Tech., Pittsburgh, Pa.
CHARACTERISTIC VALUES ASSOCIATED WITH A CLASS OF NONLINEAR SECOND-ORDER DIFFERENTIAL EQUATIONS, by Zeev Nehari. Technical rept no. 31 on Contract AF 49(638)227. Dec 59, 46p. 7 refs. AFOSR-TN-59-1262.
Order from LC mi$3.30, ph$7.80 PB 145 492

Chicago U., Ill.
INVESTIGATIONS IN THE THEORY OF PARTIAL DIFFERENTIAL EQUATIONS, by Lawrence M. Graves. Final rept. for 1 July 55-31 Dec 59 on Contract DA 11-022-ORD-1833. Dec 59, 6p.
Order from LC mi$1.80, ph$1.80 PB 145 713

Chicago U., Ill.
REVIEW OF SOME RESULTS IN COLLINEATION GROUPS, by D. R. Hughes. Rept. on Contract AF 18(600)1383. Oct 59, 18p. 28 refs. AFOSR-TN-59-1124.
Order from LC mi$2.40, ph$3.30 PB 145 486

In this paper an attempt is made to review a part of the subject of collineation groups of finite projective planes. The more or less classical aspects of Desarguesian geometry are largely disregarded and the infinite planes are skipped. An example due to Marshall Hall shows that there are infinite projective planes with trivial collineation groups (and it is also probably possible to construct an infinite plane with any prescribed countably infinite group as exactly its full collineation group). But in the finite case, every known plane has a rather "large" collineation group. Whether this is an accident of our limited knowledge, or a theorem yet to be proved, is one of the most important problems in the study of finite planes.

Chicago U., Ill.
SUBJECTIVE PROBABILITY AND STATISTICAL PRACTICE, by Leonard J. Savage. Rept. on Contracts AF 49(638)391 and Nonr-2121(09). 28 Oct 59, 46p. 116 refs. AFOSR-TN-59-1161.
Order from LC mi$3.30, ph$7.80 PB 145 491

The concept of subjective, or personal, probability has much to contribute to statistical practice. It leads to criticism and amplification of conventional methods and the development of new ones. This is especially well illustrated in problems of estimation, where precise measurement can be shown to justify sharp and rather well-defined final probability distributions of parameters. (Author)

Chicago U., Ill.
TRIPLE TORSION PRODUCTS AND MULTIPLE KUNNETH FORMULAS, by Saunders Mac Lane. Rept. on Contract AF 18(600)1383. Nov 59, 25p. 3 refs. AFOSR-TN-60-45.
Order from LC mi$2.70, ph$4.80 PB 145 512

Chicago U., Ill.
THE WEIERSTRASS CONDITION FOR MULTIPLE INTEGRAL VARIATIONAL PROBLEMS INVOLVING HIGHER DERIVATIVES, by Lawrence M. Graves. Technical rept. no. 9 on Investigations in the Theory of Partial Differential Equations, Contract DA 11-022-ORD-1833. Nov 59, 11p. OOR rept. 1444.12-M.
Order from LC mi$2.40, ph$3.30 PB 145 179

It is well known that the necessary condition of Weierstrass for multiple integrals involving several dependent variables z_k and only their first partial derivatives involves variations of the derivatives of the form $D_{x_j}\zeta_k = C_k\alpha_j$, that is, the matrix of these derivatives has rank one at most. This report treats the case when derivatives of higher order appear.

Harvard U., Cambridge, Mass.
COMPLETE IDEALS IN REGULAR LOCAL RINGS OF DIMENSION 2, by Oscar Zariski. Rept. on Contract AF 49(638)494. Dec 59, 61p. 1 ref. AFOSR-TN-59-1114.
Order from LC mi$3.90, ph$10.80 PB 145 484

The theory of complete ideals in polynomial rings k[x, y] of two variables presents some particularly striking features. This theory, developed by the author in 1938, will be presented in the appendix in a much simpler form and in greater generality. The generalization consists in dealing with arbitrary regular local rings of dimension 2, rather than with that special class of such rings which come from quotient rings of k[x, y] with respect to maximal ideals in k[x, y]. Very little is known about complete ideals in regular local rings of dimension greater than 2. It is almost certain that the theory developed here cannot be generalized to higher dimension without substantial modifications of both statements and proofs. (Author)

Hebrew U. (Israel).
THE L_p APPROACH TO THE DIRICHLET PROBLEM, PART I, by Shmuel Agmon. Technical note no. 7 on Contract AF 61(052)187. Aug 59, 100p. 32 refs. AFOSR-TN-59-815.
Order from LC mi$5.40, ph$15.30 PB 145 312

In this paper a L_p approach is presented to the Dirichlet problem and to related regularity problems for higher order elliptic equations.

Hebrew U. (Israel).
ON THE CONCEPT OF A DIFFERENTIALLY CLOSED FIELD, by Abraham Robinson. Technical note no. 6 on Contract AF 61(052)187. July 59, 38p. 14 refs. AFOSR-TN-59-814.
Order from LC mi$3.00, ph$6.30 PB 145 483

A concept of differentially closed field is formulated containing Kolchin's universal extension as a special case. Applications include a theorem on the specialisation of parameters and a constructive version of Ritt's Nullstellensatz. (Author)

Hebrew U. (Israel).
ON SOME COMPOSITIONS OF HADAMARD TYPE IN CLASSES OF ANALYTIC FUNCTIONS, by C. Loewner and E. Netanyahu. Technical note no. 5 on Contract AF 61(052)187. June 59, 7p. 1 ref. AFOSR-TN-59-843; AD-220 708.
Order from LC mi$1.80, ph$1.80 PB 145 310

Let S be the class of regular, and Schlicht functions in the unit circle. Let $f(z)=\sum_{n=1}^{\infty} a_n z^n$, $a_1=1$ and $g(z)=\sum_{n=1}^{\infty} b_n z^n$, $b_1=1$, be the representing power series of 2 elements of S. Then the composition $h(z)=\sum_{n=1}^{\infty} a_n b_n z_n$ leads to an element of the same class. The weak conjecture that h(z) has a non-vanishing derivative in $|z|<1$ is proved to be false.

Institute for Advanced Study, Princeton, N. J.
ANOTHER CUTPOINT THEOREM FOR PLANE CONTINUA, by F. Burton Jones. Rept. on Contract AF 18(600)1109. Oct 59, 5p. 2 refs. AFOSR-TN-59-1123.
Order from LC mi$1.80, ph$1.80 PB 145 485

If p and q are points of different components of the interior M then the author has previously shown that some point x of M cuts p from q in M. In other words, in the given situation there is a point x of M which belongs to every subcontinuum of M which contains both p and q. However, it is not necessary that p and q belong to the same interior component if no point of M cuts between them. But it is necessary that both p and q belong to the closure of some interior component. In other words, if the closure of no interior component of M contains both p and q, then some point x of M cuts p from q in M. (Author)

Institute for Advanced Study, Princeton, N. J.
COMMON TRANSVERSALS FOR FAMILIES OF SETS, by Branko Grünbaum. Rept. on Contract AF 49(638)253. Oct 59, 13p. 29 refs. AFOSR-TN-59-1036; AD-228 281.
Order from LC mi$2.40, ph$3.30 PB 145 069

Let a family K of compact, convex sets be given. Conditions on K are investigated for which the existence of a straight line intersecting all the members of K results from the assumption that for every k-membered sub-family of K, where k is a suitable fixed integer, there exists a straight line intersecting all the members of the subfamily. (Author)

Institute for Advanced Study, Princeton, N. J.
ON POLYHEDRA IN E^3 HAVING ALL FACES CONGRUENT, by B. Grünbaum. Rept. on Contract AF 49(638)253. Oct 59, 6p. 2 refs. AFOSR-TN-59-1129.
Order from LC mi$1.80, ph$1.80 PB 145 487

A problem of H. Steinhaus, proposed in the "New Scottish Book", is solved by the following Theorem: If all the faces of a convex polyhedron in Euclidean 3-space are congruent, then the polyhedron has an even number of faces. (Author)

Institute for Advanced Study, Princeton, N. J.
ON SOME PROPERTIES OF CONVEX SETS, by Branko Grunbaum. Rept. on Contract AF 49(638)253. Nov 59, 5p. 6 refs. AFOSR-TN-59-1157; AD-229 959.
Order from LC mi$1.80, ph$1.80 PB 145 490

A conjecture of H. Steinhaus (Fundamenta Math. 41: 284-290, 1955) on the diameters of plane sections of convex bodies in E^3 is disproved, and a positive result of a related nature is established.

Institute for Advanced Study, Princeton, N. J.
ON $u''+(1+\lambda g(x))u=0$ FOR $\int_0^\infty |g(x)|\,dx<\infty$, by R. R. D. Kemp and Norman Levinson. Rept. on Contract AF 18(600)1109. June 59, 7p. 1 ref. AFOSR-TN-59-643; AD-220 344.
Order from LC mi$1.80, ph$1.80 PB 145 297

If $g(x)\in L^1(0,\infty)$ and $u(x,\lambda)$ is the solution of $u''+(1+\lambda)g(x)u=0$ which satisfies the initial conditions $u(0)=0$, $u'(0)=1$, then there are functions $r(\lambda)$ and $\Theta(\lambda)$ such that $\lim_x [u(x,\lambda) - r(\lambda)\sin[x+\Theta(\lambda)]]$ for real λ It is shown that $r(\lambda)$ and $\Theta(\lambda)$ are real analytic on the real axis if g(x) is real, and that $r(\lambda)>0$. The nearest singularity of r and Θ to the origin is at least a distance $\log 2[\int_0^\infty g(x)\,dx^{-1}]$ from $\lambda=0$, and the singularities are determined by the zeros of two entire functions. (Author)

Israel Inst. of Tech., Haifa.
BOUNDS FOR SUMS OF RECIPROCALS OF EIGENVALUES, by Binyamin Schwarz. Technical note no. 1 on Contract AF 61(052)194. July 59, 19p. 11 refs. AFOSR-TN-59-620; AD-217 684.
Order from LC mi$2.40, ph$3.30 PB 145 298

The differential system is considered of the form $y''(x)+\lambda p(x)y(x)=0$, where $y(a)=0$, $0<a<\infty$, $p(x)>0$, and $p(x)\in C$.

Johns Hopkins U., Baltimore, Md.
A LEMMA IN THEORY OF STRUCTURAL STABILITY OF DIFFERENTIAL EQUATIONS, by Philip Hartman. Technical note no. 12 on Contract AF 18(603)41. Oct 59, 15p. 3 refs. AFOSR-TN-59-1106.
Order from LC mi$2.40, ph$3.30 PB 145 513

John Hopkins U., Baltimore, Md.
ON LOCAL HOMEOMORPHISMS OF EUCLIDEAN SPACES, by Philip Hartman. Technical note no. 13 on Contract AF 18(603)41. Oct 59, 30p. 10 refs. AFOSR-TN-59-1107.
Order from LC mi$2.70, ph$4.80 PB 145 514

Johns Hopkins U., Baltimore, Md.
ON UNIQUENESS QUESTIONS FOR HYPERBOLIC DIFFERENTIAL EQUATIONS, by John P. Shanahan. Technical note no. 11 on Contract AF 18(603)41. May 59, 18p. 8 refs. AFOSR-TN-59-650.
Order from LC mi$2.40, ph$3.30 PB 145 568

This note is concerned with questions of uniqueness, existence and convergence of successive approximations for a solution of an initial value problem, where $z_{xy}=f(x, y, z, z_x, z_y)$ and $z(x, 0)$, $z(0, y)$ are assigned. There are obtained analogues of the Nagumo and Kamke criteria in the theory of ordinary differential equations. The method employed is related to the arguments used by Viswanatham to prove the convergence of successive approximations for ordinary differential equations under conditions similar to those in Kamke's general uniqueness theorem. (Author)

Maryland U., College Park.
ALMOST UNIFORM CONVERGENCE VERSUS POINTWISE CONVERGENCE, by John W. Brace. Rept. on Contract AF 18(603)78. Aug 58, 7p. 3 refs. AFOSR-TN-58-799; AD-202 232.
Order from LC mi$1.80, ph$1.80 PB 138 063

It has been established that the topology of almost uniform convergence on the collection of all bounded continuous real valued functions over a completely regular Hausdorff space is equivalent to the topology of pointwise convergence of the extended functions over the Stone Čech compactification (PB 126 435). This raises the question as to when almost uniform convergence of a net of functions is equivalent to pointwise convergence of a net of extended functions over an enlargement of the original domain. This paper answers the question within certain restrictions.

Miami U., Coral Gables, Fla.
THE ROLE OF THE STRONG MARKOV PROPERTY IN PROBABILITY THEORY, by D. G. Austin. Research rept. no. 11 (Rept. no. 19) on Contract AF 49(638)184. Sep 59, 13p. 13 refs. AFOSR-TN-59-1035.
Order from LC mi$2.40, ph$3.30 PB 145 557

This report contains an announcement of analytic and probabilistic results on Markov processes with the emphasis on Markov chains. (Author)

Michigan State U. [East Lansing].
MULTIVARIATE BETA DISTRIBUTIONS, by Ingram Olkin. Interim technical rept. no. 15 on Contract DA 20-018-ORD-14735. 18 Dec 59, 10p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 145 710

If X and Y are independent random variables having a chi-square distribution with n and m degrees of freedom, respectively, then (m/n) (X/Y) is distributed as an F-distribution with n, m d.f. In the multivariate case, the Wishart distribution plays the role of the chi-square distribution. However, there is no single natural generalization of a ratio when the elements are matrices. In this paper several generalizations which lead to multivariate analogs of the Beta or F-distribution are given.

Michigan U., Ann Arbor.
ON IMMERSION OF MANIFOLDS, by Hans Samelson. Rept. on Contract AF 49(638)104. Oct 59, 12p. 4 refs. AFOSR-TN-59-853.
Order from LC mi$2.40, ph$3.30 PB 145 309

A simple geometrical proof, using vector fields, is given for the theorem of R. Lashof and S. Smale (Ann. of Math., 68, 562-583 (1958)) to the effect that for an imbedding of a compact manifold M into a manifold M' the normal degree equals the characteristic of M modulo that of M' (or zero if M' not compact); the relevant homology class is identified. A second proof using the theory of Morse is given for the special case where M' is Euclidean space. (Author)

Michigan U. Coll. of Literature, Science, and the Arts, Ann Arbor.
RESTRICTED CLUSTER SETS, by Paul Erdos and George Piranian. Technical note on Contract AF 49(638)633. Jan 60, 8p. 3 refs. 2913-1-T; AFOSR-TN-59-1122; AD 231 397.
Order from LC mi$1.80, ph$1.80 PB 145 543

Collingwood has shown that if a function f is continuous in the upper half-plane, then the real axis contains a residual set at each of whose points each Stolz cluster set of f coincides with the complete cluster set of f. The present paper shows that the hypothesis of continuity can be dropped from Collingwood's theorem. The paper also describes a function whose segmental cluster sets exhibits a large measure of independence. (Author)

Missouri U., Columbia.
BEST FIT TO A RANDOM VARIABLE BY A RANDOM VARIABLE MEASURABLE WITH RESPECT TO A σ-LATTICE, by H. D. Brunk. Technical rept. no. 14 on Contract AF 18(600)1108. Oct 59, 34p. 12 refs. AFOSR-TN-59-1134; AD-230 193.
Order from LC mi$3.00, ph$6.30 PB 145 489

Oregon State Coll., Corvallis.
MATHEMATICS FOR DIGITAL COMPUTERS. VOLUME II. LINEAR INTEGRAL EQUATIONS, by E. G. Kimme, A. T. Lonseth and others. Rept. on Contract AF 33(616)3216. Sep 59, 132p. 63 refs. WADC Technical rept. 57-556, Volume II.
Order from OTS $2.75 PB 161 525

Methods for the numerical solution of linear integral equations of the Fredholm type, with recommendations as to their probable usefulness on high-speed digital computers, is presented in this report. Particular emphasis is on non-homogeneous Fredholm equations of the second kind. A selected bibliography with reviews and a general bibliography appear at the end of the report. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
PLASTIC LIMIT ANALYSIS AND INTEGRAL LINEAR PROGRAMS, by C. E. Lemke, A. Charnes, and O. C. Zienkiewicz (Northwestern U.). Rept. on Contracts Nonr-591(13) and Nonr-1228(10). 17 Feb 59, 11p. 7 refs. RPI MathRep no. 12.
Order from LC mi$2.40, ph$3.30 PB 145 595

The purpose of this paper is to apply some newly-developed techniques for solving integral-solution linear programs to a problem which arises in the Theory of Plastic Collapse of Structures.

Stanford U., Calif.
THE CAPACITY METHOD OF QUADRATIC PROGRAMMING, by H. S. Houthakker. Technical rept. no. 71 on Contract N6onr-25133. 23 Mar 59, 43p. 6 refs. AD-213 000.
Order from LC mi$3.30, ph$7.80 PB 145 250

Quadratic programming is the art of finding nonnegative values of several variables $x_1, \ldots, x_n$ which maximize a polynomial of the second degree $(x_1, \ldots, x_n)$ while satisfying given constraints, which are assumed to be linear. In economics, quadratic programming is of interest because of the increase in flexibility and realism which it provides over linear programming. By postulating appropriate linear dependencies, for instance between demand and price, it is possible to expand linear programming into quadratic programming. An example of the monopoly problem is worked out. Another interpretation for which the capacity method was first developed, is the choice of commodities bought by a consumer whose utility function can be written as a quadratic expression, and who is unable to buy negative quantities. This case is used to illustrate the capacity method. (Author)

Syracuse U., N. Y.
ON UNIFORM APPROXIMATION BY POSITIVE LINEAR COMBINATIONS OF POLYNOMIALS OF A GIVEN SYSTEM OF FUNCTIONS, by W. B. Jurkat and G. G. Lorentz. Rept. on Contract AF 49(638)619. 17 Dec 59, 13p. 2 refs. AFOSR-TN-59-1287.
Order from LC mi$2.40, ph$3.30 PB 145 506

The main theorem gives necessary and sufficient conditions in order that each positive continuous function on [0, 1] be approximable by polynomials with positive coefficients in two given functions. Fairly general necessary conditions are found for such approximation by positive linear combinations of given functions or by powers of given functions. (Author)

Syracuse U., N. Y.
POLYNOMIAL APPROXIMATION OF CONTINUOUS FUNCTIONS ON LINEAR SPACES, by W. B. Jurkat. Technical note on Contract AF 49(638)619. 17 Dec 59, 11p. 5 refs. AFOSR-TN-59-1235.
Order from LC mi$2.40, ph$3.30 PB 145 554

Approximation of continuous functions on separable closed subsets of a Frechet space X by polynomials with coefficients in X. (Author)

Syracuse U., N. Y.
RELATIONS BETWEEN FUNCTION SPACES, by G. G. Lorentz. Rept. on Contract AF 49(638)619. 17 Dec 59, 8p. 4 refs. AFOSR Technical note 59-1286; AD 231 609.
Order from LC mi$1.80, ph$1.80 PB 145 505

Necessary and sufficient conditions are given, in terms of the functions ϕ and W, in order that an Orlicz space L_ϕ be isomorphic to a space $\Lambda(W)$. (Author)

Texas A. & M. Research Foundation, College Station.
A METHOD FOR SOLVING THE MODIFIED PRIMITIVE EQUATIONS, by Yoshikazu Sasaki. Scientific rept. no. 4 on Contract AF 19(604)2222 and Scientific rept. no. 2 on Contract AF 19(604)1565. Oct 58, 13p. 1 ref. Ref. 58-20T; AFCRC TN-58-649.
Order from LC mi$2.40, ph$3.30 PB 139 305

A method is proposed for solving the modified primitive equations of motion, continuity, and thermodynamics. New potentials are defined in order to simplify the introduction of boundary conditions. The second order derivatives of these potentials are the components of velocity. A convenient technique for obtaining the solutions is used in order to minimize errors, and to avoid certain computational instability. The latter arises from the advection terms, and when the oscillation is faster than the internal gravity wave.

Wayne State U., Detroit, Mich.
HOMOTOPY AND ISOTOPY PROPERTIES OF TOPOLOGICAL SPACES, by Sze-Tsen Hu. Technical note no. 6 on Contract AF 49(638)179. Nov 59, 24p. 6 refs. AFOSR-TN-59-1108.
Order from LC mi$2.70, ph$4.80 PB 145 515

The objective of the present note is twofold. First, the general tests for homotopy and isotopy properties of topological spaces are established in the first three sections in terms of hereditary and weakly hereditary properties. Second, a general method of constructing new homotopy and isotopy invariants of topological spaces are described in the last section. (Author)

Wayne State U., Detroit, Mich.
TOLERANCE LIMITS BASED ON LIFE TEST DATA TAKEN FROM AN EXPONENTIAL DISTRIBUTION, by Benjamin Epstein. Technical rept. no. 1 on Contract Nonr-2575(00). 1 Feb 59, 11p.
Order from LC mi$2.40, ph$3.30 PB 145 581

(See also PB 140 703)

Computing Devices

Air Force Cambridge Research Center, Bedford, Mass.
THE USE OF DIGITAL COMPUTERS IN SPEECH ANALYSIS AND SYNTHESIS, by C. P. Smith. Nov 59, 13p. AFCRC-TN-59-958.
Order from LC mi$2.40, ph$3.30 PB 145 246

A new approach toward the goal of compressed digital speech communication is based on speech data reduction in successive stages. First, the voice signal is measured in a Vocoder type of analyzer and the output information digitized. The spectrum pattern data is then reduced by selecting the "best approximations" from a stored set of spectrum patterns, and reading out the pattern "serial numbers." This data is further reduced by selection of the "best approximations" from a stored set of pattern sequences and pitch sequences. The serial numbers of the sequences are transmitted. At the receiver, an inverse process expands the information to a voice output. (Author)

Columbia U. School of Engineering, New York.
SAMPLED DATA CONTROL SYSTEMS CONTAINING PERIODICALLY VARYING MEMBERS, by Bernard Friedland. Technical rept. T-39/B on Contract AF 18(600)677. 12 Nov 59, 33p. 5 refs. CU-60-59-AF-677-EE; AFOSR-TN-59-1215; AD-230744.
Order from LC mi$3.00, ph$6.30 PB 145 553

The Z-transform method is extended to sampled-data systems containing periodically varying members. Every member of such a system may be characterized by an N x N "transfer matrix" H(z) whose elements are pulse transfer functions. The input-output relation for every member is given by $\underline{Y}(z) = \underline{H}(z)\,\underline{X}(z)$ where $\underline{X}(z)$ and $\underline{Y}(z)$ are 1 x N matrices (vectors) whose elements are the "skip-sampled Z-transforms" of the input and output, respectively. By the use of matrix algebra the transfer matrices of the members are combined to obtain the overall transfer matrix of the system, from which the response of the system may be determined. The method is illustrated by application to the following problems: (1) Multirate sampled systems (2) Systems in which samples are periodically omitted and holding circuit with periodically varying hold time is employed (3) Use of a periodically varying amplifier to achieve deadbeat performance.

Electronics Research Lab., U. of California Berkeley.
THEORETICAL ASPECTS OF MINIMAL-SCAN PATTERN-RECOGNITION, by Arthur Gill. Rept. on Contract Nonr-222(53). 23 Mar 59, 81p. 23 refs. IER Series no. 60; Issue no. 233; AD-216 594.
Order from LC mi$4.80, ph$13.80 PB 145 500

Recognition of finite sets of visual patterns can be effected by scanning the individual "cells" of each pattern, and comparing the resulting sequence of signals with a preconstructed table of such sequences.

The dissertation presents readily programmable algorithms for finding the minimal groups of cells to be scanned under noiseless and noisy conditions. Also presented are theoretical bounds to the size of these groups, as well as results inter-relating recognition rate, memory capacity and error probability in general scanning systems.

George Washington U., Washington, D. C.
RELIABILITY USING REDUNDANCY CONCEPTS, by Louis Depian and Nelson T. Grisamore. Technical rept. on Contract N7onr-41906. 1 Feb 59, 19p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 145 583

International Business Machines Corp., Poughkeepsie, N. Y.
DESIGN AND ANALYSIS OF HIGH SPEED CIRCUITS. Final rept. for 16 July 58-15 Oct 59 on Contract AF 19(604)4152. [1959] 278p. 4 refs. AFCRC-TR-59-351.
Order from LC mi$11.10, ph$45.60 PB 145 550

General logic requirements of large high speed systems were investigated. Included in Section II is a summary of binary adders, an analysis of the probability distribution of the longest carry sequence, and a general discussion of circuit requirements. Several examples are included which graphically show the effects of fan in and fan out considerations upon delay. The basic circuit configurations, all necessary design equations, a set of typical component values, and a discussion of the circuit operating characteristics are contained in Sections I and III.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ROCKET-MOTOR-PERFORMANCE COMPUTER, by Raymond A. Buchanan. Rept. on Contract DA 04-495-ORD-18. 6 Oct 52, 22p. 3 refs. Memo. no. 20-77.
Order from LC mi$2.70, ph$4.80 PB 145 920

Usual methods of calculating characteristic velocity and mixture ratio for a specific rocket-motor test are time consuming. An electronic analog computer has been built that will compute these motor-performance characteristics and record them while the motor test is in progress. The computer consists of two square-root extracting devices and two divider circuits. Operating experience has proved the outputs of the computer to be accurate within 1.0 per cent of hand computations made from the three computer inputs: fuel-flow, oxidizer-flow, and chamber-pressure recordings. (Author)

Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON THE REALIZABILITY OF AN ALL MAGNETIC COMPUTING SYSTEM, by H. D. Crane. Scientific rept. 1 on Contract AF 19(604)5909. Oct 59, 48p. 3 refs. AFCRC-TN-59-972.
Order from LC mi$3.30, ph$7.80 PB 145 285

This report presents early results of the study of some of the major technical areas concerned in realizing computer logic with all-magnetic circuits. A logical development of the circuit approach as presently conceived is presented. The circuitry of a two-input, three-output module is developed. A system design using approximately 750 such modules is briefly outlined. This system has the capability of five-decimal-digit addition, subtraction, and multiplication under keyboard control. Some initial thoughts on circuit packaging are presented. (Author)

Willow Run Labs., U. of Michigan [Ann Arbor]
A MULTIDIRECTIONAL BINARY-CODE CONVERTER, by Reed E. Maes. Rept. on Proj. Michigan, Contract [DA 36-039-sc-52654] Oct 57, 28p. 2 refs. Rept. no. 2144-154-T; AD-146 030.
Order from LC mi$2.70, ph$4.80 PB 137 524

A discussion is presented of a code converter built to adapt Teletype equipment, Hughes Typotron tubes, and Convair Charactron tubes for use with large-scale data-processing equipment. The converter is bidirectional in operation and can use either Teletype or Flexowriter codes as inputs which makes the 3 remaining codes (Flexowriter or Teletype, and Typotron and Charactron) all available as simultaneous outputs. All the devices use 6-bit binary codes, except the 5-bit Teletype which can develop a 6th bit by storing the letters-shift and figures-shift characters. The 4 codes are listed to show the dissimilarity. To adapt Teletype, Typotron, and Charactron to Midac (Michigan digital automatic computer), the automatic converter was constructed. It has 2 modes of operation; Teletype code is accepted in one and Flexowriter in the other. The principles employed in the development of the converter are outlined. A calculation is made of the converter component values and a mathematical analysis is given of the drive requirements.

MECHANICS

Brown U. Div. of Applied Mathematics, Providence, R. I.
ON FINITE ELASTIC DEFORMATIONS WITH A PERTURBED STRAIN-ENERGY FUNCTION, by A. J. M. Spencer. Technical rept. no. 14, Mar 56-Apr 57, on Application of Invariance Principles in Continuum Mechanics, Contract DA 19-020-ORD-3487. July 57, 30p. 6 refs. DA-4387/14; AD-140 569.
Order from LC mi$2.70, ph$4.80 PB 145 176

In order to obtain analytical solutions to problems involving finite deformations of elastic solids it is often necessary to adopt a specific form for the strain-energy function. In this paper it is supposed that such a strain-energy function W is perturbed to a new strain-energy function $W + \varepsilon W'$, with the result that an additional small deformation is superimposed on the existing finite deformation. Stress-strain relations and equations of equilibrium are formulated which, with suitable boundary conditions and a knowledge of the original finite deformation, make possible the determination of the displacements and stress-components that are superimposed when W is perturbed. The theory is illustrated by application to the problem of simultaneous extension, inflation and shear of a cylindrical tube, and also to the special case in which the tube undergoes shear only. In the applications W is supposed to have the Mooney form, while W' is an arbitrary function to the strain invariants. (Author)

Brown U. Div. of Engineering, Providence, R. I.
ON THE CONTINUING DEFORMATION OF WORK-HARDENING PLASTIC SOLIDS, by G. R. Cowper. Technical rept. no. 11 on Contract Nonr-562(20). Apr 59, 66p. 18 refs.
Order from LC mi$3.90, ph$10.80 PB 145 392

The boundary value problem for the quasi-static post-yield deformation of a work-hardening plastic body is formulated. The formulation fully accounts for the changes in geometry which accompany the deformation and includes the thermal effects arising from thermal straining and the temperature dependence of the yield stress. As an example, the plane strain deformation of a bar under uniform tension or compression is considered.

Brown U. Div. of Engineering, Providence, R. I.
STRESS WAVES IN SOLIDS, by S. R. Bodner. Technical rept. no. 8 (Final) on Contract Nonr-562(14). Mar 59, 16p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 145 391.

Contents:
Some aspects of the mechanical testing of non-metallic solids, by H. Kolsky
Dispersion effects of stress propagation, by Din-Yu Hsieh
A differential stress-strain relation for the hexagonal close-packed array of elastic spheres, by J. Duffy
An experimental study of pulse propagation in elastic cylinders, by D. Y. Hsieh and H. Kolsky
The validity of model representation for linear viscoelastic behavior, by H. Kolsky and Y. Y. Shi
Stress wave propagation in lead, by S. R. Bodner and H. Kolsky
Fractures produced by stress pulses in glass-like solids, by H. Kolsky and Y. Y. Shi

Illinois Inst. of Tech., Chicago.
PLASTIC ANALYSIS OF ROTATIONALLY SYMMETRIC SHELLS, by Philip G. Hodge, Jr. Rept. on Contract Nonr-140604. Feb 59, 85p. 50 refs. DOMIIT rept. no. 1-6.
Order from LC mi$4.80, ph$13.80 PB 145 269

The theory of limit analysis is presented from the specific viewpoint of rotationally symmetric shells. The general theory is developed in a reasonably self-contained manner. Various yield conditions are derived and compared both as to accuracy and usability. Applications are made to some known problems to illustrate the techniques used in applying the theory and to several new problems. Particular attention is paid to comparing various solutions for a simply supported spherical cap. The paper closes with an indication of some fruitful directions for future research. (Author)

New York U. Coll. of Engineering, N. Y.
STRUCTURAL SIGNIFICANCE OF DUCTILITY, by George Gerard. Status rept. no. 2, 1 Sep-31 Oct 59, on Contract NOas 59-6257c. [1959] 10p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 145 388

The general objectives of this research program are broadly as follows: (1) Investigate the basic aspects of ductility to assess the significance for design purposes of available techniques and conditions of test for ductility. (2) Investigate relations between ductility and maximum strength-weight in typical structural applications. Mechanical strength levels at which uniformity of properties become adversely affected by low ductility are of particular interest.

Polytechnic Inst. of Brooklyn, N. Y.
CREEP ANALYSIS OF HOLLOW SPHERES SUBJECTED TO UNIFORM PRESSURES, by Sharad A. Patel and K. A. V. Pandalai. Rept. on Contract Nonr-839(23). Apr 59, 16p. 7 refs. PIBL rept. no. 488.
Order from LC mi$2.40, ph$3.30 PB 145 708

The creep stress distribution in hollow spheres subjected to uniform internal and external pressure is investigated. The derived closed form solutions yield circumferential stress distributions radically different from those given by the linear elastic theory.

Rensselaer Polytechnic Inst., Troy, N. Y.
COUPLED TORSIONAL AND LONGITUDINAL VIBRATIONS OF A THIN PRISMATIC BAR, by R. C. DiPrima. Rept. on Contracts AF 18(600)1586 and Nonr-1866(02). 27 Feb 58. 14p. 3 refs. RPI MathRep no. 12; AFOSR-TN-58-126; AD-152 153.
Order from LC mi$2.40, ph$3.30 PB 145 547

The effect of pretwist on the natural frequencies of coupled torsional-longitudinal oscillations of thin bars is studied. It is found that the natural frequencies of oscillations which consist primarily of torsional motion may be considerably increased depending upon the thinness of the bar, and the amount of pretwist. The natural frequencies of oscillations which consist primarily of longitudinal motion are not significantly altered. (Author)

Stanford U. Div. of Engineering Mechanics, Calif.
ELASTIC BENDING OF PRETWISTED BARS, by J. N. Goodier and D. S. Griffin. Rept. on Contract Nonr-225(29). 15 Mar 59, 135p. 16 refs. Technical rept. no. 115.
Order from LC mi$6.90, ph$21.30 PB 145 599

It is evident that bars which have a natural twist in the unstressed state -- pretwisted bars -- do not respond to static bending loads in the same way as straight, untwisted bars. Under the action of end couples, the axis of the pretwisted bar will become a space curve. The behavior is influenced both by the varying orientation of the cross section along the bar, and by the helicoidal shape of the boundary. Stress solutions are obtained within the framework of the linear theory of elasticity for bars with a moderate, constant rate of pretwist. The differential equations and boundary conditions are expressed in terms of stress components referred to coordinates coinciding locally with the principal axes of the bar.

Watertown Arsenal Labs., Mass.
BOUNDARY IRREGULARITIES IN PLANE ELASTICITY, by O. L. Bowie. Dec 59, 38p. 5 refs. Technical rept. no. WAL TR-893.6/2.
Order from LC mi$3.00, ph$6.30 PB 145 125

Muskhelishvili's formulation of the plane problem in terms of a single analytic function is extended to an important class of regions involving geometrical irregularities in the boundary shape. The mapping functions which contain branch points to define these irregularities are preserved in their exact form and the solution is set up in terms of corresponding multi-valued forms for the stress function. It is shown by several numerical examples that such a formulation provides for a more basic understanding of the character of the solution. Although it is not possible to establish the precise forms of the mathematical singularities in an a priori manner, the information which is gained by a study of the stress function by the present formulation can be utilized in treating convergence problems in the numerical solution. (Author)

Watertown Arsenal Labs., Mass.
ELASTIC BUCKLING OF AXIALLY COMPRESSED, THIN, UNREINFORCED CYLINDRICAL SHELLS, by J. J. Connor, Jr. Jan 60, 49p. 22 refs. WAL TR 836.32/2.
Order from LC mi$3.30, ph$7.80 PB 145 373

An extensive survey of the literature on the elastic buckling of axially compressed, thin, unreinforced cylindrical shells is presented in this report. The stability of unpressurized cylindrical shells is considered first. Included in the discussion are the "small deflection" solutions, semi-empirical investigations, theoretical analyses of the nonlinear post-buckled behavior, and a general treatment of the classical and finite deflection stability criteria. Then, the theoretical and semi-empirical investigations of axially-compressed pressurized cylindrical shells are described. Finally, design criteria for both pressurized and unpressurized cylindrical shells are presented. Throughout the report, particular emphasis is placed on discussing the validity and limitations of the basic assumptions associated with each investigation. (Author)

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
UNSTEADY AIRLOADS ON POINTED AIRFOILS AND SLENDER BODIES AT HIGH MACH NUMBERS, by Garabed Zartarian. Rept. for 27 Mar 58-29 May 59 on Dynamic Problems in Flight Vehicles, Contract AF 33(616)5651. Dec 59, 113p. 61 refs. WADC Technical rept. 59-583.
Order from OTS $2.50 PB 161 509

Utilizing the piston analogy derived from the hypersonic small-disturbance theory, two approximate methods are found for the determination of airloads on pointed airfoils and slender bodies in unsteady motion at high Mach numbers. The first is an extension of the shock-expansion technique which is applicable for airfoils and certain classes of bodies when the hypersonic similarity parameter $M_\infty \tau$ is sufficiently large. The second is a variational approach, formulated primarily for bodies at moderate values of $M_\infty \tau$. Several numerical examples for simple configurations are presented to clarify both procedures, and are compared with existing solutions. For the variational approach, the cases are confined to those of steady flow, but the necessary steps to cover unsteady flows are indicated. Finally, possible extensions for bodies with more complicated cross-sectional shapes and for wing-body combinations are discussed. Some comments are offered concerning inclusion of real gas effects and the estimation of the airloads in the free-molecule flow regime. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
COMPRESSIBLE FLOW TABLES k=1.26 STAGNATION TEMPERATURE CHANGE WITHOUT FRICTION, by C. Hoebich. Rept. on One-Dimensional Compressible Flow Tables for a Perfect Gas in Mach Number Increments of 0.001 (k=1.26; Stagnation Temperature Change without Friction. Feb 59, 89p. ARGMA TN 1H 1N-2.
Order from LC mi$4.80, ph$13.80 PB 145 502

This report tabulates functions of Mach numbers for compressible perfect gas. The ratio of specific heats k is 1.26. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate time-consuming interpolation. (Author) (See also PB 144 413)

Arnold Engineering Development Center, Tullahoma, Tenn.
DYNAMIC STABILITY TESTS IN HYPERSONIC TUNNELS AND AT LARGE MODEL AMPLITUDES, by C. J. Welsh, R. L. Ledford and others. Rept. on Aro, Inc., Contract AF 40(600)800. Dec 59, 42p. 4 refs. AEDC-TR-59-24; AD-229 516.
Order from LC mi$3.30, ph$7.80 PB 145 295

Results of experimental dynamic stability tests at Mach numbers 5, 7, and 8 of a flared afterbody reentry shape are presented. Measured damping derivatives indicate that dynamic stability testing is feasible at hypersonic speeds and at large model amplitudes. (Author)

Arnold Engineering Development Center, Tullahoma, Tenn.
INVESTIGATION OF A WELDABLE TYPE, HIGH-TEMPERATURE STRAIN GAGE FOR MEASUREMENT OF STRAIN BY ELECTRICAL MEANS AT TEMPERATURES UP TO 600°F, by Guy J. Gardner and Ernest E. Newman. Rept. on ARO, Inc., Contract AF 40(600)800. Jan 60, 30p. AEDC-TN-60-30.
Order from LC mi$2.70, ph$4.80 PB 145 371

The tests indicated that unbonded strain data can be used to predict the apparent strain of bonded gages to within 0.07 to 0.4 micro-in./in./°F for temperatures up to 600°F. Gage factors were found, in general, to be lower than those specified by the manufacturer and to decrease from 2.5 to 7.5 percent with temperature at 600°F.

Bureau of Ordnance, Dept. of the Navy, Washington, D. C.
STABILITY DERIVATIVES FOR SPINNING BODIES OF REVOLUTION IN THE SUPERAERODYNAMIC REGION, by Thomas W. Finch. 1958, 23p. 2 refs. Technical note no. 43; AD-200 178.
Order from LC mi$2.70, ph$4.80 PB 145 398

Recent studies have shown that the mechanism of molecular reflection at low gas densities is closely approximated by the diffuse model in which the gas molecules are considered to strike the surface and rebound in random directions with velocities corresponding to the heat content of the body. The present paper uses this mechanism to obtain stability derivatives for spinning bodies of revolution.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
THE FINITE ASPECT RATIO JET FLAP, by R. A. Hartunian. Rept. on Contract DA 44-177-tc-439. Oct 59, 81p. 28 refs. Rept. no. AI-1190-A-3.
Order from LC mi$4.50, ph$13.80 PB 145 698

The lifting surface equations for the finite aspect ratio jet flapped wing are developed, assuming small perturbations of the undisturbed flow. The lifting surface, in this case, is comprised of the wing and the curved portion of the jet sheet. The governing integro-differential equations are written in a form, analogous to ordinary finite aspect ratio wing theory, which suggests procedures of approximation in terms of the aspect ratio of the lifting surface. The limiting case of large aspect ratio is given detailed consideration.

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
THE LAMINAR BOUNDARY-LAYER FLOW ON ROTATING CYLINDERS. PART II. THIN CYLINDERS, by Shao-Wen Liu. Rept. on Contract AF 18(600)1523. June 57, 116p. 17 refs. AFOSR-TN-57-298; AD-210 156.
Order from LC mi$6.00, ph$18.30 PB 145 479

The boundary-layer equations for a cylindrical blade of small thickness rotating with a constant angular speed about an axis perpendicular to the cylindrical axis are re-examined, and from the existing solutions, an extension is made to allow the axis of rotation to be located arbitrarily with respect to the leading edge of the blade. The cylindrical symmetry is represented by assuming a universal velocity polynomial in terms of the chordwise coordinate for the chordwise potential flow. As in the flat-plate case, solution is obtained by means of series expansions in terms of appropriate parameters. In the present case, series expansion is also made in terms of the chordwise coordinate. The perturbation due to small local taper of the cylinder is also included.

Deutsche Forschungsanstalt für Luftfahrt (Germany).
THEORETICAL AND EXPERIMENTAL CASCADE FLOW INVESTIGATIONS AT HIGH SUBSONIC MACH NUMBERS (PRESSURE DISTRIBUTIONS AND WAKE MEASUREMENTS), by U. Hopkes. Rept. on Contract AF 61(052)105. 26 June 59, 60p. 18 refs. Institut für Aerodynamik rept. no. 59/21; AFOSR-TR-59-45; AD-214 810.
Order from LC mi$3.60, ph$9.30 PB 145 501

Extensive experimental investigations on 2-dimensional cascades at high subsonic Mach numbers were carried out in the variable density high speed cascade wind tunnel. Varying the cascade geometry and the Mach number the following quantities were measured up to the choking Mach number for 2 different blade profiles (NACA 0010 and NACA 8410): (1) pressure distribution on the blade, (2) loss coefficient and (3) deflection of flow and static pressure difference across the cascade. The loss coefficient and the deflection are nearly constant up to the critical Mach number, but the static pressure difference varies with the Mach number. The experimental pressure distributions were compared with different theoretical methods for calculating pressure distributions in compressible flow. (Author)

Georgia Inst. of Tech., Atlanta.
THE COMPUTED INSTANTANEOUS VELOCITIES INDUCED AT THE BLADE AXES BY THE SKEWED HELICAL VORTICES IN THE WAKE OF A LIFTING ROTOR IN FORWARD FLIGHT, by Walter Castles, Jr. and Howard L. Durham, Jr. Rept. on Contract Nonr-991(05). Mar 59, 119p. 7 refs. AD-210 613.
Order from LC mi$6.00, ph$18.30 PB 145 395

The computed instantaneous velocities induced at the blade axes by the skewed helical vortices in the wake of a lifting rotor having 1, 2, 3, or 4 blades and operating in high-speed forward flight. Examples of the application of the results to find the approximate effects of finite number of blades and rotor angular velocity on the induced power required and on the instantaneous blade air loadings. (Author)

Illinois U. Engineering Experiment Station, Urbana.
COMPRESSIBLE NON-ISOENERGETIC TWO-DIMENSIONAL TURBULENT ($Pr_t = 1$) JET MIXING AT CONSTANT PRESSURE: AUXILIARY INTEGRALS, HEAT TRANSFER AND FRICTION COEFFICIENTS FOR FULLY DEVELOPED MIXING PROFILES, by H. H. Korst and W. L. Chow. Rept. on Transonic and Supersonic Flow of a Real Fluid at Abrupt Increases in Cross Section, Contract AF 18(600)392. Jan 59, 19p. 8 refs. ME Technical note 392-4; AFOSR-TR-59-20; AD-211 328.
Order from LC mi$2.40, ph$3.30 PB 145 545

Definitions and graphical presentation of auxiliary functions, calculated on a high speed digital computer (ILLIAC), pertaining to the two-dimensional non-iscenergetic turbulent jet mixing problem. Theoretical friction coefficients and Stanton Numbers for such mixing regions are given. The results facilitate especially the treatment of jet-slipstream interaction (base pressure and base temperature problem). (Author)

Institute of Engineering Research, U. of California, Berkeley.
HEATING RATE CHARACTERISTICS OF AN OXYACETYLENE FLAME APPARATUS FOR SURFACE ABLATION STUDIES, by Edwin Joseph Russ. Master's thesis. Rept. on Contract DA 04-200-ORD-776. 20 Dec 59, 73p. 21 refs. Technical rept. HE-150-176; Series no. 128, issue no. 3.
Order from LC mi$4.50, ph$12.30 PB 145 129

The heating rate characteristics of a surface ablation apparatus were investigated. The apparatus utilized oxyacetylene combustion products for two-dimensional hot gas flow parallel to flat plate specimens. Maximum heating rates were 2.5×10^5 Btu/hr ft^2. The apparatus produces a gas stream with a velocity of approximately 300 ft/sec for heating 3 x 5 inch flat plates. Stream temperatures around 5500^o R were measured using the sodium spectral line reversal technique. Heating rates were calorimetrically obtained by measuring the transient temperature rise of a stainless steel flat plate. Rates ranged from 10^5 to 2.5×10^5 Btu/hr ft^2 for plate temperatures of 800^o R to 2000^{o}R.

Institute of Engineering Research, U. of California, Berkeley.
LOW DENSITY AERODYNAMIC CHARACTERISTICS OF A CONE AT ANGLE OF ATTACK, by G. J. Maslach and L. Talbot. Rept. on Subcontract to Contract AF 04(647)269. 30 Oct 59, 54p. 7 refs. Rept. no. HE-150-172; Series no. 125, Issue no. 2.
Order from LC mi$3.60, ph$9.30 PB 145 693

The aerodynamic forces and pitching moment acting upon a nine degree half angle cone have been measured and the data are presented in coefficient form for the following supersonic low density flow conditions: M = 5.83, Re/in = 8940; M = 5.55, Re/in = 4370; M = 4.06, Re/in = 2630; M = 3.85, Re/in = 1550. Theoretical estimates of the various boundary layer contributions to the axial force, normal force and pitching moment are defined and sample calculations performed. The experimental results are then compared to Newtonian predictions with appropriate viscous convections. Good agreement is obtained. (Author)

Institute of Engineering Research, U. of California, Berkeley.
OXYGEN RECOMBINATION PROGRAM, by Stuart A. Hoenig. Rept. no. 2 on Contract Nonr-222(45). 23 Mar 59, 46p. 21 refs. Rept. no. HE-150-163; Series no. 20-125.
Order from LC mi$3.30, ph$7.80 PB 145 077

An experimental apparatus has been designed to measure the catalytic properties of various metals toward gaseous recombination. Experiments on a number of pure metals agree in a qualitative manner with the theory. (Author) (See also PB 137 919)

Institute for System Research, U. of Chicago, Ill.
DIGITAL COMPUTATION TECHNIQUES FOR FLUID FIELDS WITH SHOCK, by Francis J. Marshall. Rept. on Flight Dynamics Research and Analysis Services, Contract AF 33(616)2797. Oct 59, 189p. 117 refs. WADC TR-59-535.
Order from OTS $3.00 PB 161 497

The author explores the feasibility of obtaining the aerodynamic forces and moments of a body moving through a fluid by solving theoretical equations on a digital computer. The report reviews the fundamentals of the problem in-the-large and then considers a particular facet of the problem. A very broad background to the continuum-digital computer merger, primarily in terms of fluid dynamics, is provided which includes basic theory and summaries of recent approaches in this domain, most of which depart notably from classical methods. The particular problem selected is that of obtaining the two-dimensional supersonic flow field (excluding wake) of a blunt body with the strong shock wave treated as an interior element. The foredrag as a function of Mach number is one specific element sought. The author concludes that the method described is a valid and practical means of obtaining the foredrag of a two-dimensional blunt body travelling supersonically and of obtaining the details of the flow field outside the shock zone.

Naval Ordnance Lab., White Oak, Md.
COMPUTING OF AERODYNAMIC COEFFICIENTS FROM RAW DATA WITH ANALOG METHODS, by W. A. Menzel. 1 Oct 57, 18p. 1 ref. Aeroballistic Research rept. 392; NAVORD rept. 4532; AD-154 533
Order from LC mi$2.40, ph$3.30 PB 145 354

The algebraic equations for the aerodynamic coefficients are transferred by analog computational methods into equivalent electronic circuits using operational amplifiers. A strain gage balance calibration is described which provides for the initial computer setting and gives an automatic check of the proper computer setting. This method is characterized by its less time consuming procedure and the availability of data in coefficient form immediately after each test run. It has successfully been applied to determine the Magnus coefficient of spinning models. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
THE EFFECT OF CENTRIFUGAL FORCES ON BOUNDARY LAYER TRANSITION FOR A HIGHLY HEATED BODY, by Eugene Sevigny and Marian Visich, Jr. Rept. on Aerodynamic and Heat Transfer Problems in Hypersonic Flow, Contract AF 33(616)6118. Mar 59, 47p. 7 refs. WADC Technical note 59-121; AD-214 620.
Order from LC mi$3.30, ph$7.80 PB 146 105

An experimental program was conducted in the M = 3.75 wind tunnel to determine the effect of centrifugal forces on boundary layer transition for a highly heated body. The model used in this investigation was a hemispherically blunted 20^o half-angle cone having a density ratio (external of the boundary layer to wall) of approximately four along the conical region, and a maximum centripetal acceleration at the center line of the model of 300 g's. The free stream Reynolds number per foot range over which the tests were conducted was 22.2 to 51.9 x 10^6.

Polytechnic Inst. of Brooklyn, N. Y.
PRESSURE DISTRIBUTIONS ON A TWO-DIMENSIONAL BLUNT-NOSED BODY AT VARIOUS ANGLES OF ATTACK, by Victor Zakkay and Arthur K. Fields. Rept. on Contract AF 49(638)217. Oct 58, 29p. 5 refs. PIBAL rept. no. 461; AFOSR-TN-58-1016; AD-162 281.
Order from LC mi$3.00, ph$6.30 PB 145 481

Pressure distributions on a two-dimensional blunt-nosed body at angles of attack have been determined at a Mach number of 6.0 in the hypersonic facility of the Polytechnic Institute of Brooklyn Aerodynamics Laboratory. The pressure distribution results and the velocity gradient at the stagnation point are compared with the theoretical predictions. It is shown that the Newtonian theory does not apply for bodies where the sonic point does not fall on the same radius of curvature as the stagnation point. A large reduction in stagnation point heat transfer was obtained as a result of increasing the radius of curvature of the body at the sonic point over that which exists at the stagnation point of constant radius of curvature models

Polytechnic Inst. of Brooklyn, N. Y.
SIMPLE THICKNESS-SHEAR MODES OF VIBRATION IN INFINITE SANDWICH PLATES, by Yi-Yuan Yu. Technical note no. 2 on Contract AF 49(638)453. Oct 58, 19p. 4 refs. AFOSR-TN-58-897; AD-204 132.
Order from LC mi$2.40, ph$3.30 PB 145 480

Closed-form solutions are obtained for simple thickness-shear modes of free vibration of infinite sandwich plates from the exact elasticity theory. The antisymmetric mode is further solved according to the new flexural theory of sandwich plates presented in a companion paper. By matching the lower frequency calculated from the sandwich-plate theory with the corresponding fundamental frequency from the elasticity theory, the value of a shear coefficient in the sandwich-plate theory may be determined directly. It is shown that, for sandwich plates, the shear coefficient is not constant and may have a value very close to unity, in contrast to its constant value of $\pi^2/12$ for homogeneous plates given by Mindlin.

Polytechnic Inst. of Brooklyn, N. Y.
SOLUTIONS OF SUPERSONIC INTERFERENCE PROBLEMS BY GENERALIZED INTEGRAL RELATIONSHIP: EXAMPLES FOR A CIRCULAR CYLINDRICAL BODY, by Lu Ting. Rept. on Contract AF 18(600)694. Oct 58, 46p. 8 refs. PIBAL rept. no. 465; AFOSR-TN-58-1069; AD-207 229.
Order from LC mi$3.30, ph$7.80 PB 145 482

The generalized integral relationship is employed to solve the interference problem of wings and cylindrical bodies of arbitrary cross section. The procedure is to represent the pressure distribution on the body and the wing inside the interference region by a linear combination of a finite number of elementary functions of the surface variables. The combination fulfills the condition that the pressure is continuous inside the interference region and also across its boundary. The arbitrary constants in the combination are determined by the generalized integral relationship which will be reduced to a set of simultaneous linear algebraic equations.

Polytechnic Inst. of Brooklyn, N. Y.
STUDY OF DRAG REDUCTION OF HIGH-WING CONFIGURATIONS AT SUPERSONIC SPEEDS, by R. Parthasarathy. Rept. on Contract AF 18(600)694. Oct 58, 26p. 4 refs. PIBAL rept. no. 456; AFOSR-TN-58-837; AD-203 001.
Order from LC mi$2.70, ph$4.80 PB 145 566

The possibility of drag reduction of wing-body combinations at all practical values of the lift coefficient, by a proper distribution of the body volume, is explored. This is illustrated by modifying a midwing configuration, composed of a full circular cone, symmetrically disposed about the sweptwing of zero thickness, to a high-wing configuration, composed of the same wing, but two half cones of equal volume as the full cone, mounted beneath the wing. It is found that at M = 3.0 and lift coefficient = 0.1, for a cone of semi-vertex angle $\theta_c = 5^o$, the high-wing configuration gives a drag reduction of 16% over that of the corresponding midwing configuration whereas there is found to be a drag reduction of 6.5% at $M = \sqrt{2}$. Similar comparison for the percentage increase in lift drag ratio for the above-mentioned configurations shows a maximum increase of 34% at M = 3.0 for the high-wing configuration over the midwing configuration, whereas it is 22% at $M = \sqrt{2}$. Numerical results

show that the high-wing configuration gives a significant reduction in drag as compared to a midwing configuration of equal volume and furthermore, greater reductions in drag are obtained at higher Mach numbers. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A THEORETICAL INVESTIGATION ON THE USE OF COMBUSTION PRODUCTS FOR THE SIMULATION OF HYPERSONIC FLOW, by Vito D. Agosta. Rept. on Research on the Utilization of the Hypersonic Wind Tunnel, Contract AF 33(616)3978. Mar 59, 31p. 13 refs. WADC Technical note 59-81; AD-211 916.
Order from LC mi$3.00, ph$6.30 PB 146 106

A theoretical investigation has been performed on the use of combustion products for the simulation of hypersonic flow. Condensation limits were determined in order to insure vapor-free flow for various fuel-air combinations. For a particular case investigated (C/O = 0.32; H/O = 0; N/O = 2.57; p_t = 1200 psia; T_t = 3000°R) the ratios of pressures, specific heats, Mach number and Reynolds number closely simulate Mach 7 flight at 100,000 feet altitude in the atmosphere. The influence of scale on pressure distributions and forces, and the influence of viscous effects can be investigated using combustion gases. In addition the cost of equipment employing this technique would be expected to be relatively low. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A REVIEW OF SOME RECENT DEVELOPMENTS IN HYPERSONIC FLOW, by Antonio Ferri. Rept. on Aerodynamic Research, Contract AF 33(616)3265. Sep 58, 88p. 93 refs. WADC Technical note 58-230; AD-155 822.
Order from LC mi$4.80, ph$13.80 PB 146 107

The problems connected with hypersonic flows are reviewed. First, those connected with non-ideal gas behavior are shown to be not of great importance at the present time compared to the lack of information concerning other aspects of hypersonic flow. The problem of pressure distribution on blunt-nosed bodies is discussed and the importance of the sonic line pointed out. The pressure distribution in three-dimensional flows is discussed, for example, the flow about an axially symmetric body at an angle of attack is described. The present status of laminar and turbulent heat transfer calculations for hypersonic conditions is reviewed. The important effects of entropy on boundary layer characteristics are pointed out. In these several problem areas experimental data obtained at PIBAL are presented. (Author)

Technische Hochschule, Karlsruhe (West Germany).
REMARKS ON RING AIRFOIL THEORY, by Johannes Weissinger. Rept. on Contract AF 61(514)1207. Jan 58, 89p. 16 refs. AD-154 127.
Order from LC mi$4.80, ph$13.80 PB 145 330

In this note several disconnected problems are treated. The first paragraphs deal with ring airfoils in (incompressible) potential flow. The circumferential velocity at the ring surface is calculated which is required e.g. for three dimensional boundary layer calculations and for stress analysis. For ring airfoils the pitching moment due to axial forces (e.g. suction force) may be much greater than for plane wings because of the large lever arm; this moment is calculated. The influence of a central body on pressure distribution, lift and pitching moment is investigated; to begin with, the body is assumed to be an infinite circular cylinder with small diameter. Boundary layer effects are studied, in particular drag and separation. In order to obtain results quickly which may be important for the design and which may serve as a basic for the development of more rigorous methods the three-dimensional problems have been highly simplified so that the rough but quick two-dimensional methods of Truckenbrodt could be applied. For all the problems just mentioned numerical results have been evaluated. (Author)

Technische Hochschule, Munich (West Germany).
NUMERICAL INVESTIGATIONS ON THE SOLUTION OF THE NONLINEAR EQUATION OF SUPERSONIC FLOW BY FINITE DIFFERENCE METHODS (PART I), by Gerhard Seegmüller. Technical note no. 10 on Contract AF 61(514)1080. 4 Nov 59, 45p. 12 refs. AFOSR-TN-60-255.
Order from LC mi$3.30, ph$7.80 PB 145 856

This report deals with the method of characteristics in supersonic flow by the numerical way of the mean-value approximation in several variations. Information is given on the type of convergence and on the truncation error in the local case and in the large, when solving the difference equations by iteration. Pure mean-value procedures are described which also converge on the axis of flows with cylindrical symmetry. Furthermore, there is a discussion of how to find the "true solution" by extrapolation. (Author)

University of Southern California. Engineering Center, Los Angeles.
PRELIMINARY RESULTS OF PLASMA HEATING OF HIGH SPEED AIR FLOW, by Raymond L. Chuan. Technical note on Contract AF 18(603)95. 31 July 58, 10p. USCEC rept. 56-203; AFOSR-TN-58-650; AD-162 182.
Order from LC mi$1.80, ph$1.80 PB 138 109

The decay of a plasma formed by a radio-frequency discharge in a supersonic air stream is utilized to heat the latter. Preliminary experiments show the method to be feasible; and a stagnation temperature in the neighborhood of 1200°K is attained in an air-stream at Mach number 3.5. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

Carnegie Inst. of Tech., Pittsburgh, Pa.
ON THE SCATTERING OF WATER WAVES BY A CIRCULAR DISK, by Richard C. MacCamy. Technical rept. no. 30 on Contract AF 49(638)227. Dec 59, 27p. 10 refs. AFOSR-TN-59-1261.
Order from LC mi$2.70, ph$4.80 PB 145 323

The boundary-value problem describing the diffraction of two-dimensional water waves by a dock of finite width has not as yet been solved in explicit fashion. It has however received considerable attention. The general problem of diffraction by surface obstacles was investigated thoroughly by John and later by Peters and Stoker. An existence proof for the finite dock problem, using the calculus of variations was given by Rubin. Finally it was shown by the author that the integral equation approach can be greatly simplified for the dock problem. It is the purpose of this paper to point out that the earlier results can be extended to the three-dimensional problem of diffraction by a circular dock.

David Taylor Model Basin, Washington, D. C.
LINEARIZED THEORY FOR FLOWS ABOUT LIFTING FOILS AT ZERO CAVITATION NUMBER, by M. P. Tulin and M. P. Burkart. Feb 55, 29p. 5 refs. Rept. C-638.
Order from LC mi$2.70, ph$4.80 PB 145 102

A linearized theory is developed for steady, two-dimensional cavity flows about hydrofoil sections at zero cavitation number. The problem of calculating the flow characteristics including the hydrofoil forces and pitching moments is reduced to an equivalent problem of the classical thin airfoil theory. This equivalence is used to investigate the characteristics of hydrofoil shapes of practical importance. In particular, the lift, drag, and pitching moment due to angle of attack and flap deflection are determined. The important effect of hydrofoil shape on the cavitation drag is revealed, and a family of moderately low drag sections is specified. The linearized theory results for the flat plate are shown to be equal to the first-order (in angle of attack) terms of the exact theory results. (Author)

Massachusetts Inst. of Tech., Cambridge.
AEROELASTIC STABILITY OF LIFTING SURFACES IN HIGH-DENSITY FLUIDS, by Charles J. Henry, John Dugundji and Holt Ashley. Rept. on Contract AF 49(638)160. June 58, 55p. 13 refs. Fluid Dynamics Research Group rept. 58-3; OSR Technical note no. 58-626; AD-162 156.
Order from LC mi$3.60, ph$9.30 PB 145 331

The large increases anticipated in speeds of vehicles towed or propelled underwater suggests a re-examination of the problem of stability of flexible lifting surfaces mounted thereon. Experimental and theoretical evidence is assembled which suggests that oscillatory aeroelastic instability (flutter) is very unlikely at the structural-to-fluid mass ratios typical of hydrodynamic operation. It is shown that static instability (divergence) is the more important practical problem but that its occurrence can be predicted with greater confidence. Flutter data obtained in high-density fluids are reviewed, and various sources of inaccuracy in its theoretical prediction are analyzed.

Willow Run Labs., U. of Michigan, Ann Arbor.
NEW EXACT SOLUTIONS OF THE NAVIER-STOKES EQUATIONS, by W. C. Meecham. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 10p. 3 refs. Rept. no. 2144-372-T; AD-213 410.
Order from LC mi$1.80, ph$1.80 PB 145 375

These new, exact, closed-form solutions of the Navier-Stokes equations for incompressible flow and of the hydromagnetic equations for high-conductivity, incompressible flow are a potential aid in understanding many physical phenomena of fundamental importance to combat surveillance. The solutions are two-dimensional and cellular, containing a single-space Fourier component; the spatial behavior is chosen in such a way that the nonlinear inertial term and the pressure term cancel one another, leaving a linear system to be solved. The time behavior of the solutions is quite general. The solutions to the hydromagnetic equations are such that the velocity and the magnetic fields are parallel and decoupled. The velocity behaves as it does in the purely mechanical case, and the magnetic field simply decays in time; there is no source term for the magnetic field in the present treatment. (Author)

METALLURGY

American Potash and Chemical Corp., West Hanover, Mass.
EXPLOSIVE FORGING, by Vasil Philipchuk. Final technical rept. for July 58-Sep 59 on Contract AF 33(600)37751. Oct 59, 68p. AMC Technical rept. 59-7-694.
Order from OTS $1.75 PB 161 457

Explosives were proved feasible for producing close tolerance, one-sided, closed die aluminum alloy forgings for aircraft and missiles. Capital investments for equipment for explosive forging are lower than for conventional forging, but current operating costs are higher.

Birmingham U. [Gt. Brit.]
THE BEHAVIOUR OF GRAIN BOUNDARIES IN METALS IN A TEMPERATURE GRADIENT, by R. W. Cahn and R. W. Lucas. Final technical summary rept. for Oct 56-Oct 59 on Contract AF 61(514)1020. [1959] 45p. 14 refs. AFOSR-TR-59-126; AD-230 161.
Order from LC mi$3.30, ph$7.80 PB 145 664

Grain boundary motion induced by a temperature gradient does not take place in a metal of high purity. It does so only at temperatures within a few degrees of the melting point of the solvent metal. It can occur when appropriate solutes are concentrated at the grain boundary. The "driving force" for migration is always small and surface tension forces, tending to contract a curved boundary, readily mask the effect.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SELECTED REFERENCES ON MAKING HIGH-TEMPERATURE ALLOYS BY POWDER METALLURGY, by Vincent D. Barth. 18 Mar 60, 6p. 33 refs. DMIC memo 47.
Order from OTS $0.50 PB 161 197

These comments are primarily confined to some of the more informative references which are useful as guides in planning refractory alloy production.

Materials Research Lab., Watertown Arsenal, Mass.
TEMPERATURE DEPENDENCE OF THE DEBYE TEMPERATURES OF ALUMINUM, LEAD, AND BETA BRASS BY AN X-RAY METHOD, by D. R. Chipman. Oct 59, 15p. 20 refs. MRL Rept. no. 67; AD-228 367.
Order from LC mi$2.40, ph$3.30 PB 145 355

The temperature dependence of the Debye temperatures of aluminum, lead, and beta brass were determined by measuring the integrated intensity of a high angle X-ray diffraction peak from each of the materials as a function of temperature. Corrections were made for the accompanying changes in density, scattering factor, and Lorentz-polarization factor, as well as for the underlying temperature diffuse scattering peak. In agreement with recent elastic constant measurements, evidence is found for an explicit temperature dependence beyond that resulting from the simple dependence of Debye temperature on volume.

Northwestern Technological Inst., Evanston, Ill.
KINETICS OF SINTERING OF SODIUM CHLORIDE IN THE PRESENCE OF AN INERT GAS, by D. H. Whitmore and J. B. Moser. Rept. on Contract AF 49(638)436. 19 Nov 59, 27p. 23 refs. AFOSR-TN-59-1256; AD-231 157.
Order from LC mi$2.70, ph$4.80 PB 145 644

Direct observations of interfacial growth and the approach of centers between spheres of sodium chloride were made in an argon atmosphere and over a temperature range of 700 to 800°C. A model is presented which considers Stefan flow to occur within a thin boundary layer in the gaseous phase adjacent to the condensing surface, the sintering rate being predominantly governed by the rate at which sodium chloride vapor diffuses through this boundary layer.

Ohio State U. Research Foundation, Columbus.
THE OXIDATION CHARACTERISTICS OF COLUMBIUM ALLOYS, by Gerald Gordon, Coulson Scheuermann, and R. Speiser. Rept. on Contract N6onr-22528. Mar 59, 56p. 29 refs. Technical rept. 467-5.
Order from LC mi$3.60, ph$9.30 PB 145 625

Contents:
Oxidation behavior of columbium-titanium alloys
Oxidation of columbium-titanium-chromium alloys
The oxidation behavior of columbium-zirconium alloys
The oxidation of Cb-Zr-Ti and Cb-Zr-Cr alloys
Oxide morphology
Variation of hardness across oxidized zones
Identification of the various oxide phases

Springfield Armory, Mass.
DETERMINATION OF THE REACTIVITY OF THE ACTIVE CHEMICAL CONSTITUENTS IN CUTTING FLUIDS WITH VARIOUS METALS AND ALLOYS, by L. Krasnor. Edited by Associated Engineers, Inc., under Contract DA 19-020-504-ORD-4800. 30 July 59, 24p. 7 refs. SA-TR16-1057.
Order from LC mi$2.70, ph$4.80 PB 145 377

An analysis was made of the reaction of six different oils upon twelve different metals and alloys. A temperature of 400 F. was maintained for two hours. These oils were made with five separate classes of active chemical ingredients. Results show that there is a positive and substantial chemical effect.

Ferrous Metals

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
THEORETICAL CONSIDERATIONS OF CORROSION AND HYDROGEN EMBRITTLEMENT INHIBITION (REVIEW OF CONTRACT WORK AT RUTGERS UNIVERSITY) by M. Rosenfeld. 12 Jan 60, 25p. Rept. no. CCL-88.
Order from LC mi$2.70, ph$4.80 PB 145 360

The writer proposes that hydrogen embrittlement inhibition is proportional to the fraction of anodic area covered by the inhibitor(s). Inhibition is due to the potential that is set up between the anodic and cathodic adsorbed inhibitor(s) and this potential opposes the corrosion potential.

Rodman Lab., Watertown Arsenal, Mass.
EFFECTS OF LEAD ADDITION ON THE LATHE CUTTING PROCESS, by Roy Mennell and Fenton L. Bagley, Jr. Oct 59, 25p. 22 refs. Rept. no. RPL-23/8.
Order from LC mi$2.70, ph$4.80 PB 145 379

The effects of lead on the cutting mechanism were revealed only below a critical speed, which was found to decrease for increased workpiece hardness and feed. The lead additive acting as a lubricant on the tool chip interface satisfactorily explains the effects of lead addition below the critical speed.

Watertown Arsenal Labs., Mass.
LOW TEMPERATURE TENSILE-HARDNESS CORRELATIONS OF SAE 4340 STEEL, by John Nunes and Frank R. Larson. Feb 60, 19p. 8 refs. Technical rept. no. WAL TR-320.4/1.
Order from OTS $0.50 PB 161 467

Vickers hardness (DPH) and tensile strength (UTS) were studied on one heat of SAE 4340 steel as a function of testing temperature. It was found that these two variables (DPH and UTS) are linear with respect to the reciprocal absolute temperature. It is possible to derive some simple empirical equations for calculating approximate values of DPH or UTS in the temperature range studied.

Watertown Arsenal Labs., Mass.
MULTIPLE BLOW TRANSITION IN CHARPY TESTING, by George M. Orner and Carl E. Hartbower. Nov 59, 16p. 8 refs. Technical rept. no. WAL TR 112/87-8; AD-228 452.
Order from LC mi$2.40, ph$3.30 PB 145 527

Investigations using a multiple-blow technique in Charpy impact testing, have demonstrated an abrupt inflection in the low-energy range of the energy-to-propagate transition curve. It was desired to determine the effect of variations in the magnitude of low-blow on the transition temperature.

Light Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
RECENT DEVELOPMENTS IN TITANIUM BRAZING, by G. E. Faulkner and W. J. Lewis. 4 Mar 60, 8p. 4 refs. DMIC memo. 45.
Order from OTS $0.50 PB 161 195

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
FATIGUE BEHAVIOR OF 2014-T6, 7075-T6 AND 7079-T6 ALUMINUM ALLOY REGULAR HAND FORGINGS, by D. A. Paul (Kaiser Aluminum and Chemical Corp.) and D. Y. Wang. Rept. for Feb 58-Aug 59 on Materials Analysis and Evaluation Techniques. Jan 60, 34p. WADC Technical rept. 59-591.
Order from OTS $1.00 PB 161 500

This report presents the test procedures and results of a fatigue investigation on regular hand forgings of the aluminum alloys 2014-T6, 7075-T6 and 7079-T6. The effects of forging direction on fatigue strength are investigated in the unnotched and notched condition. The unnotched fatigue strength of the three alloys ranged from 20,000 psi at 2 x 10^7 cycles, with the 7079-T6 alloy being slightly lower than 7075-T6 and about the same as that of the 2014-T6 alloy. The fatigue strength in the short transverse direction is consistently lower than in the longitudinal direction; however, the difference becomes less in the notched condition. (Author)

Metals Research Lab., Brown U., Providence, R. I.
THE USE OF ULTRASONIC METHODS TO DETERMINE FATIGUE EFFECTS IN METALS, by Rohn Truell, Bruce Chick and others. Rept. for 16 June 58-15 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5884. Nov 59, 24p. 1 ref. WADC Technical rept. 59-389; AD-226 098.
Order from OTS $0.75 PB 161 487

An investigation was made to detect and follow physical changes in materials, primarily Al, during stress cycling by means of high frequency ultrasonic attenuation and velocity measurements. A discussion is presented of observed changes in ultrasonic attenuation and velocity in commercially pure 1100 Al (Alcoa) when subjected to slow continued stress cycling (1 to 6000 c) and a delayed recovery phenomenon that appeared when the cycling was interrupted. The development of an automatic instrument to measure and record ultrasonic attentuation changes is also discussed.

Michigan U. Research Inst., Ann Arbor.
EFFECT OF PRIOR CREEP ON THE MECHANICAL PROPERTIES OF A HIGH-STRENGTH HEAT-TREATABLE TITANIUM ALLOY, Ti-16V-2.5Al, by Jeremy V. Gluck and James W. Freeman. Rept. for 8 July 58-31 Mar 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3368. Nov 59, 76p. 6 refs. WADC Technical rept. 59-454.
Order from OTS $2.00 PB 161 490

The effect of creep to 2 percent in 10 or 100 hours at temperatures from 600° to 900°F was determined on the tension, compression, and tension-impact properties of Ti-16V-2.5Al at room temperature or the exposure temperature. Prior creep at 600°F raised ultimate tensile and yield strength. Lesser changes were found at higher temperatures. Changes in properties are attributed to a combustion of stress-accelerated age-strengthening and a Bauschinger effect. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
RESIDUAL STRESSES IN WELDED TITANIUM PLATES, by E. F. Nippes and W. F. Savage. Final technical rept. on Contract DA 20-089-ORD-36696. Nov 57, 45p. 3 refs. AD-148 171.
Order from LC mi$3.30, ph$7.80 PB 145 367

The magnitude and type of residual stresses in welded titanium plates were determined by the subdivision technique employing electrical resistance strain gages. Commercially pure titanium plate and 7%-manganese titanium alloy plate, 5/8-in. thick, were investigated, welded in both cases with commercially pure titanium filler wire utilizing the inert-gas consumable arc process.

Nonferrous (except light) Metals

Rice Inst., Houston, Tex.
STEADY-STATE CREEP OF TIN NEAR THE MELTING POINT, by W. A. Zama, D. D. Lang, and F. R. Brotzen. Technical rept. no. 1 (Final) on Contract DA 23-072-ORD-1167. 15 Oct 59, 33p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 368

The steady-state creep rates of commercial tin were investigated at temperatures between 180 and 230°C. At temperatures below 215°C results indicate that the steady-state creep process is one governed by a single activation energy of 22,500 cal/mol. At higher temperatures, however, the simple Arrhenius-type equation cannot properly express the creep behavior.

Springfield Armory, Mass.
COLUMBIUM AS A HIGH TEMPERATURE STRUCTURAL MATERIAL, by E. H. Abbe. 3 June 59, 25p. 3 refs. SA-TR19-1207.
Order from LC mi$2.70, ph$4.80 PB 145 530

An investigation was made to determine the influence of oxygen in the strengthening and hardening of columbium at both elevated and room temperatures, results of metallurgical examination, X-ray diffraction studies, and hardness tests of sintered and compacted columbium specimens which had been impregnated with various amounts of oxygen are discussed. Increments of added oxygen diffused inwardly through the sintered and compacted metal will strengthen it in essentially a linear manner.

Temple U., Philadelphia, Pa.
EFFECTS OF TEMPERATURE AND COLD WORK ON OPTICAL PROPERTIES OF METALS AND ALLOYS, by L. Muldawer. Final rept. on Contract AF 49(638)73. 15 Oct 58, 26p. 27 refs. AFOSR-TR-58-140; AD-204 553.
Order from LC mi$2.10, ph$4.80 PB 137 954

Alloys similar in character to β-brass have been studied with respect to spectral reflectivity and color as a function of temperature and surface treatment. Large changes in reflectivity edge position and color were observed for changes in temperature; a tendency toward edge disappearance was observed upon cold working. Alloys which are basically face-centered cubic do not show these properties. Electron and x-ray diffraction studies indicate stress induced phase transformations in many of the alloys of the β-brass type. (Author)

Structural Metallurgy and Corrosion

Case Inst. of Tech., Cleveland, Ohio.
HYDROGEN EMBRITTLEMENT IN TERMS OF MODERN THEORY OF FRACTURE, by P. A. Blanchard and A. R. Troiano. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)6419. Aug 59, 31p. 18 refs. WADC Technical rept. 59-444.
Order from OTS $1.00 PB 161 531

An attempt was made to apply Cottrell's theory of brittle fracture to hydrogen embrittlement. A tentative explanation was given to the fact that only transition metals have been thus far embrittled by hydrogen. The influence of the composition of nickel base alloys on their susceptability to hydrogen embrittlement was discussed with the help of some previous and new experimental results. (Author)

Case Inst. of Tech., Cleveland, Ohio.
THE LOWER CRITICAL STRESS FOR DELAYED FAILURE, by E. A. Steigerwald, F. W. Schaller, and A. R. Troiano. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)6419. Aug 59, 36p. 21 refs. WADC Technical rept. 59-445.
Order from OTS $1.00 PB 161 532

The lower critical stress was defined as the minimum stress necessary to produce the critical amount of hydrogen segregation required for crack initiation. A distribution law involving hydrogen concentration, applied stress, and temperature was assumed. On the basis of this law, the observed changes in the lower critical stress as a function of notch acuity, yield strength, temperature, and initial hydrogen content were explained for a significant range of these variables. (Author)

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
STUDY OF A NEWLY DEVELOPED INHIBITOR FOR ETHYLENE GLYCOL IN STORAGE, by Charles B. Jordan. 28 Dec 59, 15p. 4 refs. CCL #86.
Order from LC mi$2.40, ph$3.30 PB 145 683

The object of this study is to show the effect of inhibited ethylene glycol on unlacquered tin-coated steel. Inhibitors involved in the study were a newly developed sodium tetraborate/propylene glycol condensate, borax, and mercaptobenzothiazole. Diluted and undiluted ehtylene glycol was studied. Tin-Coated steel panels were immersed in solutions contained in test jars at room temperature. Inspections were made after 2, 4, 6 and 8 months. It appears that ethylene glycol can be stored in metal containers using MBT in the inhibitor systems providing some of the new condensate forms a part of the inhibitor system. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
CURRENT TESTS FOR EVALUATING FRACTURE TOUGHNESS OF SHEET METALS AT HIGH STRENGTH LEVELS, by J. E. Campbell and W. P. Achbach. Rept. on Contract AF 18(600)1375. 28 Jan 60, 71p. 40 refs. DMIC rept. 124.
Order from OTS $2.00 PB 151 081

In attempting to overcome the brittle fracture problem in solid propellant rocket cases, a number of investigators have developed special tests to measure the fracture toughness of high-strength sheet metals. None of the standard tests are suitable, and the tests that have been used in brittle fracture studies of shipplate and landing-gear steels could not be used for high-strength sheet. A review of the tests that were developed for high-strength sheet metals is presented. These tests involve tensile loading of notched specimens; bending of flat and notched specimens; impact loading of notched specimens; bulging of unnotched, notched, and welded specimens; and combinations of tensile loading and internal pressuring of cylindrical specimens. None of these has been recognized as a standard test and correlation of test data with pressure-vessel performance is very limited. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
METHODS FOR CONDUCTING SHORT-TIME TENSILE, CREEP, AND CREEP-RUPTURE TESTS UNDER CONDITIONS OF RAPID HEATING, by Donald P. Moon and Ward F. Simmons. Rept. on Contract AF 18(600)1375. 28 Dec 59, 43p. 68 refs. DMIC rept. 121.
Order from OTS $1.25 PB 151 078

This report reviews the equipment and testing methods used by 15 different organizations in the tensile and short-time creep testing of materials under conditions of rapid heating. Special attention is devoted to specimen design, method of heating, and the measurement of temperature, load, and strain during the test. ASTM-recommended practices are cited and relative merits of alternative techniques are discussed. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STRUCTURAL DAMAGE IN THERMALLY CYCLED RENE 41 AND ASTROLOGY SHEET MATERIALS, by D. P. Moon, J. A. VanEcho and others. Rept. on Contract AF 18(600)1375. 29 Feb 50, 27p. DMIC rept. 126.
Order from OTS $0.75 PB 151 083

Stress-rupture life at 1650 F and tensile properties at room temperature and at 1400 F were used to determine the extent of structural damage in thermally cycled René 41 and Astroloy sheet materials. Solution-treated and aged René 41 was tested both in the heat-treated condition and after exposure to 10 or 100 thermal cycles between 1350 F and 1750 or 1875 F. All of the conditions of thermal-cycling exposure caused at least some loss in the strength of this material. Metallographic examination indicated that overaging was primarily responsible for the damage at 1750 F, and resolution of the $Ni_3(Al, Ti)$ precipitate and depletion of the alloy by surface oxidation were the damaging mechanisms at 1875 F. Solution-treated and aged Astroloy was evaluated in the same manner in the heat-treated condition and after 10 thermal cycles between 1350 F and 1875 F. No loss of strength was incurred by this exposure, but overaging had taken place and would probably have caused structural damage with further exposure. (Author)

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
FOUNDRY TECHNIQUES. Summary rept. no. 1 on Contracts AF 33(616)3892 and AF 04(645)09. Oct 57, 51p. 21 refs. Rept. R-154; AD-155 405.
Order from LC mi$3.60, ph$9.30 PB 146 125

Techniques are presented which permit production of high-strength - high-ductility 356 aluminum alloy castings. The high-strength - high ductility castings may be cast and heat treated to possess minimum mechanical properties as high as 38,000 psi tensile strength, 28,000 psi yield strength, 6 percent elongation. Application of the techniques to specific intricate castings is described. Foundary procedures used in making the castings are outlined and mechanical properties obtained from test bars cut from the castings are presented.

Martin Co., Baltimore, Md.
DEVELOPMENT AND EVALUATION OF STRUCTURAL BERYLLIUM, by C. J. Giemza. Final rept. for 1 May 58-30 Apr 59 on Contract AF 33(616)5180. Apr 59, 70p. 30 refs. WADC Technical rept. 59-349.
Order from OTS $1.75 PB 161 507

Three major problems have been studied: (1) the development of a process for fabricating structural beryllium sheet to the requirements of airframe applications; (2) the evaluation of its mechanical properties and characteristic behavior to establish its structural merit; and (3) the fabrication of a box-beam structure and a preliminary experimental and analytical qualification of its structural behavior. The goals posed by these problems have been achieved by: defining requirements for structural beryllium sheet, developing a fabrication process, and evaluating fabrication parameters, mechanical properties, and structural characteristics. The comprehensive body of data which has been accumulated will provide a basis for additional study of a broad range of topics, including fundamental behavior, sheet fabrication, forging, forming, design, and testing. (Author) (See also PB 151 263)

Materials Research Corp., Yonkers, N. Y.
THE INVESTIGATION OF THE MECHANISM OF SUBSTRUCTURAL FORMATION IN REFRACTORY METALS AND THE RELATION TO THE OBSERVED MECHANICAL PROPERTIES, by A. Iannucci, J. Intrater and others. Rept. for 15 June 58-15 June 59 on Metallic Materials, Contract AF 33(616)5908. Jan 60, 32p. 3 refs. WADC Technical rept. 59-441, Pt. I.
Order from OTS $1.00 PB 161 489

The formation of substructure in molybdenum as a function of prestrain and polygonization anneal temperature has been demonstrated by metallographic and x-ray techniques. The x-ray diffraction line width is markedly increased by the presence of substructure. In both polycrystalline and single crystal creep tests the creep resistance increased as a function of prestain. In single crystal tests the creep resistance decreased with increased polygonization anneal time. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
OBSERVATIONS ON DIFFUSION IN THE IRON-CHROMIUM SYSTEM, by H. W. Paxton, E. J. Pasierb and T. Kunitake. Technical rept. on Contract Nonr-760(08). 1 Mar 59, 22p. 33 refs.
Order from LC mi$2.70, ph$4.80 PB 145 394

Measurements of self diffusion of chromium using the isotope Cr^{51} in the iron-chromium system from 30 to 100% chromium have been made by autoradiographic techniques at 1275°C.

Naval Engineering Experiment Station, Annapolis, Md.
INVESTIGATION OF CORROSION MECHANISMS IN IDLE BOILERS AND CONDENSATE SYSTEMS, by Frank E. Clarke and A. J. Ristaino. 28 Apr 58. 54p. Research and Development rept. 610314A; AD-204 405.
Order from LC mi$3.60, ph$9.30 PB 145 357

Among factors that contribute to corrosion in idle boilers are partially filled tubes and conventional boiler water treatment chemicals in presently prescribed concentrations which tend to localize attack rather than to prevent it completely in partially filled ferrous containers. Sodium nitrite appears to be the most promising chemical inhibitor of corrosion in idle boilers.

Naval Engineering Experiment Station, Annapolis, Md.
RESISTANCE OF COPPER-NICKEL ALLOYS TO CORROSION BY JP-5 FUEL, by T. N. Cornish and C. L. Brown. 25 Sep 57, 7p. 6 refs. Research and Development rept. 070444A; AD-147 464.
Order from LC mi$1.80, ph$1.80 PB 145 358

Corrosion studies were made of attack by JP-5 jet fuel on 70-30 and 90-10 copper-nickel alloys. Both copper-nickel alloys showed some corrosive attack with the fuels tested. The West Coast fuel appeared to be somewhat less corrosive than the other two fuels. 70-30 copper-nickel was less susceptible to attack.

Rock Island Arsenal Lab., Ill.
DEVELOPMENT OF AN INTERNAL PRESERVATIVE OIL FOR MACHINE TOOLS, by R. LeMar. 24 Nov 59, 32p. 5 refs. Rept. no. 59-3003.
Order from LC mi$3.00, ph$6.30 PB 145 115

Experimental work was carried out to develop oil formulations whose corrosion preventive properties approached those of Military Specification MIL-C-14201A, Grade 1, "Corrosion Preventive, Soft-Film, Cold Application", and would be suitable as an internal preservative for machine tools. A number of accelerated corrosion tests were evaluated to find methods suitable for the reasonably rapid testing of highly inhibited, heavy, long-term preservative oils. In the course of these tests it was shown that cyclic accelerated corrosion tests can show very poor performance characteristics for oils that perform well in constant temperature and constant humidity tests. These test results on the RIA blends provided a basis for the preparation of a list of test methods and requirements to define the proposed long-term internal preservative oil for machine tools.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Admiral Corp., Chicago, Ill.
EVALUATION-DEVELOPMENT OF MIL-C-14157 CAPACITORS FOR NUCLEAR RADIATION ENVIRONMENT, by E. R. Pfaff. Scientific rept. no. 1 on Contract NObsr-77612. 22 Oct 59, 23p.
Order from LC mi$2.70, ph$4.80 PB 145 207

The experimental procedures being employed for evaluating the radiation damage to the CPM-08 capacitors are discussed. The radiation environment is produced by a 20,000 curie cobalt-60 source. The capacitors are to be subjected to gamma fields of approximately 10^5R/hr. for 1000 hours. Initial tests show that the kraft dielectric tissue becomes brittle and gas evolution is associated with the mineral oil impregnant. (Author)

Armour Research Foundation, Chicago, Ill.
REVIEW OF RADIATION CHEMISTRY PAPERS PRESENTED AT THE 2ND GENEVA CONFERENCE, by P. Y. Feng. Rept. on Contract AF 18(603)121. [1959] 41p. 34 refs. AFOSR-TN-59-36; AD-213 865.
Order from LC mi$3.30, ph$7.80 PB 145 655

This review is a condensation of the papers presented for oral presentation at the Radiation Chemistry sessions (C-12 and C-13) of the Second UN Conference on the Peaceful Uses of Atomic Energy held at Geneva, Switzerland, in September 1958. It includes topics on elementary processes, detection of intermediates, irradiation facilities, aqueous systems, organic systems, polymers, catalysts, as well as the reactions of hot atoms.

Diamond Ordnance Fuze Labs., Washington, D. C
EFFECTS OF SPECTRUM ON NEUTRON RADIATION DAMAGE IN SOLIDS, by John S. Wicklund. 15 Dec 59, 15p. 3 refs. TR-803.
Order from LC mi$2.40, ph$3.30 PB 145 359

This paper treats the effects of a variety of spectra, develops a method for comparing spectra in terms of radiation damage in solids, and derives expressions for neutron damage as a function of time and neutron energy.

Michigan U. Research Inst., Ann Arbor.
GEOMETRICAL CORRECTIONS IN DIRECTIONAL CORRELATION EXPERIMENTS, by R. G. Arne, R. E. Sund, and M. L. Wiedenbeck. Technical rept. to 1 Jan 59 on Investigation of Nuclear-Energy Levels, Contract Nonr-1224(13). Feb 59, 13p. 6 refs. 2375-4-T; AD-217 467.
Order from LC mi$2.40, ph$3.30 PB 145 792

The relationship between the point-point angular correlation, $W(\theta) = \sum_l A_l P_l(\cos\theta)$, and the measured correlation function, $W'(\theta) = \sum_l A_l' P_l(\cos\theta)$, has been discussed by Feingold and Frankel for finite detectors of arbitrary shape and efficiency. Their results are applied to the special case of gamma-gamma angular correlation experiments with cylindrical scintillation detectors and axially extended sources. The inherent limitations of the method and effect of detector shielding are discussed. The resulting correction factors have been determined for various energies and configurations and verified experimentally. (Author) This report also refers to 7 articles published in Physical Review or Physical Review Letters.

Elementary Particles

Army Chemical Warfare Labs., Army Chemical Center, Md.
AN EXPERIMENTAL STUDY OF THE INDUCTION OF GAMMA-EMITTING ACTIVITIES IN SEVERAL AMERICAN SOILS BY NEUTRONS OF VARIOUS ENERGIES, by John H. McNeilly and Eugene Eichler. Sep 59, 27p. 9 refs. CWLR-2299; AD-226 908.
Order from LC mi$2.70, ph$4.80 PB 145 634

This report describes experiments to determine the important gamma-emitting nuclides which are formed in soils by neutrons of various energies. It was found that the radiative capture of thermal neutrons was the predominant reaction and the important nuclides formed are Al^{28}, Mn^{56}, and Na^{24}. (Author)

Cambridge U. (Gt. Brit.)
DISPERSION RELATION PREDICTIONS FOR π, p SCATTERING, by T. D. Spearman. Scientific note no. 1 on Contract AF 61(052)233. Oct 59, 6p. 12 refs. AFOSR-TN-59-1313.
Order from LC mi$1.80, ph$1.80 PB 145 682

The dispersion relations for forward elastic π-p scattering are used to calculate the real parts of the forward scattering amplitude. It is found that using more accurate experimental data, the discrepancy observed by Puppi and Stanghellini can be resolved. A more precise value for the renormalized π, N coupling constant is predicted. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
UPPER BOUNDS ON SCATTERING LENGTHS WHEN COMPOSITE BOUND STATES EXIST, by L. Rosenberg, L. Spruch, and T. F. O'Malley. Rept. on Contract AF 19(604)4555. Oct 59, 34p. 21 refs. Research rept. no. CX-44; AFCRC-TN-59-604.
Order from LC mi$3.00, ph$6.30 PB 145 293

In the case of the zero energy scattering of one compound system by another, where one real scattering length completely characterizes the problem, (e. g., the reaction A+B→C+D, in addition to A+B,→ A+B, cannot take place) it has previously been shown that the Kohn-Hulthén variational principle provides an upper bound on the scattering length if no composite bound states exist. The extension of this result to the case where one or more composite bound states do exist is presented here. The inclusion of tensor forces, exchange forces, and Coulomb forces is allowed. Several methods are given for obtaining a rigorous upper bound on the scattering length, which involve the addition of certain positive terms to the Kohn-Hulthen variational expression.

Lawrence Radiation Lab., U. of California, Berkeley.
NOTE ON THE K-MESON NUCLEON INTERACTION, by Robert Karplus, Leroy Kerth, and Thaddeus Kycia. Rept. on Contract AF 49(638)327. [1959] 11p. 12 refs.. AFOSR-TN-59-677.
Order from LC mi$2.40, ph$3.30 PB 145 577

Maryland U., College Park.
HIGH ORBITAL S-STATE CAPTURE OF π-MESONS BY PROTONS, by T. B. Day, G. A. Snow and J. Sucher. Rept. on Contracts AF 49(638)24 and AT(40-1)2504. Dec 59, 9p. 10 refs. Physics Dept. Technical rept. no. 159; AFOSR-TN-59-1295.
Order from LC mi$1.80, ph$1.80 PB 145 643

Maryland U., College Park.
$|\Delta I = 1/2$ - RULE AND THE WEAK FOUR-FERMION INTERACTION, by S. Oneda, J. C. Pati, and B. Sakita (U. of Wisconsin). Dec 59, 11p. 19 refs. Physics Dept. Technical rept. no. 160; AFOSR-TN-60-12; AD 230 873.
Order from LC mi$2.40, ph$3.30 PB 145 511

New York U. Coll. of Engineering, N. Y.
ELASTIC SCATTERING OF ELECTRONS BY ATOMIC HYDROGEN, by Benjamin Bederson, Jacob M. Hammer, and Herbert Malamud. Technical rept. no. 2 on Electron Scattering Project, Nonr-285(15). 1 Jan 58, 85p. 45 refs. AD-154 792.
Order from LC mi$4.80, ph$13.80 PB 137 950

An atomic beam method has been used to perform measurements on the total scattering cross sections of electrons by atomic hydrogen for electron energies between 1.5 and 14.5 e.v. An $H_1 + H_2$ beam is produced by an RF discharge and an electron beam is produced by an electrostatically focused gun. The $H_1 + H_2$ beam is mechanically chopped (25 cps) and is made to cross the electron beam in the scattering region. The scattered electrons are collected by a Faraday chamber and the observed signal recorded by a phase sensitive detection system. Absolute values for the atomic cross sections are obtained by normalizing to the known molecular cross sections.

Uppsala U. (Sweden).
$A_\Lambda H^4$ HYPERFRAGMENT EMITTED FROM AN ANTIPROTON CAPTURE STAR, by A. G. Ekspong, A. Frisk, and B. E. Ronne. Technical note no. 4 on Contract AF 61(052)13, phase D. [1959] 10p. 12 refs. AFOSR-TN-59-842.
Order from LC mi$1.80, ph$1.80 PB 145 676

The observation of a definite case of Λ hyperon emission from an antiproton annihilation in a heavy nucleus in nuclear emulsion is reported. The emulsion stack was exposed to a beam of 740 MeV/c antiprotons at the Bevatron. The Λ hyperon is emitted bound in a Λ H^4 hyperfragment. From observational data we calculate a Λ binding energy of 2.6 ± 1.0 MeV. (Author)

Weizmann Inst. of Science (Israel).
MONTE-CARLO CALCULATION OF MESON PRODUCTION IN NUCLEAR REACTIONS. PART I: N-N COLLISIONS AT 100 BEV REGION, by Uri Maor and Gideon Yekutieli. Technical scientific note no. 1 on Contract AF 61(052)58. [1959] 13p. 7 refs. AFCRC-TN-59-433.
Order from LC mi$2.40, ph$3.30 PB 145 689

The two known models of nucleon-nucleus reaction: the nuclear cascade and the "tunnel" models are good approximation at low and at extremely high energies respectively. A third model of nucleon-nucleus reaction "the cascade of excited nucleons" is proposed for the intermediate energy range 25-250 Bev.

Yale U., New Haven, Conn.
ELECTRIC POLARIZABILITY OF THE NEUTRON, by G. Breit and M. L. Rustigi. Rept. on Contract AF 18(600)771. 3 Dec 58, 25p. 7 refs. AFOSR-TN-58-1063; AD-207 223.
Order from LC mi$2.70, ph$4.80 PB 138 352

In connection with a proposed explanation of the anisotropy observed in the scattering of neutrons from various elements at energies of a few hundred kev the order of magnitude of the neutron polarizability is estimated making use of data on photopion production.

Instruments and Installations

Army Chemical Warfare Labs., Army Chemical Center, Md.
DESCRIPTION AND OPERATION OF CHEMICAL CORPS HELICOPTER-TO-GROUND AERIAL SURVEY INSTRUMENT, by Michael J. Schumchyk, John P. Johnson, and John R. Lapic. Sep 59, 27p. 8 refs. CWL Special pub. 3-7; AD-225 266.
Order from LC mi$2.70, ph$4.80 PB 145 272

A helicopter-to-ground aerial radiological survey instrument and its operation are described. The instrument consists of a radiation detector mounted in a tripod connected by a four-conductor cable to an indicating meter through a powered reel. While the helicopter hovers several hundred feet in the air, the radiation detector can be positioned 3 ft above the ground. This instrument is especially suitable for an accurate point survey of radiation fields where survey by ground crews is impractical either because of excessive dose rates in the area or because of inaccessible terrain features. (Author)

Lamont Geological Observatory, Palisades, N. Y.
EXTENSION OF TECHNIQUE FOR NATURAL TRITIUM MEASUREMENTS, by Wallace S. Broecker. Final rept. on Contract AF 19(604)4076. 8 Dec 59, 26p. AFCRC-TR-59-402.
Order from LC mi$2.70, ph$4.80 PB 145 654

An attempt has been made to define the sources and time variations in the natural background of large volume proportional counters in order that more sensitive counters might be constructed for the tritium assay of natural waters.

Radioactivity

Naval Radiological Defense Lab., San Francisco, Calif.
THEORY OF DECONTAMINATION, PART I, by C. F. Miller. 15 July 58, 128p. 13 refs. Research and development technical rept. USNRDL-460.
Order from LC mi$6.30, ph$19.80 PB 146 263

The available concepts of contamination by and decontamination of fallout resulting from nuclear detonations at sea, on land, and over harbors are reviewed; and theoretical equations describing the important chemical interactions with surfaces are summarized, and others are newly developed. The theoretical equations are fitted to and compared with applicable experimental data. The theory can be used as an aid in planning decontamination experiments as well as in interpreting decontamination data from field tests, since it designates the important variables on which the decontamination results depend. These variables include (1) the initial level of contamination, (2) the surface contaminated, (3) the decontamination method, (4) the environmental materials at the point of detonation, (5) the composition of the radioactive sources in the fallout, and (6) the yield and constituents of the bomb. Practical uses of the theory is illustrated by the interpretation of data from several decontamination experiments. The intent of the reported theory is to establish a basis for application of consistent scientific methods in experimental decontamination investigations and in interpretation of data in the field. The state of available literature on the subject is a clear indication that guides to a scientific approach are needed. (Author)

Naval Research Lab., Washington, D. C.
CALCULATION OF ABSORBED DOSE, by C. H. Cheek and V. J. Linnenbom. 24 Feb 60, 34p. 15 refs. NRL rept. 5448.
Order from OTS $1.00 PB 161 259

Equations and tabular data are presented for calculating the absorbed dose in rads when the field conditions of exposure to radiation are known. The elements considered here are those most commonly found in low-Z organic materials, such as plastics, elastomers, lubricants, and insulating materials. The types of radiation considered are gamma radiation, fast monoergic electron beams, and neutrons having a spectrum of energies. Examples are included to illustrate application of the formulas. (Author)

Technical Operations, Inc. [Arlington, Mass.]
SCATTERING OF GAMMA RAYS NEAR AN INTERFACE, by Eric T. Clarke and Paul L. Richards. Rept. on Contract AF 29(601)178. July 57, 58p. 4 refs. TOI 57-16; AFSWC-TR-57-3; AD-96 304.
Order from LC mi$3.60, ph$9.30 PB 146 128

Scintillation counter measurements of gamma ray flux from sources of Na-24, Co-60, and Au-198 immersed in water are reported. Data are presented showing variation in flux with depth of source and of detector for separation distances up to 20 mean free paths in water. It is shown that near the surface the predominant source of gamma rays is air scatter, particularly at large separation distances. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE USE OF COLORED FILTER GOGGLES FOR PROTECTION AGAINST FLASH BLINDNESS, by John Lott Brown. 22 Oct 59, 32p. 6 refs. NADC-MA-5917; BuMed Proj. MR005.13-6002.1, R-19; BuAer Proj. TED ADC AE-5210.
Order from LC mi$3.00, ph$6.30 PB 145 128

The times required for the resolution of parallel line grating test patterns displayed at various luminance levels up to 10^4 foot-lamberts were determined following exposure to an intense adapting flash (12, 500, 50, 000, or 100, 000 foot lamberts) of one second duration. Two gratings were used which required visual acuities of 0.13 and 0.33. The effect of viewing the adapting flash alone or both the adapting flash and the test flash through selective colored filters on the resolution was also determined. The resolution time was found to vary directly with the luminance level of the adapting flash and inversely with the luminance level of the display test pattern and dominant wavelength of the selective color filters. Under all conditions of adapting and testing used, the resolution time appeared to approach an asymptote of about 1/2 second. (Author)

Psychometric Lab., U. of North Carolina, Chapel Hill.
DEVELOPMENT OF SUITABLE RATING SCALES FOR MEASURING THE SUBJECTIVE REACTIONS OF TROOPS USING QM ITEMS UNDER ACTUAL FIELD TEST CONDITIONS, by Lyle V. Jones and Thomas E. Jeffrey. Rept. on Contract DA 19-129-QM-1291. Nov 59, 110p. 4 refs. Technical rept. R-5; FEA MRS-5902.
Order from LC mi$5.70, ph$16.80 PB 145 112

The purpose of this investigation was to determine: (1) The minimum number of characteristics necessary for the full investigation of the items studied; (2) The relative importance of these characteristics in the determination of overall acceptability by the soldier user. This research has undertaken to define 6 or 7 dimensions that provide most of the information normally found in 18 dimensions. A further result has been to show that by proper selection, only 4 dimensions may be necessary for the prediction of troop acceptability. (Author)

PHYSICS

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TECHNICAL PAPERS FROM THE QUARTERLY REVIEW OF BUMBLEBEE ACTIVITIES, JANUARY-DECEMBER 1958. Rept. on Contract NOrd-7386. [1958] 67p. 30 refs. Bumblebee rept. no. 283; AD-226 974.
Order from LC mi$3.90, ph$10.80 PB 145 307

Contents:
Mechanism of propane-air reaction based on analysis of flame front profiles
Skin friction measurements during ascending Viking flight
Ceramic rod antennas
Analysis of a transistor operational amplifier
Design and performance criteria of the acceleration switching hydraulic servo
Structure of hydrocarbon (C_2)-oxygen flames
Molecular diffusion studies in gases at high temperatures
Frequency analysis of a control loop containing a bistable element
A transistorized voltage-controlled FM subcarrier oscillator
Evaluation study of a transistor operational amplifier
Accuracy of zero-counters and their use in high-precision doppler measuring devices
A compiler for network analysis

Duke U., Durham, N. C.
MIXED BOUNDARY VALUE PROBLEMS IN MATHEMATICAL PHYSICS, by I. N. Sneddon and F. J. Lockett. Rept. on Contract AF 18(600)1341. 4 Jan 60, 178p. 70 refs. AFOSR-TN-60-51.
Order from LC mi$8.10, ph$27.30 PB 145 476

The occurrence of mixed boundary value problems in mathematical physics; The problem of the electrified disk; Dual integral equations and dual series; and Electrostatic problems.

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
THEORETICAL AND EXPERIMENTAL RESEARCH IN THERMOELECTRICITY. Scientific rept. no. 1 on Contract AF 19(604)4153, continuation of AF 33(616)3984, and on Contract Nonr-1841(51). 31 Dec 59, 163p. 31 refs. AFCRC-TN-60-125.
Order from OTS $3.00 PB 161 468

Techniques and equipment for growing single crystals of Bi_2Te_3. Preparation of HgTe-CdTe alloys with a general discussion of measurements on this material.

Measuring equipment which has been developed to measure those parameters which characterize thermoelectric material. Investigation of both the dependence of thermoelectric parameters on detailed microscopic processes and the actual behavior of thermoelectric devices. Theoretical analyses of devices and materials.

Maryland U., College Park.
PROPERTIES OF THE SUPERCONDUCTING CURRENT WHICH FOLLOW FROM CAUSALITY, by Richard A. Ferrell. Rept. on Contract Nonr-1797(00). Jan 59, 19p. 23 refs. Physics Dept. Technical rept. no. 129.
Order from LC mi$2.40, ph$3.30 PB 145 443

Acoustics

Harris Transducer Corp., Woodbury, Conn.
THE THEORY OF ACOUSTIC REFLECTORS FOR SONAR APPLICATIONS. REPORT 2. THE VARIABLE POSITION RESONATOR, by H. K. Farr and R. L. Townsend. Rept. on Contract Nonr-2720(00). 13 Feb 59, 20p. HTC-73-R2.
Order from LC mi$2.40, ph$3.30 PB 145 248

This report is the second in a program for the study of passive devices for the reflection or scattering of sound energy in deep water. The object of the general program is to develop alternatives to the conventional low density baffle materials (cork, "cell-tite", etc.) which fail at high hydrostatic pressures. Report I of this project discussed one device, an end loaded hollow cylinder, which was studied as a possible reflector of this kind. The present report is a study of another device, the passive variable position (V. P.) resonator. This consists of a sealed external shell surrounding an internal mass and coupled to this mass by a spring which permits relative motion between the two.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
CHARACTERIZATION OF PROBABILITY DISTRIBUTIONS FOR EXCESS PHYSICAL NOISES, by Jack Hilibrand. Rept. on Contract DA 36-039-sc-64637. 7 Sep 56, 54p. 30 refs. Technical rept. 276; AD-149 545.
Order from LC mi$3.60, ph$9.30 PB 145 526

Theoretical and experimental techniques are described for characterizing the probability distributions of certain excess physical noises by their moments. Theoretical methods are presented for applying this "moments technique" in the time domain to random-pulse noise, and in the frequency domain to any random functions for which the moments exist. The frequency-domain technique is used for a theoretical study of the approach to a gaussian distribution of random-pulse noise that is subjected to severe band-limiting. In contrast, the departure from a gaussian distribution of random-pulse noise that is band-limited by RC cutoffs at low and high frequencies is examined by using the time-domain technique. It is found that the approach of noise distributions to gaussian is governed by the "memory" of the filter system rather than simply by its bandwidth. (Author)

Electricity and Magnetism

Antenna Lab., Calif. Inst. of Tech., Pasadena.
CURRENT ON AN INFINITELY LONG CYLINDRICAL ANTENNA, by Hans H. Kuehl. Technical rept. no. 23 on Contract AF 18(600)1113. Oct 59, 11p. 3 refs. AFOSR-TN-59-1168.
Order from LC mi$2.40, ph$3.30 PB 145 316

The infinitely long circular cylindrical antenna driven at some cross section by a localized electromotive force, V, circumscribing the cylinder in a peripheral band is considered. The asymptotic expression for the current at large distances from the driving e. m. f. is derived using the saddle point method. It is shown that the amplitude of this current is proportional to the reciprocal of the logarithm of axial distance from the driving e. m. f. (Author)

Antenna Lab., Calif. Inst. of Tech., Pasadena.
A NOTE ON CURRENTS ON A QUADRATIC SURFACE, by George G. Weill. Technical rept. no. 21 on Contract AF 18(600)1113. Sep 59, 9p. 2 refs. AFOSR-TN-59-1102.
Order from LC mi$1.80, ph$1.80 PB 145 319

Although no explicit general solution is known for the vector integral equation satisfied by the current density vector on a conducting surface, it is shown in the following report that the vector equation can be "scalarized" in the case of a quadratic conducting surface. (Author)

Electro-Mechanics Co., Austin, Tex.
VARIABLE-mu MAGNETOMETER. Final rept. on Contract AF 19(604)1742. 5 Jan 59, 28p. AFCRC-TR-59-208; AD-210 483.
Order from LC mi$2.70, ph$4.80 PB 145 570

This project includes the investigation of the feasibility of a variable-μ magnetic variometer and the construction of workable instruments that might be used to measure and record the fluctuations of magnetic fields. The basic principle involved is to utilize the variation in the permeability of a core that occurs when the core is placed in a fluctuating magnetic field such as the earth's field. The effect of this variation in the permeability is a change in the inductance of a coil that is wound on the magnetic core. The core and coil form a variable inductance, the values of which determine the frequency of the oscillating circuit of which the inductance is a part. A frequency counter may be used to read the frequency of the oscillating circuit. Consequently, the variations in a magnetic field may be registered with a frequency counter; or the variations in frequency, as indicated by the counter, may be shown graphically with the addition of a pen recorder.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
MAGNETIC PROPERTIES OF SOME FERRITE MICROPOWDERS, by A. E. Berkowitz and W. J. Schuele. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)5041. Nov 59, 15p. 2 refs. WADC Technical rept. 59-709.
Order from OTS $0.50 PB 161 533

Micropowders of stoichiometric copper, nickel, and cobalt ferrites were prepared by low temperature (<800°C) treatment of the coprecipitated metal oxalates. The magnetic properties of each ferrite were determined as functions of particle or crystallite size in the range from 70 to >2000 A. Particle sizes were determined from x-ray line broadening and from electron micrographs. The micropowders exhibited superparamagnetic, single domain, or multi-domain behavior depending on the particle size. The critical size for single domain behavior, depending on composition, was between 300 and 700 A. In this size range, high coercive force and remanence were observed in spite of appreciable sintering of the particles in some cases. The remanence values and the magnitude and temperature dependence of the coercive force indicated that magnetocrystalline anisotropy determined the properties of the single domain particles. The magnetic properties of the very small particle size samples showed the large temperature dependence characteristic of superparamagnetism. (Author)

Miami U., Coral Gables, Fla.
ON THE HIGH-TEMPERATURE EXPANSIONS OF THE SUSCEPTIBILITY OF A HEISENBERG FERROMAGNET, by Harry Brown. Rept. on Contract AF 49(638)630. 1 Oct 59, 19p. 9 refs. AFOSR-TR-59-154, AD-231 828.
Order from LC mi$2.40. ph$3.30 PB 145 663

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
MODAL ANALYSIS AND SYNTHESIS OF ELECTROMAGNETIC FIELDS. CHAPTER IV. ASYMPTOTIC EVALUATION OF INTEGRALS, by L. B. Felsen and N. Marcuvitz. Rept. on Contract AF 19(604)2031. 21 Oct 59, 80p. 13 refs. Rept. R-776-59; PIB-705; AFCRC-TN-59-991.
Order from LC mi$4.50, ph$12.30 PB 145 768
Contents:
General considerations
Saddle points and the paths of constant level and constant phase
Asymptotic expansions of certain classes of integrals
Examples
Appendix A: Asymptotic expansion of
$$I(\Omega) = \int_{\bar{P}} G(s)\, e^{\Omega\tau(s)}\, ds$$
Appendix B: Higher order derivatives of $G(s) = f(z)\frac{dz}{ds}$
Appendix C: Asymptotic expansion of the Airy Functions

Northwestern U., Evanston, Ill.
OPTICAL ABSORPTION, PHOTOCONDUCTIVITY, ELECTRICAL CONDUCTIVITY, AND HALL EFFECT IN GERMANIUM MONOSULFIDE, by Carl R. Betz. Doctoral thesis. Rept. on Contract NObsr-72520. Apr 58, 97p. 33 refs. AD-211 260.
Order from LC mi$5.40, ph$16.80 PB 145 818

GeS crystals grown from the vapor phase are optically measured. The geometry of these crystals is ideally suited for optical measurements. Measurement of the optical absortion spectrum was made over a wide range of temperature and to very large values of the absorption constant. Measurements of photoconductivity are also reported for several temperatures. For conductivity measurements at high temperatures, samples were sealed into a bulb constructed of 35-mm Pyrex tubing. Electrical connections entered through a 4-wire tungsten press. A chromel-alumel thermocouple was also sealed into the bulb, which was then sealed on to a vacuum system. At low temperatures, the electrical conductivity changed very little from the room temperature value. The electrical conductivity ranges from 0.14 to 0.04 $ohm^{-1}\ cm^{-1}$. The problems that were encountered with crystal contacts, and with electrical measurements in general, made the possibility of a satisfactory Hall measurement seem unlikely for some time. Thickness of the crystals was measured by transmission interference fringes in the region of high transmission, whenever a sufficient number of sharp maxima could be obtained to establish the thickness with reasonable accuracy. A derivation of the expressions for the absorption constant in the cases of direct and indirect transitions is included in Appendix A. Some measurements of the decay of the photo-current with time are reported in Appendix B.

Syracuse U. Research Inst., N. Y.
FERROMAGNETIC RESONANCE IN MAGNETITE BELOW TRANSITION TEMPERATURE, by Gerog Herz, R. A. Johnson and D. W. Healy, Jr. Final rept. on Contract AF 49(638)77. June 58, 41p. 14 refs. SURI rept. no. EE472-587F; AFOSR-TR-58-118; AD-201 883.
Order from LC mi$3.30, ph$7.80 PB 137 552

The conditions for electronic resonance in an orthorhombic magnetic crystal are examined and the relationship between $\frac{\omega}{\gamma}$ and H required for resonance is predicted. The effect of pressure and a biasing magnetic field on the selection of the easy axis of magnetization are also examined as well as the role which magnetic dipolar forces may play in the observed anisotropy.

Technische Hochschule, Aachen (Germany).
MEASUREMENTS OF THE DIFFUSION OF ELECTRONS OUT OF STRONG SHOCK WAVES, by H. Groenig. Final rept. on Contract AF 61(514)1046. June 59, 50p. 24 refs. AFOSR-TR-59-160.
Order from LC mi$3.30, ph$7.80 PB 145 680

The diffusion processes which occur with the transition of strong shock waves in gases have been investigated by means of a gas discharge probe developed for these purposes. The experiments have been performed in argon of different degrees of impurities.

No difference with the various degrees of impurities can be observed. The Mach numbers have been restricted to the range of 5 to 10, where the experiments are most interesting due to the relatively small degree of ionization.

Union Thermoelectric Corp., Forest Park, Ill.
HIGH FREQUENCY FIFTH HARMONIC UNITS, by G. S. Mero, R. D. Contright and others. Final rept. for 25 June 52-24 Dec 55 on Development and Operation of an Experimental Manufacturing Facility for Quartz Crystal Units, Contract DA 49-025-sc-118. [1955] 327p.. AD-100 223.
Order from LC mi$11.10, ph$50.10 PB 137 789

Development of mass production techniques together with drawings, specification, etc. for the manufacture of "CR-54/U" quartz crystal units on 60.75 mc, 75.45 mc, 83.542 mc, 90 mc, and 100 mc. Investigation of Lapmaster and Grinder as mass production tools. Development and design of an experimental, semi-automatic evacuating and induction sealing machine. Engineering design for a semi-automatic sputtering machine. Design of a semi-automatic X-ray blank-sorting machine.

Electronics

Antenna Lab., Calif. Inst. of Tech., Pasadena.
RADIATION PATTERNS OF THE NOISE EMISSION FROM A GASEOUS DISCHARGE, by Nick George. Technical rept. no. 22 on Contract AF 18(600)1113. Oct 59, 31p. 15 refs. AFOSR-TN-59-1101; AD-229 974
Order from LC mi$3.00, ph$6.30 PB 145 320

Theoretical and experimental radiation patterns are given in spectral form for the thermal radiation from a cylindrical discharge column which is adjacent to a long thin slot in a metallic plane. A spatial distribution is predicted which exhibits interference minima and maxima when the length of the slot and the wavelength of the emission are the same order of magnitude. The analysis is based on Maxwell's equations and the Leontovich-Rytov distributed-source generalization of Nyquist's noise formula. Fraunhofer pattern measurements are presented in which an argon source is used to excite slots of 7.3π and 9.5π radians in length. Data are also presented to show the effects of variations in the pressure and the d-c current of the discharge.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
TWO THEOREMS IN MULTI-WEIGHTED SUMS, AND THEIR APPLICATION IN THE STABILITY ANALYSIS OF ACTIVE LINEAR SYSTEMS, by Basil R. Myers. Technical note no. 10 on Contract AF 49(638)63. 5 Nov 59, 21p. 6 refs. AFOSR-TN-59-1096; AD-231 383.
Order from LC mi$2.70, ph$4.80 PB 145 558

The first theorem in this paper shows that the collection of all normalized, nonnegatively multiweighted sums of a finite set of vectors belonging to an arbitrary finite-dimensional vector space is contained in the convex hull of the vertex vectors of the normalized weights. The second theorem states a sufficient condition under which the collection is complete, i.e. such that there is no point in the convex hull which is not a point of the sum. Two corollaries of this theorem identify particular types of sum for which the collection is complete. Application of the theorems in the stability analysis of active linear systems with multi-parameter variance leads to a useful graphical method which might be described as a generalization of Nyquist's criterion for stability. (Author)

Electronics Research Lab., U. of California, Berkeley.
DETERMINATION OF SOURCE OF RADIATION OF CIRCULAR WAVEGUIDE AND REFLECTING DISK, by Thomas W. Doeppner. Rept. on Contract N7onr-29529. 21 Apr 59, 33p. 5 refs. Rept. no. 86; IER Series no. 60, Issue no. 235.
Order from LC mi$3.00, ph$6.30 PB 145 694

A study was made of the radiation from the open end of a circular waveguide, in front of which a circular reflecting disk was placed. This system was found to have an apparent circular ring source, the ring being parallel to the disk, concentric with the waveguide, and at greater distance from the waveguide aperture than the disk.

Institute of Mathematical Sciences, New York U., N. Y.
MAXIMAL GAINS OF ANTENNAS, by Nathan Newman and Wilhelm Magnus. Rept. on Contract AF 19(604)5238. Sep 59, 48p. 2 refs. Research rept no. EM-142; AFCRC-TN-59-779.
Order from LC mi$3.30, ph$7.80 PB 145 291

The gain of an antenna is defined as the ratio of the radiated energy $\mathcal{E}$ to the heat loss $\mathcal{W}$. For a linear, finite antenna of length $2\mathcal{L}$, this gain can be shown to have a least upper bound B for all possible current distributions and for all $\mathcal{L}$. We determine B explicitly. For a fixed small value of $\mathcal{L}$, the maximal gain is computed up to an error term of order $\mathcal{L}^3$. If the gain of an antenna is defined as the ratio of the energy $\mathcal{E}^*$ radiated into a half-space, to the total heat loss $\mathcal{W}$, similar but less complete results can be derived. Finally, it is shown that the problem of maximizing $\mathcal{E}^*/\mathcal{E}$ does not have a solution. There exists no realizable current distribution on the antenna which maximizes this quotient. (Author)

Microwave Lab., Stanford U., Calif.
NONLINEAR EFFECTS IN ELECTRON PLASMAS, by P. A. Sturrock. Scientific rept. no. 4 on Contract AF 19(604)5226. Oct 59, 18p. 12 refs. M. L. rept. no. 654; AFCRC-TN-59-956.
Order from LC mi$2.40, ph$3.30 PB 145 688

The effect of nonlinear terms in the dynamical equations governing wave propagation in plasmas may be analyzed by a perturbation procedure which is acceptable for amplitudes which are not too large. Two theorems concerning wave interaction are proved. The first relates energy-transfer between a group of interacting waves to the frequency of these waves. These "action-transfer relations" lead to the Manley-Rowe relations for steady-state or quasi-steady-state configurations. The second theorem relates the frequency-displacements of a group of interacting waves to the energies of these waves. The properties of electron plasmas undergoing longitudinal oscillations are re-examined in the light of the preceding theorems. The interaction between longitudinal (electrostatic) and transverse (electromagnetic) waves in plasmas is considered.

Minnesota U., Minneapolis.
STUDY OF ELECTRICAL AND PHYSICAL CHARACTERISTICS OF SECONDARY EMITTING SURFACES, by W. G. Shepherd. Rept. on Research on Particle Physics of Electronic Components, Contract AF 33(616)3325. Dec 59, 65p. 18 refs. WADC Technical rept. 59-473.
Order from OTS $1.75 PB 161 491

A study of the oxidation schedule for silver-magnesium alloy is described, and a revised schedule is presented for the preparation of MgO films with optimum secondary yield. A broad investigation of the influence of adsorbed cesium on the secondary emission properties of MgO films is reviewed. (See also PB 140 869)

National Research Labs., Ottawa (Canada).
DIRECT MEASUREMENT OF POWER SPECTRA BY AN ANALOG COMPUTER, by T. H. Wonnacott. Sep 59, 46p. 5 refs. Mechanical engineering rept. MK-5; AD-230 392.
Order from LC mi$3.30, ph$7.80 PB 145 536

The power spectral density (spectrum) of a continuous random process is estimated in the most natural way: the record is passed through a filter selecting frequencies close to f_o, then squared, and the resulting "power" is averaged to give an estimate of the spectrum at f_o. The random nature of the record implies that this spectrum estimator is also a random variable, and its variation is investigated. The analysis often parallels that of the digital analysis of a discrete time series. As an example the spectrum of band-limited white Gaussian noise is measured. (Author)

Oxford U. (Gt. Brit.)
THE RADIATION RESISTANCE OF AN ELEMENTARY DIPOLE IN ANISOTROPIC PLASMAS, by Herwig Kogelnik. Technical note no. 3 on Contract AF 61(514)1183. [1960] 14p. 13 refs. AFOSR-TN-60-49.
Order from LC mi$2.40, ph$3.30 PB 145 669

A theoretical study is made of the radiation resistance of and the power radiated by an elementary dipole and "short" antennas placed in anisotropic dielectric media such as an ionized gas in a magnetic field.

Philips Labs., Irvington-on-Hudson, N. Y.
RESEARCH ON NOISE IN HIGH POWERED KLYSTRONS, by William R. Atkinson. Final rept. on Contract AF 18(603)33, Supp. 1 (57-345). 31 May 58, 42p. 19 refs. Technical rept. no. 129; AFOSR-TR-58-90; AD-162 122.
Order from LC mi$3.30, ph$7.80 PB 137 551

Several techniques were used to measure the spectral dependence of the mean square frequency deviations of two-cavity klystron oscillators having an integrated rms frequency deviation of a few hundred cycles per second over the entire audio frequency range. Comparison of the measurements with existing theories of electronic noise indicated that mechanisms that were not purely electronic in nature were present in all the klystrons tested. (See also PB 128 816)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
ELECTRON-STIMULATED ION OSCILLATIONS, by Paul Chorney. Rept. on Contract DA 36-039-sc-64637. 26 May 58, 84p. 11 refs. Technical rept. 277; AD-200 516.
Order from LC mi$4.80, ph$13.80 PB 145 266

Certain ion oscillations that are sometimes excited in microwave tubes were investigated on a theoretical basis. A study of some general properties of propagation in plasma-loaded waveguides was made; the plasma consisted of both stationary ions and an electron beam. The effect of an axial magnetic field was included in the analysis. Specifically, the propagation in waveguides that were loaded merely with a stationary ion plasma was studied. It was found that these waveguides are propagating structures at frequencies that are very low, as compared with the empty waveguide cutoff frequency. A short-circuited section of an ion-loaded waveguide, which was considered as a resonant cavity, was found to have resonant frequencies of the order of the ion plasma frequency and ion cyclotron frequency (a few megacycles per second for positive gas ions such as hydrogen). The energy transfer from a beam traversing an oscillating ion-loaded cavity to the fields of the cavity was calculated, and a criterion for oscillation was established. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
IMPEDANCE AND POWER TRANSFORMATION BY THE ISOMETRIC CIRCLE METHOD AND NON-EUCLIDEAN HYPERBOLIC GEOMETRY, by E. Folke Bolinder. Rept. on Contract DA 36-039-sc-64637. 14 June 57, 100p. 110 refs. Technical rept. 312; AD-208 704.
Order from LC mi$5.40, ph$15.30 PB 145 778

The means of solving microwave problems by modern geometry is investigated. The isometric circle method, an elementary inversion method for the linear fractional transformation, and models of non-Euclidean hyperbolic geometry are used. The isometric circle method is applied to numerous examples of impedance and reflection-coefficient transformations

through bilateral 2-port networks. The method is transferred to, and generalized in, the Cayley-Klein model of 2-dimensional hyperbolic space for impedance transformations through lossless 2-port networks. A similar transfer and generalization is performed in the Cayley-Klein model of 3-dimensional hyperbolic space for impedance transformations through lossy 2-port networks.

Stanford Research Inst., Menlo Park, Calif.
RAY-TRACING AND DIFFRACTION IN A MEDIUM WITH VARIABLE PERMITTIVITY AND ATTENUATION, by James A. Cochran. Rept. on Contract AF 19(604)3458. Oct 58, 54p. 65 refs. Technical rept. 65; AFCRC-TN-58-555; AD-160 864.
Order from LC mi$3.60, ph$9.30 PB 137 791

An asymptotic development of the electromagnetic field in a region with dielectric constant of the form $(1 + Kr^{-1})$, when there is a source at an infinitely remote point, has been obtained previous to this report. In the investigation reported here, field expressions have been obtained for propagation in this medium, neglecting diffraction effects. A comparison between field values for the two methods has been made for a given numerical example that permits an assessment of the importance of diffraction in such problems. Parameters for the medium of the numerical example were selected to stimulate an ionized gas cloud. Brief attention is also given to the effect of deviation from unity of the effective dielectric constant in lossy obstacles, in an attempt to evaluate the accuracy of present experimental techniques of model measurement. (Author)

Tennessee U. Engineering Experiment Station, Knoxville.
PARASITIC EXCITATION OF CIRCULAR ARRAYS, by T. L. Simpson, H. P. Neff, and J. D. Tillman. Scientific rept. no. 2 on Contract AF 19(604)4967. 1 Aug 59, 65p. 6 refs. AFCRC-TN-59-553; AD-220 382.
Order from LC mi$3.90, ph$10.80 PB 145 294

An analysis is given of circular antenna arrays in which only one element of the array is driven. The configuration which is considered consists of m identical parallel dipoles or monopoles which are spaced uniformly around the circumference of a circle. An additional element, not necessarily having the same half length, is located at the center. There are two ways to excite the antenna by driving only one element. If an element in the ring is driven, a pattern with directivity in the plane of the ring results. The other method of exciting the array parasitically is to drive the center element. Experimental confirmation is given for the theoretical analyses in both parts. The agreement is quite good. Both antennas appear to be entirely practical. The patterns for the case where a ring element is driven are comparable to those of a Yagi antenna. At frequencies where the array is rather large physically, the beam can be steered by a simple switching system which selects the driven element. The principal use of the omnidirectional system seems to be as a broadcast antenna, utilizing its vertical directivity to reduce fading. (Author)

Tufts U., Medford, Mass.
STUDIES OF A HIGH CURRENT ELECTRICAL DISCHARGE IN AN IONIZED GAS, by Lewis S. Combes and Samuel P. Zimmerman. Scientific rept. no. 1 on Contract AF 19(604)1578. 16 June 58, 61p. 10 refs. AFCRC-TN-58-439; AD-152 614.
Order from LC mi$3.90, ph$10.80 PB 145 690

In Section 1 are described experiments with a pinched discharge in a toroidal glass tube stabilized by an included magnetic field. Photographs taken through an image converter show how the discharge pinches and then becomes unstable. In Section 2 experiments using a straight discharge tube are described. Photographs are shown of discharges in this tube that remained stable for approximately 15 to 20 microseconds.

Molecular Physics and Spectroscopy

Institute of Geophysics, U. of California, Los Angeles.
EMISSION SPECTRA OF THE OXYGEN MOLECULE IN LABORATORY AFTERGLOWS AND THE NIGHT AIRGLOW, by Charles A. Barth. Scientific rept. no. 1 on Contract AF 19(604)2143. Mar 58, 90p. 49 refs. AFCRC-TN-59-482; AD-230 695.
Order from LC mi$4.80, ph$13.80 PB 145 653

This report will first briefly review the spectroscopy of the oxygen molecule. Then, the experimental findings on the emission spectra of laboratory afterglows will be enumerated and analyzed. The chemistry of the upper atmosphere, or chemical aeronomy, will be described and then related to the molecular oxygen emission spectra of the night airglow. Finally, the laboratory and upper atmosphere findings will be used to estimate the lifetimes of the metastable oxygen molecules. The high-speed spectrograph and the afterglow flow systems will be described in the Appendix.

Johns Hopkins U., Baltimore, Md.
FAR INFRARED SPECTRA OF SOME SYMMETRIC TOP MOLECULES, by Dean W. Robinson and Donald A. McQuarrie. Rept. on Contract AF 49(638)468 [1958] 17p. 8 refs. [AFOSR] TN-59-967.
Order from LC mi$2.40, ph$3.30 PB 145 308

Pure rotational spectra out to 30 cm^{-1} are presented of the gaseous molecules CH_3CN, CH_3CCH, HCF_3 and $(CH_3)_3N$. These spectra are interpreted in the view of the rotational constants previously determined from microwave data. The heretofore undetermined value of D_J for CH_3CN has been estimated to be 1.45×10^{-7} cm^{-1}, the value of D_{JK} for $(CH_3)_3N$ is shown to be positive, and intensity distribution in the high -J subbands of the oblate top, HCF_3, has been estimated to have its center at K = 17. (Author)

Lyman Lab. of Physics, Harvard U., Cambridge, Mass.
PHOTOELECTRIC AND INTERNAL CONVERSION SPECTRA OF NEUTRON-DEFICIENT IRIDIUM ISOTOPES, by Walter Reilly Kane. Doctoral thesis. Rept. on Contract Nonr-1866(19). 23 Jan 59, 139p. 116 refs. Technical rept. no. 3-9.
Order from LC mi$6.90, ph$21.30 PB 145 385

Photoelectric and internal conversion spectra of the neutron-deficient isotopes Ir^{188}, Ir^{189}, and Ir^{190} have been investigated with the aid of a double-focusing spectrometer. The energies and intensities of a large number of electromagnetic transitions are reported.

Institute of Geophysics, U. of California, Los Angeles.
BLUE NITRIC OXIDE AFTERGLOW, by Charles A. Barth, William J. Schade, and J. Kaplan. Scientific rept. no. 2 on Contract AF 19(604)2143. Sep 58, 8p. 7 refs. AFCRC-TN-59-291; AD-230 683.
Order from LC mi$1.80, ph$1.80 PB 145 672

A change in the intensity distribution of the emission spectra of the blue nitric oxide afterglow has been observed with a rare gas added to the afterglow mixture. The sensitivity of the vibrational intensity distribution of the nitric oxide afterglow emission spectra to the addition of helium is evidence that the afterglow emission spectra arises from the three-body recombination of a ground state oxygen atom and a ground state nitrogen atom by way of some intermediate state into the excited upper states of the beta, gamma, and infrared bands.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
CALCULATION OF ENERGY LEVELS FOR INTERNAL TORSION AND OVER-ALL ROTATION, III, by Dudley R. Herschbach. Rept. on Contract N5ori-1866(14). [1959] 52p. 52 refs.
Order from LC mi$3.60, ph$9.30 PB 145 383

A general treatment of hindered internal rotation is given for molecules that can be regarded as a rigid symmetric top attached to a rigid frame which may be completely asymmetric. The perturbation approach developed in previous papers is simplified and extended by use of a method which relates the perturbation coefficients to the exact energy levels obtainable for the limiting case of two coaxial symmetric tops. Tables are given which provide the torsional energy levels and the perturbation coefficients through fourth order in the coupling between internal and over-all rotation.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
STARK EFFECT ON THE HYPERFINE STRUCTURE OF CESIUM^{133}, by R. D. Haun, Jr. Doctor's thesis. Rept. on Contract DA 36-039-sc-64637. 18 Jan 57, 67p. 37 refs. Technical rept. 322.
Order from LC mi$3.90, ph$10.80 PB 145 130

The change of the hyperfine-structure separation energy caused by an electric field has been measured in cesium^{133} by the atomic-beam magnetic-resonance method. The shift of the $(F=4, m_F=0) \leftrightarrow (F=3, m_F=0)$ transition frequency (9192.6 mc/sec) caused by electric field ξ is given by $\Delta(\xi) = -2.29 \times 10^{-6} (1 \pm .03) \xi^2$ cps, where ξ is in volt/centimeter. This number is 2.8 times the value predicted from the atomic polarizability measurements of H. Scheffers and J. Stark, if a simplified theory that neglects hyperfine-structure perturbations of the ground-state wave functions is used. A more precise theory which takes into account these wave-function differences has been outlined but the calculations have not been carried out in detail. (Author)

Stanford Research Inst., Menlo Park, Calif.
SURVEY OF ELECTRON TRANSFER SPECTRA OF INORGANIC IONS, by Rudolph J. Marcus. Technical note no. 2 (Rept. no. 13) on Contract AF 18(603)7. 1 Dec 59, 17p. 32 refs. AFOSR-TN-59-1322.
Order from LC mi$2.40, ph$3.30 PB 145 670

The literature was searched for electron transfer spectra of inorganic ions. These are reported, together with the chemical evidence of light-induced electron transfer and with thermodynamic data needed for interpretation of the spectra. (Author)

University of Southern California. Engineering Center, Los Angeles.
DIFFUSION OF A FULLY IONIZED GAS CONFINED IN A STRONG MAGNETIC FIELD, by Toyoki Koga. Technical note on Contract AF 18(603)95. 30 Dec 59, 36p. 14 refs. USCEC rept. 56-209; AFOSR-TN-59-1162.
Order from LC mi$3.00, ph$6.30 PB 145 638

The purpose of the present report is to develop a method of approach which may be valid for a case where the distribution of particles deviates considerably from the Maxwell distribution.

Uppsala U. (Sweden).
DERIVATION OF THE CLEBSCH-GORDAN-COEFFICIENTS BY MEANS OF PROJECTION OPERATORS, by Jean-Louis Calais. Technical note no. 25 on Contract AF 61(514)1200. 1 June 59, 22p. 10 refs. AD-227 247.
Order from LC mi$2.70, ph$4.80 PB 145 189

The Clebsch-Gordan coefficients for the coupling of 2 angular momenta are derived by using the projection operator technique, developed by Lowdin. The derivation is done in 2 steps: (1) for the so-called principal case, i.e. R=M; and (2) for the general case with an arbitrary M. Two different derivations are given for the principal case, a direct one, and one based on a recursion procedure. The general case is obtained from the principal case with a step-down operator. (Author)

Uppsala U. (Sweden).
THE IDEA OF ATOMIC ASSOCIATIONS IN A SIMPLE FORM OF PERTURBATION METHODS, by Heinzwerner Preuss. Technical note no. 24 on Contract AF 61(514)1200. 20 Apr 59, 21p. 5 refs.
AD-226 405.
Order from LC mi$2.70, ph$4.80 PB 145 188

Quantum chemistry must become more general in order to obtain closer connections with chemical questions and chemical laws. This brief paper is a starting-point for further treatments in this sense and also an outline of a new basis for quantum chemical calculations. The opinion presented here is that agreement of molecular calculations with experiment can be expected only when we start from a solved many-electron one-center-problem or from formulas which include the general atomic problem as a basis.

Uppsala U. (Sweden).
ON THE NON-ORTHOGONALITY PROBLEM ON THE SEMI-EMPIRICAL MO-LCAO METHOD, by Giuseppe del Re. Technical note no. 20 on Contract AF 61(514)1200. 20 Oct 58, 20p. 13 refs.
AD-226 404.
Order from LC mi$2.40, ph$3.30 PB 145 187

A treatment of the non-orthogonality problem is given for the case when overlap integrals are assumed to be proportional to the corresponding bond-integrals. Formulas for reducing explicitly, albeit formally, the non-orthogonal case to an orthogonal one are derived and discussed. Formulas for dipole-moments and first-order perturbation coefficients are also given, and their implications stated. (Author)

Uppsala U. (Sweden).
SYMMETRY RELATIONS AND ELECTRIC MULTIPOLE INTERACTIONS, by Laurens Jansen. Technical note no. 22 on Contract AF 61(514)1200. 15 Jan 59, 25p. 18 refs.
Order from LC mi$2.70, ph$4.80 PB 145 325

It is shown how expressions for the electrostatic interaction between molecular charge distributions in multipole form may be considerably simplified by making use of symmetry relations. These relations refer both to invariance properties of the electrostatic potential, and to the internal symmetry of the distributions themselves. An equivalence theorem is derived between three- dimensional distributions of charge and linear assemblies along an axis of symmetry of the molecule. On the basis of this theorem a unique definition can be given for the scalar molecular multipole moments. For molecules with symmetry C_{sv} or D_{sh} the theorem holds for interactions between multipoles of order $n < s$. Therefore, if the molecule has cylindrical symmetry (point groups $C_{\infty v}$ or $D_{\infty h}$), the theorem is valid for multipole moments of arbitrary order. (Author)

Washington U., Seattle.
STUDIES IN MOLECULAR SPECTROSCOPY, by P. C. Cross, D. F. Eggers, Jr., and W. T. Simpson. Technical rept. for 15 July 55-30 Sep 59 on Contract AF 18(600)1522. [1960] 12p. AFOSR-TR-60-3.
Order from LC mi$2.40, ph$3.30 PB 145 679

The cyclopropene molecule, C_3H_4, is the only example of a three-membered ring containing a double bond, and it was studied intensively along with a random deuterium derivative. The infrared spectrum of hydrogen sulfide shows some bands with a very odd and unsymmetrical shape; they absorb strongly at frequencies higher than the band center, but very weakly lower than the center. This is explained quantitatively.

Optics

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A LIGHT-SCATTERING METER FOR THE DETERMINATION OF THE SIZE DISTRIBUTION OF THE AEROSOL, by Robert W. Fenn. 1 June 59, 19p. 7 refs, USASRDL Technical rept. 2038.
Order from LC mi$2.40, ph$3.30 PB 145 659

A new light-scattering meter is described. The instrument allows the measurement of the intensity of light scattered from aerosol particles over an angular range from 2.5 to 135 degrees with respect to the direction of the incident light beam. The measurements can be made with four different wavelengths. The instrument incorporates the ability to investigate polarizing effects connected with light scattering. Some results of test measurements made in natural aerosol and latex particles are presented.

Centro di Studio per la Fisica Delle Microonde (Italy).
EXPERIMENTAL TEST OF A 360° FIELD LENS FOR MICROWAVES, by A. M. Scheggi and G. Toraldo di Francia. Technical note no. 6 on Contract AF 61(052)67. Sep 59, 14p. 12 refs. AFCRC-TN-59-992.
Order from LC mi$2.40, ph$3.30 PB 145 282

The present report is concerned with the construction and experimental test of a perfect configuration lens, of the type described by G. Toraldo di Francia as well as of a stack of such lenses. Suitable feeders were designed and constructed. Radiation patterns and wave front plots are given from which there results a very good agreement with the theory. (Author)

Cornell U., Ithaca, N. Y.
THE EFFECT OF REFLECTIVITY ON THE MEASUREMENT OF ATTENUATION COEFFICIENTS IN THE 100 ev RANGE, by D. H. Tomboulian. Technical rept. on Contract Nonr-401(37). Mar 59, 16p. 6 refs. AD-212 582.
Order from LC mi$2.40, ph$3.30 PB 145 798

Special problems are treated that are encountered when attempts are made to measure the attenuation coefficient of matter irradiated by very low energy (40 - 120 ev) photons. The process consists in comparing I(x), the intensity transmitted by an absorber of thickness x, with the intensity I_0 incident upon it. Quantitatively the attenuation is expressed by the relation $I(x) = I_0 \exp(-\mu x)$ where μ represents the total attenuation coefficient; i. e., the probability (per unit thickness of matter traversed) that a photon will be removed from the incident beam by all processes which play a significant role in the limited range of photon energies and for the particular physical characteristics of the absorber. (Author)

Institute of Optics, U. of Rochester, N. Y.
OPTICAL CONSTANTS OF GERMANIUM IN THE REGION, 0-10 ev, by M. P. Rimmer and D. L. Dexter. Rept. no. 3 on Contract AF 49(638)432. Oct 59, 13p. 5 refs. AFOSR-TN-59-1254.
Order from LC mi$2.40, ph$3.30 PB 145 646

A program has been written for the IBM 650 Digital Computer to evaluate the Kramers-Kronig dispersion relation between real and imaginary parts of the index of refraction, n and k. By this means measurement of the reflection coefficient over a sizable energy range allows the determination of n and k throughout most of this region. Reflection data of Philipp and Taft on germanium have been analyzed in this way, and the results are compared with those of Philipp and Taft obtained by another method. The results are similar, minor differences occurring in the fine structure. (Author)

Johannes Gutenberg U. (West Germany).
THEORETICAL INVESTIGATION OF THE VISIBILITY UNDER SPECIAL ATMOSPHERIC CONDITIONS (THE HORIZONTAL VISUAL RANGE OF NOT SELF-LUMINOUS OBJECTS UNDER OVERCAST SKY) by Fritz Kasten and Fritz Möller. Final rept. for 1 July 58-30 Sep 59 on Contract DA 91-508-EUC-380. 30 Oct 59, 53p. 18 refs.
Order from LC mi$3.60, ph$9.30 PB 145 239

The present report summarizes a theoretical study on the horizontal visual range of not self-luminous objects under overcast sky. After a brief review on the definitions of brightness contrast, contrast threshold of the human eye, and visual range, the dependence of contrast threshold on the visual angle presented by a graph of H. R. BLACKWELL, is expressed analytically. Suitable substitution delivers a connection between visual range, extinction coefficient of the air, and luminances of both the object and the horizon. The luminance distribution of overcast sky is investigated. The results lead to the statement that the luminance distribution of overcast sky depends on the visual albedo of the underlying surface. The exact definitions of total and visual albedo are given, and calculated and measured values of them are presented. A "visual range function" is derived. It is discussed with respect to uniqueness, domain of definition, and zero points. The visual range function is described by means of several graphs showing the visual range plotted over the object albedo with ground albedo as parameter for different extinction coefficients, and vice versa. The theory is applied on visibility in polar regions. A brief description of the "polar whiteout" is given, and the optical phenomena of whiteout explained on the basis of our visual range theory. Finally some remarks are made with regard to future improvement and extension of the theory.

Naval Ordnance Test Station, China Lake, Calif.
OPERATIONAL PERFORMANCE OF THE CARY MODEL 14 SPECTROPHOTOMETER, by Charles E. Hathaway and Allen L. Olsen. 21 Aug 59, 50p. 1 ref. NOTS TP-2311; NAVORD rept. 6583.
Order from LC mi$3.30, ph$7.80 PB 145 629

The Cary Recording Spectrophotometer Model 14 is described briefly both as to photometric and electronic systems. Thorough performance and calibration checks have been made to evaluate the instrument and to provide calibration data for future checks. A detailed operating procedure for the Cary 14 to achieve maximum performance is given.

New York U., N. Y.
A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS, by J. H. Rohrbaugh. Scientific rept. no. 8, 1 June-31 Aug 59, on Contract AF 19(604)2673 [1959] 18p. AFCRC-TN-59-957.
Order from LC mi$2.40, ph$3.30 PB 145 651

An account is given of the procedures taken toward bringing the spectrometer to full operating condition. Using the frequency distributions given in the last report, the heat capacity is found for NaCl in the range from 2-100°K. (See also PB 144 969)

Office of Scientific Research and Development. Div. 16.
MEMORANDUM ON THE POLARIZATION-OPTICS OF THE PHOTOELECTRIC SHUTTER, by Hans Mueller (Mass. Inst. of Tech.). Rept. no. 2 on Contract OEMsr-576. 15 Nov 43, declassified 31 Mar 54. 50p. 2 refs. Div. 16. 4-18; OSRD rept. 3171; ATI-184-211.
Order from LC mi$3.30, ph$7.80 PB 146 130

This report discusses the theoretical aspects of the problem of the photoelastic shutter. In particular it is an investigation of the polarization-optical systems used in connection with this shutter and serves to determine the most favorable system to be used for attaining maximum range of transmission. The light transmitted by the shutter is in general a mixture of natural light and elliptically polarized light, i. e. so-called partially elliptically (abbrev. pe), or eventually partially linear (pl), or partially circular (pc) polarized light. This is true even if the shutter is illuminated with monochromatic linear (l), elliptical (e), or circular (c) polarized light. Since the mathematical tools necessary for the handling of problems involving partially polarized (pp) light appear to be little known, we start out discussion with a short exposition of these mathematical method.

Visibility Lab., U. of California, San Diego.
PHOTIC FIELD THEORY FOR NATURAL HYDROSOLS, by R. W. Preisendorfer. Rept. on Contract NObs-72092. 10 Sep 58, 20p. 5 refs. SIO Reference 58-66; AD-206 113.
Order from LC mi$2.40, ph$3.30 PB 145 259

An example of the application of the vector theory of the photic f ld (light field) to an important class of scattering-absorbing optical media, namely the class of natural hydrosols consisting of oceans, harbors, and lakes. The application is at the same time of practical value in that it yields explicit expressions for the depth-dependence of the light vector in terms of its components at the surface and certain of the optical properties of these media. The discussion presents particularly simple interpretations of the quasipotential and related functions. While the practical context limited specifically to that of natural hydrosols, the mathematical arguments apply equally to any arbitrary plane-parallel scattering-absorbing medium in which the light vector possesses a quasipotential. (Author)

Solid State Physics

Armour Research Foundation, Chicago, Ill.
ORGANIC SEMICONDUCTORS, by D. E. Laskowski, E. H. Tompkins, and O. W. Adams. Quarterly rept. for 15 Mar-15 June 59 on Contract AF 49(638)576. Dec 59, 43p. 12 refs. Rept. no. ARF-3142-1; AFOSR-TN-60-63.
Order from OTS $1.25 PB 161 459

A theoretical study was made of the various mechanisms and reactions which would lead to organic semiconductors. A series of experiments were also initiated to develop materials and to bolster theoretical conclusions. The usual approaches applicable to inorganic semiconductors fail for organic conductors because of their high resistivity and other factors. The study of donor-acceptor combinations has led to a whole series of possibilities. An organotin polymer was found to decrease in resistivity manyfold when treated with iodine. It shows interesting promise as an organic semiconductor.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A STUDY OF THE RELATIONSHIP BETWEEN THE FIRST COMPRESSIVE STRESS AND GROSS PLASTIC DEFORMATION IN EXPLOSIVELY LOADED COPPER, by G. Moss and C. Class. Sep 59, 28p. 4 refs. Memo. rept. no. 1236.
Order from LC mi$2.70, ph$4.80 PB 145 014

A copper single crystal in the form of a hollow cylinder was subjected to an internal explosion in an effort to determine whether or not strain markings are formed in the first very intense compression fronts developed in metals by explosions. Analysis of framing camera pictures and macrostructures indicates that slip and kink bands are not associated with this compression front, but develop later and are indications of the atomic movements in the metal which result in the final specimen shape. (Author)

Brown U., Providence, R. I.
INVESTIGATIONS OF SURFACE PROPERTIES OF SILICON AND OTHER SEMICONDUCTORS, PHASE I AND II, by H. E. Farnsworth, D. Haneman and others. Scientific rept. no. 1, 1 Oct-31 Dec 59, on Contract AF 19(604)5986. Jan 60, 24p. 16 refs. AFCRC-TN-60-128.
Order from LC mi$2.70, ph$4.80 PB 145 624

A comparison has been made of the structure of the surface of a bismuth-telluride crystal produced by cleaving in high vacuum with a similar surface prepared by the ion-bombarding and annealing technique. No observable adsorption of oxygen or carbon monoxide was found for any of the surfaces produced. Tests have been undertaken to determine the condition under which high-conductivity films appearing on heat-treated silicon can be produced and removed. (See also PB 138 890)

Compagnie Générale de Télegraphie Sans Fil (France).
RESEARCH ON RECOMBINATION PROCESSES IN SEMI-CONDUCTOR. Technical final rept. on Contract AF 61(052)100. [1959]. 11p. AFOSR-TR-59-37; AD-213 630.
Order from LC mi$2.40, ph$3.30 PB 145 039

A special cryostat and optical system were designed and built. This system is transportable and entirely non-magnetic. Experiments have now begun, but it is too early to report on results.

Cornell U., Ithaca, N. Y.
STUDIES ON THE SEPARABILITY OF SIZE EFFECTS IN ELECTRON DIFFRACTION FROM SINGLE CRYSTAL SURFACES, by Harold P. Furth, James A. Krumhansl, and Benjamin M. Siegel. Technical rept. no. 7 on Theoretical and Experimental Investigations of the Atomic Phenomena Occurring on and Near the Surfaces of Solids, Contract AF 18(600)674. 22p. 12 refs. AFOSR-[TN]-58-284; AD-154 188.
Order from LC mi$2.70, ph$4.80 PB 137 712

Reflection electron diffraction at low angles from very smooth surfaces of solids give an interface pattern which is produced by electrons scattered from only a few net planes of atoms parallel to the surface. An analysis is attempted of the information that can be obtained, conditioned by the nature of the investigations of surfaces by electron diffraction, of the character of the diffraction phenomena from these surface net planes. The relaxation of the Laue condition caused by the limited extent of the atomic arrays producing a given coherent interference will be the overriding factor in determining the type of diffraction pattern obtained from low angle electron diffraction from very smooth surfaces. The relaxation phenomena are analyzed through the use of a semi-dynamical model, which can lead to a method for investigating the possible lattice contraction of crystals in the surface planes.

Emerson and Cuming, Inc., Canton, Mass.
INVESTIGATION OF STANDARD AND ARTIFICIAL DIELECTRICS, by J. W. Lefforge. Rept. no. 4 (Final) on Contract AF 19(604)2448. [1958] 41p. 4 refs. AFCRC-TR-58-183; AD-160 834.
Order from LC mi$3.30, ph$7.80 PB 137 979

Controlled dielectric constant materials suitable for fabricating microwave lenses for elevated temperature service have been obtained using a structural low density matrix of fine borosilicate glass bubbles called Eccospheres. This matrix has been bonded by a number of different techniques and loaded with high dielectric constant materials to provide the desired dielectric properties. Pertinent properties of the best combinations are shown in the table. (Author)

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
STUDIES OF INDIVIDUAL DISLOCATIONS IN CRYSTALS BY X-RAY DIFFRACTION MICRORADIOGRAPHY, by A. R. Lang. Technical rept. no. 2 on Contract Nonr-1866(39). 5 Mar 59, 29p. 21 refs. AD-218 280.
Order from LC mi$2.70, ph$4.80 PB 145 215

The distribution of imperfections within the interior of crystals has been studied using "projection topographs" which are X-ray diffraction images showing a projection of a slice of crystal and the imperfections in it. Individual dislocations have been observed in single crystals of diamond, silicon, germanium, lithium fluoride, sodium chloride, silver chloride, magnesium oxide, calcite, quartz and aluminum. From the variation of dislocation contract with the orientation of the X-ray reflecting plane the direction of Burgers vector can be found. Dislocations can be seen with good contrast when the product of linear absorption coefficient (μ) and slice thickness (t) is of the order of unity or less. If $\mu t \gg 1$ the contrast is reversed through the Borrmann effect. Stereopairs of projection topographs can be prepared from the pair of reflections h k l and $\bar{h}\,\bar{k}\,\bar{l}$. (Author)

Institute of Engineering Research, U. of California, Berkeley.
CHEMICAL CONSIDERATIONS IN HIGH TEMPERATURE THERMOELECTRIC POWER DEVELOPMENT, by Alan W. Searcy and David J. Meschi. Technical rept. no. 6 on Contract Nonr-222(32). Mar 59, 32p. 49 refs. Series no. 84, issue no. 6.
Order from LC mi$3.00, ph$6.30 PB 145 076

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
SOME REMARKS ABOUT FREQUENCY SPECTRUM OF CRYSTAL LATTICES, by Jean Peretti. Rept. on Contract AF 18(600)1315. Aug 58, 37p. 12 refs. Technical note BN-145; AFOSR-TN-58-775; AD-201 921.
Order from LC mi$3.00, ph$6.30 PB 137 538

In this paper it is shown how to construct in a general way the frequency distribution of a crystal lattice when the force constants between atoms are known.

Institute of Optics, U. of Rochester, N. Y.
TRAPPED CHARGE AND THE LOW TEMPERATURE LUMINESCENCE OF UNDOPED KI, by K. Teegarden and R. F. Weeks. Technical note B 1 on Contract AF 49(638)433. 10 Nov 58, 18p. 8 refs. AFOSR-TN-58-918; AD-204 562.
Order from LC mi$2.40, ph$3.30 PB 137 845

This paper presents new data on the low temperature blue luminescence of undoped KI. It is shown that the emission previously observed during irradiation in the fundamental bands can also be stimulated by irradiation in the F. and F'- bands formed by exposure to ultraviolet light at 93°K. The crystals display a burst of red luminescence when warmed after irradiation with light absorbed in the fundamental bands at 93°K. No emission upon irradiation in the F-band at 93°K occurs if F-centers have been formed above the temperature of the thermal burst of red luminescence.

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
AN EXPERIMENT ON THE POSSIBLE DEPENDENCE OF SUPERCONDUCTIVE TRANSITION TEMPERATURE ON THE SURFACE CHARGE DENSITY, by Guido Bonfiglioli and Renato Malvano. Technical note no. 3a (supplemental) on Study of the Surface Electrical Conduction in Metals, Contract AF 61(514)1333. [1959] 10p. 2 refs. AFOSR-TN-59-1234.
Order from LC mi$1.80, ph$1.80 PB 145 673

The experiment has been performed through direct measurement of the resistance of a strip of lead. Pb becomes a superconductor above the temperature of liquid He under atmospheric pressure.

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
FURTHER INVESTIGATIONS ON THERMOLUMINESCENCE AND F CENTERS, by Guido Bonfiglioli, Piero Brovetto, and Cesare Cortese. Technical note no. 2d on Study of the Traps Distribution in Dielectrics or Semiconductors by Thermoluminescence Experiments, Contract AF 61(514)1333. [1959] 15p. 5 refs. AFOSR-TN-59-1126.
Order from LC mi$2.40, ph$3.30 PB 145 674

This note is concerned with further investigations both experimental and theoretical. The experiments consisted of the recording and analyzing of glow curves and separate peaks of light. (See also PB 137 477)

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
THEORY OF THE ISOTHERMAL BLEACHING OF F CENTERS PRODUCED BY IRRADIATION IN ALKALI HALIDES, by Guido Bonfiglioli, Piero Brovetto, and Cesare Cortese. Technical note no. 3d on Study of the Traps Distribution in Dielectrics or Semiconductors by Thermoluminescence Experiments, Contract AF 61(514)1333. [1959] 14p. 8 refs. AFOSR-TN-59-1315.
Order from LC mi$2.40, ph$3.30 PB 145 681

The same model used in the previous Techn. Notes to quantitatively interpret thermoluminescence of irradiated alkali halides, is applied in the present paper to account for the experimental results on thermal bleaching of the optical density in the same materials. The present calculation do fit remarkably well with experiment, showing that the presence of several species of V-Centers was actually responsible for the well known big interpretation difficulties which, so far, characterized this subject.

Massachusetts Inst. of Tech., Cambridge.
INTERACTIONS OF ELASTIC WAVES IN SOLIDS, by L. Van Hove and L. P. Howland. Technical rept. no. 11 on Contract Nonr-1841(34): 15 Mar 59, 101p. 21 refs.
Order from LC mi$5.70, ph$16.80 PB 145 384

Contents:
Interacting phonons in an ideal non-conducting crystal: Hamiltonian
The classical theory of lattice vibrations
Quantization of lattice vibrations; creation and annihilation operators
Formulation of the perturbation problem
Elements of the perturbation formalism
Results for the perturbed ground state
Derivation of results for the ground state
Scattering of neutrons by a crystal in its ground state: general discussion
Peaks in the energy spectrum of neutrons scattered at $0^{o}K$
Free energy of an anharmonic crystal
Scattering of neutrons by a crystal at an arbitrary temperature

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
THEORY OF D_0 FOR RING SELF-DIFFUSION IN METALS, by G. M. Pound, W. R. Bitler, and H. W. Paxton. Rept. on Contract Nonr-760(08). [1959] 18p. 25 refs.
Order from LC mi$2.40, ph$3.30 PB 145 393

The kinetics of ring self-diffusion in metals is treated in terms of statistical mechanics from the viewpoint of absolute rate theory. It is concluded that there are synchronal contributions to the entropy and enthalpy of activation of all processes in solids which require a simultaneous, cooperative, and similar movement of n atoms.

Microwave Labs., Stanford U., Calif.
FERRIMAGNETIC RESONANCE IN POLYCRYSTALLINE YTTRIUM IRON GARNET, by P. E. Seiden. Technical note on Contract AF 49(638)415. Oct 59, 84p. 61 refs. M. L. rept. no. 657; AFOSR-TN-59-1186.
Order from LC mi$4.80, ph$13.80 PB 145 017

Samples ranged from 25 per cent iron excess through stochiometric proportions to 15 per cent yttrium excess. Firing atmospheres used were air, oxygen, nitrogen, and argon to obtain different states of sample oxidation. Ferrimagnetic resonance experiments were performed at 9317 Mc, and the linewidth, g-value and saturation curves of microwave susceptibility as a function of rf magnetic field strength were obtained. The x-ray diffraction data and photomicrographs show that no substitution occurred in the garnet lattice and all excess material went into ceramic second phases.

Naval Ordnance Test Station, China Lake, Calif.
A SURVEY OF SOLID-STATE LIGHT AMPLIFIERS AND ALLIED DEVICES, by Justin Ruhge. 20 Nov 59, 67p. 14 refs.
Order from OTS $1.75 PB 161 465

Literature on the phenomenon of electroluminescence, the photoconductive properties of CdS and CdSe, the electroflor phosphors, thin photoconductive films, and image tubes is reviewed. Three solid-state light amplifiers and their applications are discussed, as well as the application of electroflors and the electroluminescent lamp to plotting boards, X-ray screens, radar and television displays, relays, and to the digital display of analog information. The discussion emphasizes the development and application of the solid-state light amplifier, the electroflor, and the image tube as electronic shutters. Of these, the image tube is considered the most available commercially as an electronic shutter and for this purpose requires the least development. Both the solid-state light amplifier and the electroflors show much promise as shutters but their use as such requires further development. (Author)

Northwestern U., Evanston, Ill.
GRAIN BOUNDARY SLIDING VERSUS GRAIN BOUNDARY MIGRATION IN CREEP, by J. O. Brittain and N. R. Adsit. Rept. on Contract AF 18(600)1598. 23 Dec 59, 9p. 5 refs. AFOSR-TN-60-108; AD-231 829.
Order from LC mi$1.80, ph$1.80 PB 145 666

Creep tests on bicrystals of pure zinc showed that in zinc there is no explicit relation between the amount of grain boundary sliding and grain boundary migration. Observations made while the specimen were being tested indicate that part of the inactive periods of grain boundary sliding are due to grain boundary migration.

Ohio State U. Research Foundation, Columbus.
SPECIFIC HEATS OF METALS AND ALLOYS BELOW $1^{o}K$, by C. V. Herr. Final rept. on Contract AF 49(638)254. Nov 59, 11p. 10 refs. Rept. 795; AFOSR-TR-59-198.
Order from OTS $0.50 PB 161 461

The specific heat of a normal metal Na, a ferromagnetic metal Co, a ferromagnetic alloy $Co_{93}Fe_7$, an antiferromagnetic metal α-Mn, and an antiferromagnetic salt MnF_2 have been measured in the temperature region between 0.4 and $2^{o}K$. A two-stage magnetic refrigerator isothermal enclosure for future studies between 0.03 and $0.3^{o}K$ was completed at the end of the contract. (Author)

Plastics Lab., Princeton U., N. J.
PRESSURE INDUCED CRYSTALLIZATION IN POLYETHYLENE, by S. Matsuoka and B. Maxwell. Rept. on Contract DA 36-039-sc-78105. 30 Apr 59, 92p. 45 refs. Technical rept. 53E.
Order from OTS $2.25 PB 161 455

By modifying the classical theory of phase transition a kinetic theory of crystallization involving chain molecules has been developed. The process of crystallization for high polymers has been found to be divisible into two stages; (1) primary crystallization where nuclei develop from randomly distributed "subembryos" and continue to grow until their further growth is restricted by the entangled amorphous regions and (2) secondary crystallization where crystallization of the remaining amorphous regions takes place through disentanglement.

Polytechnic Inst. of Brooklyn, N. Y.
COMPOUNDS WITH DEFECT LATTICES, by E. Banks. Final rept. for 1 June 56-31 Aug 57 on Contract DA 36-039-sc-71242. [1957] 113p. 47 refs. AD-149 732.
Order from LC mi$6.00, ph$18.30 PB 138 243

Variation in magnetic intensity of $BaFe_{12}O_{19}$ was studied as a function of the substitution of ions like Al^{III}, Ga^{III}, Cr^{III}, Zn^{II} for Fe^{III}. Mixtures of Na_2CO_3, ZnO, and Fe_2O_3 resulted in single phases with the spinel structure, which were strongly magnetic. On attempts at controlled growth of large single crystals of $NiFe_2O_4$ and $CoFe_2O_4$ from molten PbO, material was in the form of domains having lamellae of PbO and $CoFe_2O_4$. This may be an extremely large-grained eutectic crystallization. New ternary compounds have been found in the Cu-Fe-Se system. Solid solutions up to 5% $NaTaO_3$ in WO_3 have been prepared. Single crystals of CdF_2, containing additions of NaF, CeF_3, were grown from the melt. Physical constants of CdF_2 were measured. Large single crystals of $BaSO_4$ have been grown on platinum wires. The red fluorescence of $BaSO_4 \cdot BaS$ appears to be inherent in this system. (See also PB 138 207)

Rochester U., N. Y.
ON THE VARLEY MECHANISM FOR DEFECT FORMATION IN ALKALI HALIDES, by D. L. Dexter. Rept. no. 4 on Contract AF 49(638)432. Nov 59, 6p. 5 refs. AFOSR-TN-59-1255.
Order from LC mi$1.80, ph$1.80 PB 145 645

Discusses the Varley mechanism and several alternate concepts.

Royal Inst. of Tech. (Sweden).
ON THE CRYSTAL STRUCTURE OF TELLURIUM(IV) CATHECOLATE, by P. J. Antikainen and Georg Lundgren. Technical note no. 1 on Contract AF 61(052)162. 27 July 59, 12p. 7 refs. AFOSR-TN-59-661.
Order from LC mi$2.40, ph$3.30 PB 145 621

The crystals of $Te(C_6H_4O_2)_2$ are monoclinic. They contain 8 formula units per unit cell giving a calculated density of 2.10 g/ml. The tellurium arrangement in the crystals has been determined. Work on the determination of the positions of the oxygen and carbon atoms is in progress.

Rutgers State U., New Brunswick, N. J.
STEADY-STATE FREE PRECESSION IN NUCLEAR MAGNETIC RESONANCE, by H. Y. Carr. Rept. on Contract AF 18(603)06. 1 Sep 58, 26p. 12 refs. AFOSR-TN-58-1052; AD-206 984.
Order from LC mi$2.70, ph$4.80 PB 145 329

A steady-state free precession technique for observing nuclear magnetic resonance is described. A mathematical analysis is presented for certain special conditions, and initial experiments verifying the results of this analysis are reported. This technique provides two opportunities for improving the signal-to-noise ratio. First, it provides a mechanism, similar to that of the "spin echo," for eliminating the effect of the inhomogeneity of the magnetic field on signal strength. This permits the effective use of larger samples. In the second place it provides a steady-state signal which can be observed with a narrow-band detector. Under certain conditions the technique has a broad response as a function of frequency or field. The upper limit to the width of this response is determined by the electronic apparatus supplying the rf pulses rather than the magnet or the nuclear sample. (Author)

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
RESEARCH ON ELECTRON DENSITY DISTRIBUTION IN SEMICONDUCTORS, by J. R. Townsend, G. A. Jeffrey, and G. Panagis. Technical rept. on Contract DA 36-061-ORD-516. Aug 59, 46p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 145 702

Contents:
"The alignment of the general electric single crystal Orienter and diffractometer for single crystal intensity measurements" by J. R. Townsend, G. A. Jeffrey and G. Panagis
"The application of the general electric crystal orienter and counter diffractometer to crystal structure analysis", by G. A. Jeffrey
Report on the international union of crystallography commission on crystallographic apparatus conferences in Stockholm, June 9-12, 1959 on X-ray wavelength problems
Precision lattice parameter determination counter methods for crystal structure analysis

Stanford U., Calif.
ON THE ANOMALOUS LOSS OF RESOLUTION OF PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE IN LIQUIDS, by G. E. Pake and T. R. Tuttle, Jr. Technical note no. 2 on Contract AF 18(603)131. Oct 59, 7p. 9 refs. AFOSR-TN-59-1018.
Order from LC mi$1.80, ph$1.80 PB 145 305

Hausser (Z. Naturforsch. 14a, 425 (1959)) has recently observed a remarkable temperature dependence in the resolution of hyperfine splittings for paramagnetic molecules in liquid solution. Typically, he finds that increasing temperature from a point of high solvent viscosity ultimately brings out a well-resolved structure which surprisingly blurs and disappears at still higher temperatures. An explanation is proposed here for the anomalous loss of structure.

Stockholm U. (Sweden).
STUDIES ON THE CRYSTAL CHEMISTRY OF TITANIUM, VANADIUM AND ZIRCONIUM OXIDES AT ELEVATED TEMPERATURES, by Arne Magneli, Sten Andersson and others. Final technical rept. no. 1, 1 Oct 57-30 Sep 58, on Contract DA 91-508-EUC-245. 1 Oct 58, 99p. 19 refs. AD-157 156.
Order from LC mi$5.40, ph$15.30 PB 145 923

Three phases exist within the solubility range of oxygen in α-titanium, corresponding to random, partly ordered and ordered states respectively. The crystal structure of the so-called δ-titanium oxide is related to that of the ω-phases of several binary alloy systems containing titanium. Ti_3O_5 shows a rapid, reversible phase transformation at 100°C. The structure of V_3O_5 has been determined. When heated to 70°C, VO_2 of MoO_2-type structure undergoes a rapid, reversible transformation to a structure essentially of the rutile type.

Uppsala U. (Sweden).
ADDITION COMPOUNDS OF DIPHOSPHORUS TRIOXIDE TETRACHLORIDE, by Ingvar Lindqvist, Margareta Zackrisson, and Sigvard Eriksson. Technical note no. 5 on Contract AF 61(052)43. 17 July 59, 7p. 5 refs. AFOSR-TN-59-575; AD-217 022.
Order from LC mi$1.80, ph$1.80 PB 145 619

The formation of addition compounds with diphosphorous trioxide tetrachloride as donor molecule has been studied. The following new compounds have been prepared: $2SbCl_5 \cdot P_2O_3Cl_4$ and $SnCl_4 \cdot P_2O_3Cl_4$ and their infrared spectra have been recorded. (Author)

Uppsala U. (Sweden).
STUDIES ON MOLECULAR CRYSTALS. 1. EXCITATION IN A PURE CRYSTAL, by George G. Hall. Technical note no. 15 on Contract AF 61(514)1200. 1 Aug 58, 20p. 12 refs. AD-226 403.
Order from LC mi$2.40, ph$3.30 PB 145 186

The group velocity and the energy of excitation depend on the shape of the zone of excited states of the crystal. The problem of calculating this zone is considered and shown to involve a calculation of long range dipole interactions. The method of long waves is adapted to enable the nature of the excited states to be investigated further and it is shown that, in some circumstances, the excitation is like a longitudinal wave of polarization but that there is an electromagnetic wave coupled to the excitation as it moves.

Uppsala U. (Sweden).
STUDIES ON MOLECULAR CRYSTALS. 2. EXCITON STATES OF PURE CRYSTALS, by George G. Hall. Technical note no. 23 on Contract AF 61(514)1200. 1 Feb 59, 21p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 145 324

The problem of finding the exciton states of a pure molecular crystal is considered. In these states the positive and negative charges are separated but have a Coulomb attraction. The approximations involved in finding those states by the Wannier method of comparing with a hydrogen-like atom are discussed in some detail. Little movement of excitation is likely in these states until the charges are dissociated from one another. To illustrate the accuracy of the Wannier approximation the exciton states of a linear lattice of molecules are found by two methods. An exact solution of the difference equations can be obtained and the eigenvalues have a simple closed form. The Wannier solution gives very similar eigenvalues when the principle quantum number is large or if the effective charge is small and they can be improved by adding a first order perturbation correction. (Author)

Uppsala U. (Sweden).
TOWARDS A THEORY OF THE CRYSTALLOGRAPHIC POINT GROUPS, by Harold V. McIntosh. Technical note no. 21 on Contract AF 61(514)1200. 3 Nov 58, 23p. AD-218 832.
Order from LC mi$2.70, ph$4.80 PB 145 326

Summary is made of the theorems to be expected in a comprehensive theory of both the double and single crystallographic point groups. Based upon their decomposition as semi-direct products, it is shown how the theory may yield a nomenclature for the groups and their representations, and a factored form for the projection operators belonging to the rows of the irreducible representations. This factorization is used to discuss the reduction of spherical harmonics according to their point group symmetry, as well as to discuss normal coordinate analyses, the construction of symmetric Hamiltonians, and the derivation of selection rules. The selection rules follow from the reduction of Kronecker product representations. The equivalence of complex conjugate representations and the construction of unitary representation is discussed. The entire analysis is predicated upon a certain canonical form for the representation of a semi-direct product, which is described. (Author)

Westinghouse Electric Corp., Youngwood, Pa.
RESEARCH IN THE PREPARATION OF HYPER-PURE SINGLE CRYSTAL SILICON CARBIDE. Scientific rept. no. 5, 29 Aug 58-30 June 59, on Contract AF 19(604)2174. [1959] 46p. 11 refs. AFCRC-TN-59-792.
Order from LC mi$3.30, ph$7.80 PB 145 370

Preparation and properties of pure silicon carbide: Extensive experiments have been carried out on the preparation of single crystals of SiC in a graphite tube furnace, after the method of Lely. A wide range of ambients have been employed. Crystals have been grown in argon, hydrogen, and over a wide range of temperatures. Emphasis is laid upon the relationship between these variables and the composition and habit of the material grown. Interferometric determination of twist and polytype in silicon carbide whiskers: Whiskers of hexagonal SiC have been prepared in a graphite tube furnace. They are grown by sublimation of SiC in hydrogen, depositing at temperatures about 2000°C as acicular crystals of hexagonal section, with [0001] along the whisker length. The $(1\bar{1}00)$ faces have been examined using optical interference techniques, and are found to exhibit a twist. The Eshelby formula for twist caused by a screw dislocation has been used to estimate the strength of the associated Burgers vector. It is found that, within the experimental error, the estimated Burgers vector is equal to, or is an integral multiple of the unit cell of the SiC polytype 4H. It is thus concluded that these twisted whiskers grow by means of a screw dislocation of integral strength parallel to the axis, and that they are of polytype 4H. (Author)
(See also PB 140 092)

Theoretical Physics

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
PLASMA PROPULSION BY A RAPIDLY VARYING MAGNETIC FIELD, by M. M. Klein and K. A. Brueckner. Rept. on Contract AF 04(647)269. 2 Dec 59, 51p. 7 refs. Technical Information Series R59SD453.
Order from LC mi$3.60, ph$9.30 PB 145 704

The motion of a plasma driven by a rapidly varying magnetic field from a stationary coil have been investigated for (1) the diamagnetic case (ionization process ignored) and (2) non-diamagnetic case.

Air Force Cambridge Research Center, Bedford, Mass.
HYDRODYNAMIC MODEL OF DIFFUSION EFFECTS ON SHOCK STRUCTURE IN A PLASMA, by O. W. Greenberg, H. K. Sen, and Y. M. Trève. Dec 59, 48p. 12 refs. Geophysical Research Papers no. 66; AFCRC-TR-59-278.
Order from OTS $1.25 PB 161 522

Diffusion effects on the structure of a steady, plane shock in a proton-electron plasma have been studied using a simplified, two-fluid, hydrodynamic model in which diffusion is the only shock-broadening mechanism. Charge separations occur inside the shock because of the mass difference between protons and electrons. The shock is shown to have electric field and density oscillations as a function of distance through the shock. The peak electric fields are large; the peak electric field inside a weak shock of Mach 1.169 reaches 41,700 volts/cm for typical quiescent plasma conditions. The distance in which electric field changes occur is of the order of the Debye length of the quiescent plasma. The present work is limited to shocks of Mach number less than 2. (Author)

Avco-[Everett] Research Lab. [Mass.]
TWO-DIMENSIONAL INCOMPRESSIBLE MAGNETO-HYDRODYNAMIC FLOW ACROSS AN ELLIPTICAL SOLENOID, by Nelson H. Kemp and Harry E. Petschek. Rept. on Contracts AF 04(645)18 and AF 49(638)61. Apr 58, 74p. 7 refs. Research rept. 26; AFOSR-TN-58-438; AD-158 243 and AD-159 613.
Order from LC mi$4.50, ph$12.30 PB 137 763

An analysis has been made of the two-dimensional flow of an incompressible, constant-conductivity fluid through an elliptically-shaped solenoid containing a constant magnetic field directed normal to the flow plane. The effect of both Hall current and ion slip has been included in the Ohm's Law used for the fluid. The analysis was performed by means of a perturbation procedure in two parameters, one being the magnetic Reynolds Number R_m and the other the ratio of magnetic force per unit area to dynamic pressure, S. Calculations were carried through first order in each parameter, and closed-form analytic expressions were obtained for the force and moment on the solenoid, the current density, stream function, magnetic field and other pertinent physical quantities. It was found that in zero order, there is a force but no moment on the solenoid. In the first order in S, where the flow field changes but the magnetic field does not, there is a moment and a force, the latter being antiparallel to the zero order force. In the first order in R_m, where the magnetic field changes but the flow field does not, there is a moment, but no force. Thus, through first order the lift to drag ratio is the same as in zero order. Graphs are presented which illustrate some of the effects of angle of attack, fineness ratio of the ellipse, Hall current and ion slip on the forces and moments. (Author)

California U., Berkeley.
FUNDAMENTALS OF THE POLAR METHOD IN GAS WAVE DYNAMICS, by R. A. Stern and A. K. Oppenheim. Technical note DR 5 on Contract AF 49(638)166. Nov 59, 104p. 37 refs. AFOSR-TN-59-1152.
Order from LC mi$5.70, ph$16.80 PB 145 544

Gas wave dynamics is concerned with the analysis of interactions between waves propagating in compressible and reacting media. Multiple interactions, such as those occurring in shock tubes or during the development of detonation, require solutions "in the large", that is by means of analysis which considers only the compatibility conditions for the wave system resulting from each interaction without any regard for the details of its progress. These dynamic boundary conditions are expressed in terms of invariance relations between equilibrium states across each component wave. For the solution of the wave system they have to be pieced together, either numerically by an iterative procedure, or graphically by the polar method. The present work introduces the fundamentals of the polar method, which consists of the formulation of the basic problem leading to the establishment of invariance relations in the general case of a wave process, the derivation of invariance relations for an elementary wave process in the general case of a compressible and reactive medium, and the illustration of the analysis by the derivation of invariance relations for two special cases of simple waves: one with friction and the other with chemical reaction.

Dugway Proving Ground, Utah.
ON THE STRUCTURE OF HYDRODYNAMIC AND ELECTRODYNAMIC FIELDS. PART I: VECTOR EXPANSIONS IN RECTANGULAR COORDINATES, by Keith L. McDonald. Aug 59, 42p. 5 refs. Technical rept. DPGR 240.
Order from LC mi$3.30, ph$7.80 PB 145 697

In a previous paper the author discussed the linear component fields appearing in the Taylor expansion of an arbitrary solenoidal vector. The present work complements these fields to include those vectors with a non-vanishing divergence. The second and third order fields are treated extensively for both the solenoidal and divergence cases. A general scheme for treating higher order fields is also presented. Field structures are pictorially elucidated by means of figures showing vector lines of force. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
A SHALLOW-LIQUID THEORY IN MAGNETOHYDRODYNAMICS, by L. E. Frankel. Rept. on Contract AF 49(638)476. June 59, 77p. 18 refs. OSR Technical note 59-563; AD-216 758.
Order from LC mi$4.50, ph$12.30 PB 145 299

The nonlinear and linear shallow-water theories, which describe long gravity waves on the free surface of an inviscid liquid, are extended to the case of an electrically conducting liquid on a horizontal bottom, in the presence of a vertical magnetic field. The dish holding the liquid, and the medium outside it, are assumed to be non-conducting. The approximate equations are based on a small ratio of depth to wavelength, on the properties of mercury, and on a moderate magnetic field strength. These equations have a magneto-hydraulic character, for in the shallow liquid layer the horizontal fluid velocity and current density are independent of the vertical coordinate. Some explicit solutions of the linear equations are obtained for plane flows and for axi-symmetric flows in which the velocity vector lies in a vertical, meridianal plane. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
RAYLEIGH'S PROBLEM IN A TRANSVERSE MAGNETIC FIELD, by Hsun Tiao Yang. Rept. on Contract AF 49(638)401. Dec 58, 19p. 4 refs. Technical note BN-158; AFOSR-TN-59-47; AD-209 418.
Order from LC mi$2.40, ph$3.30 PB 145 567

Rayleigh's problem of an infinite flat plate set impulsively into uniform motion in its own plane, in the presence of a transverse uniform magnetic field, is studied in the present note. The fluid is assumed to be an incompressible continuum, and the plate electrically non-conducting. Two limiting cases are discussed somewhat in detail (1) The magnetic field is very weak. In this case it is found that the flow field is only slightly perturbed from the classical Rayleigh's result. (2) The magnetic field is very strong. Here the flow field is greatly influenced by the magnetic field. An Alfven wave, propagating at high speed in the direction of the magnetic field, gives rise to a small discontinuity in the flow velocity at the wave front.

Institute of Theoretical Physics, Stanford U., Calif.
PION-PION SCATTERING IN THE φ^4 THEORY, by M. Baker and F. Zachariasen. Technical note no. 9 on Contract AF 49(638)388. Dec 59, 25p. 5 refs. AFOSR-TN-59-1324.
Order from LC mi$2.70, ph$4.80 PB 145 642

Pion-pion scattering has been calculated using the determinantal method, assuming that a relativistic $(\lambda/4)(\varphi_i\varphi_i)^2$ coupling is responsible for the interaction. The scattering amplitude for the individual partial waves is expressed as a ratio of two power series and terms through λ^3 have been kept in each series. Numerical results for the S- and P-waves have been obtained. λ is adjusted by attempting to fit the electromagnetic structure of nucleons. The best value of λ obtained by this fit is unfortunately so large that the validity of the determinantal approximation is doubtful. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
SOME REMARKS ON COMPTON SCATTERING, by J. D. Walecka. Technical note no. 8 on Contract AF 49(638)388. Dec 59, 16p. 8 refs. AFOSR-TN-59-1332.
Order from LC mi$2.40, ph$3.30 PB 145 640

As of the present time, no successful theory of nuclear Compton scattering exists. The best attempts at a theory combine the amplitude for the scattering of photons by a Dirac particle with a point anomalous moment (this amplitude is known to be exact in the low-energy limit) with an amplitude which attempts to take into account the internal structure of the nucleon. In this note, the first, or "Powell amplitude," is presented in a form which is useful in such calculations. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
X-RAY INCOHERENT SCATTERING FUNCTIONS FOR NON-SPHERICAL CHARGE DISTRIBUTIONS. II. Ti^{+2}, V^{+2}, Mn^{+2}, Mn AND Fe, by A. J. Freeman. Nov 59, 18p. 14 refs. MRL Rept. no. 68.
Order from LC mi$2.40, ph$3.30 PB 145 631

Compton incoherent scattering functions have been calculated for the transition elements, Ti^{+}, V^{+2} Mn^{+2}, Mn^{+}, Mn and Fe using available Hartree-Fock free atom wave functions. The methods reported earlier for including the effects of non-spherical charge distributions on the scattering function have been employed in these calculations as well. In agreement with previous results, large differences are found from the values of James & Brindley, due mainly to the inclusion of all the exchange terms in the Waller-Hartree theory. (Author) (See also PB 139 657)

Microwave Lab., Stanford U., Calif.
INTERPRETATION OF THE RESULTS OF THE RF CONFINEMENT EXPERIMENT, by P. A. Sturrock. Scientific rept. no. 3 on Contract AF 19(604)5226. Oct 59, 30p. 8 refs. M. L. rept. no. 638; AFCRC-TN-59-787.
Order from LC mi$2.70, ph$4.80 PB 145 289

The results of certain experiments upon the confining action of low frequency (about 10 Mc/s) rf fields upon plasmas are reviewed. Attempts at theoretical explanation of these results by various confinement mechanisms also are reviewed. The theories are not found acceptable, and there are certain general reasons for believing that the experiments do not represent true confinement. Investigation of the electric field configuration necessary to explain the observed plasma configuration leads one to interpret the experiment in terms of "pseudo-confinement". Surface charges build up on the inner wall of the glass tube in such a way that electrons experience a radially inward force at the surface of the plasma over almost all of the surface of the plasma almost all of the time; ions therefore experience an outward force almost everywhere most all of the time. The effect of the rf electric field is therefore to promote the formation of a high-voltage sheath separating the plasma from the glass tube. This interpretation appears to be fully compatiable with observations so far made with various electric-field patterns; it also offers an explanation of the dark deposits on the glass tube noted in certain experiments. Further experiments which may be conducted to verify this theory are proposed. (Author)

Microwave Lab., Stanford U., Calif.
A PARAMETRIC AMPLIFIER THEORY FOR PLASMAS AND ELECTRON BEAMS, by G. S. Kino. Scientific rept. no. 14 on Contract AF 19(604)1930. Sep 59, 28p. 5 refs. AFCRC-TN-59-776; ML rept. no. 636.
Order from LC mi$2.70, ph$4.80 PB 145 652

The theory of a new type of parametric amplifier which uses a gas discharge plasma as a nonlinear propagating medium is given. This theory is based on a zero temperature plasma assumption. The nonlinear coupling between traveling waves passing through the plasma is determined by taking second-order terms in the velocity into account. A simplified normal mode theory is used to describe the effect on the propagation constants of the individual modes due to coupling between them. The theory is carried out in detail for a plasma in an infinite magnetic field and for a plasma in a zero magnetic field. The final propagation equation for the traveling waves is found in terms of the fields in the plasma of the small-signal pumping wave, signal wave and idler wave. In the appendix the theory is extended to cover the case of beam-type parametric amplifiers. The results obtained are in agreement with the theory of Louisell and Quate for the principal waves of a space-charge wave parametric amplifier.

Oslo U. (Norway).
THEORETICAL RESEARCHES IN MAGNETOHYDRODYNAMICS, by Øivin Holter, Eberhart Jensen and others. Technical (final) rept. on Contract AF 61(052)49. 30 June 59, 19p. AFOSR-TR-59-92; AD-219 370.
Order from LC mi$2.40, ph$3.30 PB 145 665

The subjects covered are plasma oscillations in the classical sense; general theory of wave propagation in a plasma; the form and importance of viscous forces in plasma phenomena when magnetic fields are active; plasma shock waves; and forces in a plasma conditioned by certain deviations from thermal equilibrium, in particular deviations from equipartition of kinetic energy. (Author)

Uppsala U. (Sweden).
SYMMETRY-ADAPTED FUNCTIONS BELONGING TO THE SYMMETRIC GROUPS, by Harold V. McIntosh. Technical note no. 19 on Contract AF 61(514)1200. 6 Oct 58, 24p. 19 refs.
Order from LC mi$2.70, ph$4.80 PB 145 327

Young's factorization of the idempotents belonging to the symmetric groups is given a necessary and sufficient characterization, by means of a lemma due to Burrow. The use of these idempotents is contrasted with Yamanouchi's representation, and finally the equivalence of Löwdin's path-diagram method to the group-theoretical treatment of the angular momentum states arising from the coupling of an assemblage of spin 1/2 particles is demonstrated. (Author)

Thermodynamics

Armour Research Foundation, Chicago, Ill.
THE DEVELOPMENT OF THERMOCOUPLES FOR TEMPERATURES IN THE REGION OF 1600° TO 2000°C, by Gary Steven and Walter C. Troy. Final rept. on Subcontract to Contract [DA 36-039-sc-2004] 18 Sep 50, 122p. 50 refs. NEPA 1580; ATI-155 272.
Order from LC mi$6.30, ph$19.80 PB 137 512

Thermocouples representing combinations of tungsten, molybdenum, tantalum, platinum, rhodium, iridium and alloys of these metals. In a neutral atmosphere, optimum properties and performance were obtained with the tungsten/iridium thermocouple. Alumina was selected among the pure oxide refractories for the protection of the w/Ir thermocouple. The Ir/60% Ir, 40% Rh thermocouple required no protective shielding for temperature measurements in oxidizing atmosphere.

Battelle Memorial Inst., Columbus, Ohio.
THERMAL PROPERTIES OF MATERIALS AT ELEVATED TEMPERATURES, by Herbert W. Deem, Webster D. Wood, and Charles F. Lucks. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5849. Dec 59, 22p. 1 ref. WADC Technical note 59-215.
Order from OTS $0.75 PB 161 478

Apparatus was designed and assembled for making linear-thermal-expansion, specific-heat, and thermal-conductivity measurements to 5000 F or above on metals and ceramic-type materials. Linear-thermal-expansion and specific-heat measurements are made in the same apparatus using the same specimen. Expansion measurements are made by directly viewing fiducial marks on a cylindrical specimen with two telemicroscopes. Specific-heat measurements are

made by measuring the heat input to an inner heater which is required to heat the specimen of known mass over a measured temperature range. Thermal-conductivity measurements are made by a radical heat-flow method using a thick-walled-cylindrical specimen with an encircling graphite heater. The apparatus are essentially completed and are ready for calibration. No measurements are reported. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
STEADY FLOW OF SLIGHTLY VISCO-ELASTIC FLUIDS, by W. E. Langlois and R. S. Rivlin. Technical rept. no. 3 on Contract DA 19-020-ORD-4725. Dec 59, 109p. 10 refs. DA-4725/3. OOR rept. 1271. 27-M.
Order from LC mi$5.70, ph$16.80 PB 145 365

A number of problems concerning flow of an incompressible slightly-viscoelastic fluid are discussed. There are: flow through a straight pipe of elliptical cross-section; flow in a converging channel formed by two infinite planes; and convergent flow in a conical vessel. Inertial forces are systematically neglected. (Author)

California U., Berkeley.
STATISTICAL STUDY OF ACCELERATING FLAMES: ANALYSIS OF VARIANCE, by R. A. Stern, A. J. Laderman, and A. K. Oppenheim. Technical note DR 6 on Contract AF 49(638)166. Nov 59, 79p. 12 refs. AFOSR-TN-59-1171.
Order from LC mi$4.50, ph$12.30 PB 145 637

Study of velocity fluctuations observed by means of ionization probes during the development of detonation reveals its significance as an indicator of physical characteristics of the flame. The results of the study are used to establish the requirements for more detailed, systematic investigation of the fluctuating characteristics of accelerating flame fronts.

Duke U. [Durham, N. C.]
THE STEADY-STATE THERMOELASTIC PROBLEM FOR THE ELASTIC LAYER RESTING ON A RIGID FOUNDATION, by I. N. Sneddon and F. J. Lockett. Rept. on Contract AF 18(600)1341. Sep 59, 12p. 4 refs AFOSR-TN-59-1291.
Order from LC mi$2.40, ph$3.30 PB 145 508

Naval Ordnance Test Station, China Lake, Calif.
APPLICATION OF A SINGLE PROBE FOR DERIVATIVE DIFFERENTIAL THERMAL ANALYSIS, by Jack M. Pakulak, Jr. 1 Sep 59, 18p. 4 refs. NOTS TP 2315; NAVORD rept. 6586; AD-227 047.
Order from LC mi$2.40, ph$3.30 PB 145 279

The application of an RC network to thermal analysis makes possible the use of a less complicated apparatus containing a single thermal sensing element. The described apparatus is particularly sensitive in studying the thermal physical aspects of a material under investigation. In this case the endo-exothermic peak area or height is proportional to the rate of change for that particular reaction rather than to the concentration. The apparatus is very sensitive and simple with non-critical components being used for the most part. The data obtained from the use of this apparatus are reliable and accurate in the temperature range considered valid for glass enclosed thermistors. Its practical application is shown by the qualitative determination of transition points for certain inorganic and organic compounds and the possibility of its incorporation into future kinetic studies. (Author)

Purdue U., Lafayette, Ind.
HEAT TRANSFER FROM NON-ISOTHERMAL SURFACES, by Helmut Wolf. Rept. on Project Squid, Contract Nonr-1858(25). Apr 59, 26p. 10 refs. Squid Technical rept. PUR-38-P.
Order from LC mi$2.70, ph$4.80 PB 145 380

Heat transfer experiments conducted in circular tubes having variations in wall temperature with axial distance are corrected to conditions of constant tube wall temperature by employing a form of the theory due to Rubesin for flat plates. The corrected results are compared with experiments wherein the wall temperature was held constant with respect to axial distance.

Wave Propagation

Boston Coll., Chestnut Hill, Mass.
ABSORPTION OF ULTRASONIC ENERGY IN LIQUIDS, by Frederick E. White. Final rechnical rept. for 2 Feb 53-1 Dec 56 on Contract DA 19-020-ORD-2569. [1956] 41p. 37 refs. OOR rept. 674. 1 P; AD-118 798.
Order from LC mi$3.30, ph$7.80 PB 138 419

The purpose of the research was to attempt to obtain reliable data on the absorption of ultrasonic energy in various liquids over as wide as possible ranges of both frequency and temperature, and then to consider the significance of the data. Several liquids have been used, with the most study being given to ethyl acetate. A major portion of the time spent on this project has been in the endeavor to develop apparatus capable of yielding reliable data in a reasonable time. Practically none of the apparatus in use at the beginning of the project is now being used, changes having been made in almost every part.

Brown U. Div. of Engineering, Providence, R. I.
THE DIFFRACTION OF AN ACOUSTIC OR ELECTRO-MAGNETIC PULSE BY A RESISTIVE HALF-PLANE, by V. M. Papadopoulos. Rept. on Contract AF 19(604)4561. Oct 59, 38p. 2 refs. Scientific rept. AF 4561/6; AFCRC-TN-59-793.
Order from LC mi$3.00, ph$6.30 PB 145 288

The two dimensional wave diffraction problem, acoustic or electromagnetic, in which a pulse of step-function time dependence is diffracted by a resistive half-plane is solved by assuming dynamic similarity in the solution. (Author)

Columbia U. School of Engineering, N. Y.
A TRANSPORT EQUATION FOR THE SPECTRAL DENSITY OF A MULTIPLY SCATTERED ELECTROMAGNETIC FIELD, by Dmitri S. Bugnolo. Technical rept. T-3/D on Contract AF 49(638)350. 19 Nov 59, 27p. 19 refs. CU-8-59-AF-350-EE; AFOSR-TN-59-1175.
Order from LC mi$2.70, ph$4.80 PB 145 315

The use of a first Born approximation is open to question when the path length is greater than a mean free path in the scattering region. It is therefore of interest to develop a transport equation capable of predicting the spectral density for such cases. The general theory presented in this paper is applied to the case of multiple scattering by dielectric noise. It is independent of models for the dielectric fluctuations. A method of solution is developed for the case of forward scattering. The particular case of a monochromatic plane wave incident of a half space is discussed in detail. The results are applied to a numerical example in the troposphere. (Author)

Columbia U. School of Engineering, New York.
ON THE QUESTION OF MULTIPLE SCATTERING IN THE TROPOSPHERE, by Dimitri S. Bugnolo. Technical rept. T-4/D on Contract AF 49(638)350. 19 Nov 59, 23p. 18 refs. CU-9-59-AF-350-EE; AFOSR-TN-59-1252.
Order from LC mi$2.70, ph$4.80 PB 145 555

A criteria is developed to serve as a measure of multiple scattering in the troposphere as a result of dielectric noise. The question to be answered is: What is the probability that any ray of the incident field will be scattered at least twice in a distance R? This is a useful criteria in that it can be used as a measure of reliability for the usual single scatter approximations. The criteria is developed in detail for an arbitrary dielectric noise and applied to a number of special cases. The results indicate that multiple scattering effects should be of importance in the microwave spectrum. (Author)

Cornell U., Ithaca, N. Y.
THEORY OF SCATTERING OF X-RAYS AT ULTRA-SMALL ANGLES, by A. W. K. Metzner and L. G. Parratt. Technical rept. no. 15 on Contract AF 18(600)300. 14 Sep 58, 30p. 57 refs. AFOSR-TN-58-780; AD-202 001.
Order from LC mi$2.70, ph$4.80 PB 137 537

The present study represents a survey and discussion of small-angle scattering theory with an attempt in particular to clarify the picture in the ultra-small-angle region. It will be seen that interparticle interference effects play a dominant role here. On the other hand it will also be seen that no theory based on just the single scattering process can predict the experimental scattering curve correctly in this region, and multiple scattering theory has not yet been developed to the point where interparticle interference effects are taken into account.

Cruft Lab., Harvard U., Cambridge, Mass.
THEORETICAL AND EXPERIMENTAL STUDY OF THE BACK-SCATTERING CROSS SECTION OF AN INFINITE RIBBON, by Michael S. Macrakis. Scientific rept. no. 2, series 2 on Contract AF 19(604)4118. 5 June 59, 19p. 11 refs. AFCRC-TN-59-788.
Order from LC mi$2.70, ph$4.80 PB 145 579

The geometrical optics approximation is derived for the back-scattering cross section per unit length of an infinite ribbon. A comparison is made with the exact theory, the approximate theory of Sommerfeld, the variational method, and with experimental results obtained through the space-separation method for the measurement of back-scattering cross sections in a parallel-plate region.

Electrical Engineering Research Lab., U. of Texas, Austin.
AN ANALYSIS OF RADIOSONDE EFFECTS ON THE MEASURED FREQUENCY OF OCCURRENCE OF DUCTING LAYERS, by N. K. Wagner. 1 Dec 59, 38p. 15 refs. Rept. on Contract AF 19(604)2249. Rept. no. 6-31; AFCRC-TN-59-967.
Order from LC mi$3.00, ph$6.30 PB 145 286

The influence and importance of radiosonde sensing element time lag, data transmission techniques and significant level selection criteria on the resulting computed index of refraction profile are discussed. Time lag is found to be the most important single effect with data transmission techniques next in importance. Significant level criteria have a very small effect on ducting layer detection, and when considered in combination with time lag and data transmission techniques, are negligible. The quantitative importance of these radiosonde effects on ducting layer detection for the Southern California coastal region is determined by employing a refractometer profile data sample along with known and assumed characteristics for the radiosonde. A comparison is also made between layer frequency of occurrence statistics obtained from refractometer and radiosonde data for this geographical area. (Author)

Electrical Engineering Research Lab., U. of Texas [Austin]
RADIO PROPAGATION MEASUREMENTS IN THE 100-118 KMCS SPECTRUM, by C. W. Tolbert, C. O. Britt, and J. H. Douglas. Rept. on Contract Nonr-375(01). 15 Apr 59, 24p. 5 refs. Rept. no. 107.
Order from LC mi$2.70, ph$4.80 PB 145 695

This report describes the measuring technique and the results of propagating millimeter wavelengths between the frequencies of 100 and 118 kmcs over a 2155 foot path. The attenuation measured at these frequencies are best fit by a 2.53 mm oxygen line having a strength of 1.7 db/km and a line breadth constant of

0.045/cm/atmos. The water vapor attenuation measured indicates the presence of an absorption line resonant at 108.8 kmcs with a strength of 0.35 db/km and a line breadth constant of 0.075/cm for a standard sea level atmosphere. There was also evidence, particularly in the region of 100 to 106 kmcs, of absorption that can be explained only by some of the rare atmospheric gases such as N_2O, NO_2, SO_2 and O_3. (Author)

Electronics Research Lab., U. of California, Berkeley.
SCATTERING OF MICROWAVES BY FIGURES OF REVOLUTION, by J. S. Honda, S. Silver and F. D. Clapp. Rept. on Contract N7onr-295(29). 16 Mar 59, 40p. 11 refs. Rept. no. 84; Series no. 60, Issue no. 232; AD-216 595.
Order from LC mi$3.00, ph$6.30 PB 145 499

The image-plane (half-space) technique for measuring back scattering cross-sections as a function of aspect, and the azimuthal pattern of the scattered field of a target for a given aspect presented to the incident wave, for targets that are figures of revolution is described. The technique has been developed to yield results of a high degree of accuracy. The accuracy and precision are especially high for back scattering across sections where by a process of measuring return as a function of transmitter-receiver to target distance the background reflections can be eliminated and the true far zone cross section can be identified.

Geophysical Inst., U. of Alaska, College.
ARCTIC PROPAGATION STUDIES AT TROPOSPHERIC AND IONOSPHERIC MODES OF PROPAGATION, by Leif Owren, H. F. Bates and others. Final rept. on Contract AF 19(604)1859. Oct 59, 134p. 31 refs. AFCRC-TR-59-366.
Order from LC mi$6.90, ph$21.30 PB 145 560

Two types of direct scatter from the F region are identified on the records from the oblique incidence sweep-frequency sounder located at College, Alaska. One type of echo appears to come from randomly distributed, field-aligned irregularities in the ionosphere and the other from discrete patches of irregularities. Certain phenomena frequently recorded on high latitude ionograms such as Spread F and triple splitting are probably manifestations of backscatter from ionospheric irregularities. Fixed frequency oblique incidence soundings on frequencies of 12, 18 and 30 mc/s made at College, Alaska show both direct backscatter from the E and F layers and F layer propagated backscatter from the ground. Direct backscatter from the E layer (1E echo) occurs in the range interval of 200 to 800 km with a maximum between 300 and 500 km. F layer propagated backscatter from the ground (2F echo) is investigated using both the 12 mc/s 1956 soundings and soundings on 12, 18 and 30 mc/s obtained during 1958. A technique of estimating the electron densities of the outer ionosphere by the use of nose whistlers is described. The mathematical theory of longitudinally propagated whistlers in a magnetic dipole field is developed. Five short-term transpolar transmission tests conducted jointly by the Geophysical Institute and the Norwegian Defence Research Establishment during 1956-59 are described briefly.

Georgia Inst. of Tec.. Engineering Experiment Station, Atlanta.
METEOR BURST PROPAGATION, by W. B. Jones and J. B. Berry. Final rept. on Contract AF 19(604)5187. 30 Sep 59, 100p. 3 refs; AD-230515. AFCRC-TR-59-357.
Order from LC mi$5.40, ph$15.30 PB 145 300

Duty cycle as a function of receiver decision level and the distribution of echo decay time constants have been studied by analyzing propagation data obtained from the operation of two typical meteor-burst radio links utilizing two frequencies in the VHF spectrum. This study concludes that the duty cycle relationship is exponential for echoes reflected from underdense meteor trails with an exponent value which agrees with theory and previous observations of meteoritic mass distribution. As a consequence of this fact, a meteor-burst communication system's average information rate may be maximized by using wide band-width and a high instantaneous information rate. The distribution of echo decay time constants has been measured at two critical times of day. Empirical values were obtained for the median decay constant on each frequency. The predicted diurnal variation in this distribution has been confirmed and evaluated. The effects of path geometry and antenna patterns on the rate of occurrence of detectable radio-wave reflections from ionized meteor trails are considered from a theoretical point of view. The use of an electronic digital computer to predict meteor rates is described. An example computation showing how this technique is used to select antenna parameters is presented and discussed. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
TRANSCENDENTAL EQUATIONS IN ELECTROMAGNETIC THEORY, by Leon Kotin and Wilhelm Magnus. Rept. on Contract AF 49(638)229. Aug 58, 40p. 3 refs. Research rept. no. BR-27; AFOSR-TN-58-749; AD-201 501.
Order from LC mi$3.00, ph$6.30 PB 138 062

The problem of determining the zeros of the Hankel function $H_\nu^1(x)$ for fixed real x and variable (complex) ν plays a role in propagation theory and in the theory of diffraction by a metallic sphere. The equation $H_\nu^1(x) = 0$ defines ν as a function of x. The qualitative behavior of this function (for $x>0$) is determined for all $x \geq 1/4$. Complex values of x are also considered. In the case of a sphere of finite conductivity, the corresponding transcendental equation is similarly treated. (Author)

Menzel, Donald H., Cambridge, Mass.
INTERACTION OF ELECTROMAGNETIC AND ACOUSTIC WAVES IN AN IONIZED MEDIUM [and] A DYNAMICAL MODEL FOR STELLAR ATMOSPHERES, by Donald H. Menzel, David Layzer, and Max Krook. Final rept. no. 1 on Contract AF 19(604)3897. 15 Mar 59, 7 refs. AFCRC-TN-59-403.
Order from LC mi$3.00, ph$6.30 PB 145 573

A reformulation and critical discussion of ionospheric cross-modulation shows that the main predictions of the current theory depend on two assumptions: (i) that the effect is small enough to justify a linearized description, and (ii) that certain average properties of the electrons, such as the electron temperature, the (mean) collision frequency and the rate of cooling of the electron gas by collisions between electrons and gas-molecules, are related in a way that does not depend on the modulation frequency.

Microwave Lab., Stanford U., Calif.
THE PROPAGATION OF MICROWAVES THROUGH A MAGNETO-PLASMA, AND A POSSIBLE METHOD FOR DETERMINING THE ELECTRON VELOCITY DISTRIBUTIONS, by A. L. Cullen. Scientific rept. no. 1 on Contract AF 19(604)5226. Oct 59, 20p. 2 refs. M. L. rept. no. 632; AFCRC-TN-59-786.
Order from LC mi$2.40, ph$3.30 PB 145 290

Sagdeyev and Shapranov have shown that the absorption of microwaves in a hot plasma in a steady magnetic field can be calculated in simple closed form with the help of the Boltzmann equation, provided that the effect of collision can be ignored. The present paper is restricted to the special case of propagation of circularly polarized waves parallel to the magnetic field, and the extraordinary ray, in magneto-ionic terminology, is given special attention. It is shown that the formula given by Sagdeyev and Shapranov for this case can be deduced by considering the motions of individual electrons by elementary dynamical methods, using the concepts of Doppler shift and velocity distribution functions to obtain a macroscopic conductivity formula for a high temperature plasma. From this, the absorption is easily calculated.

Rome Air Development Center, Griffiss AFB, N. Y.
A PROPOSED TROPOSPHERIC SCATTER COMMUNICATIONS EQUIPMENT CONFIGURATION FOR TIME DIVERSITY RECEPTION, by C. Frederick Huntington. Dec 59, 24p. 12 refs. RADC-TN-59-304.
Order from LC mi$2.70, ph$4.80 PB 145 600

In this report, an equipment configuration is proposed which enables the use of time diversity with no decrease in channel capacity and no appreciable decrease in transmission speed. Appropriate time delay is introduced at the transmitter terminal to provide signal channels in which the intelligence is incoherent. Signal channels are separated at the receiver terminal by polarization. The introduction of time delay to the received signal channels provides coherence of intelligence for detection and uncorrelation of fast fade which is necessary for effective combining. The small fraction of signal rotated in plane of polarization in the transmission media is reduced to negligible value by the application of feedback techniques.

Stanford Electronics Lab., Stanford U., Calif.
FADING AND ATTENUATION OF HIGH-FREQUENCY RADIO WAVES OVER A LONG PATH CROSSING THE AURORAL ZONE, by K. C. Yeh. Scientific rept. no. 2 on Contract AF 19(604)1830. 28 July 58, 77p. 39 refs. AFCRC-TN-58-415; AD-152 580.
Order from LC mi$4.50, ph$12.30 PB 145 588

This investigation is concerned with the fading and attenuation of high frequency radio signals propagated over a long path crossing the auroral zone. The fading of high frequency signals propagated over non-auroral paths of comparable length has also been studied, and some new results are presented. The theory of radio wave fading and the methods of analyzing fading records are outlined and discussed. The presence of irregularities in the ionosphere introduces signal amplitude variations which are, in general, functions of time, space coordinates, and the radio frequency. A theory of selective fading is developed in terms of diffraction from an assumed one-dimensional screen of random irregularities.

Stanford Electronics Labs., Stanford U., Calif.
MOTIONS OF LARGE-SCALE TRAVELING DISTURBANCES DETERMINED FROM HIGH-FREQUENCY BACKSCATTER AND VERTICAL INCIDENCE RECORDS, by J. F. Valverde. Scientific rept. no. 1 on Contract AF 19(604)1830. 21 May 58, 100p. 22 refs. AFCRC-TN-58-414; AD-152 579.
Order from LC mi$5.40, ph$15.30 PB 145 587

The existence, in the F region of the ionosphere, of large-scale traveling disturbances has been known for a number of years. A new method of study of these ionospheric anomalies is described in this report, and an analysis is presented of the advantages and limitations of the method. The method is based on back-scatter sounding of the ionosphere. In backscatter sounding a pulse of radio energy is transmitted from a rotatable directional antenna and strikes the ionosphere at oblique incidence. The radio signal is reflected in a mirror-like manner by the ionosphere and returns to earth at a distant point. Some of the energy striking this point is scattered back towards the transmitter location by irregularities on the earth's surface. This ground-scattered energy can be received as an echo at the transmitter location following an additional reflection by the ionosphere. The range at which the ground scattered echo returns depends on the reflecting ability of the ionosphere at the particular time in the direction towards which the antenna is directed. As the antenna rotates, a Plan Position Indicator (PPI) display of echo range is traced out on an oscilloscope and photographed on 16 mm movie film.

Stanford Electronics Labs., Stanford U., Calif.
REDUCTION AND PROCESSING OF F-LAYER PROPAGATION DATA, by P. M. LaTourvette. Scientific rept. no. 4 on Contract AF 19(604)1830. 15 Dec 58, 72p. 15 refs. AFCRC-TN-59-202.
Order from LC mi$4.50, ph$12.30 PB 145 572

Data from the backscatter records have been compared with the Central Radio Propagation Laboratory frequency predictions for the same period. Information scaled from Stanford's vertical incidence sounder has also been included in the comparisons.

Stanford Electronics Labs., Stanford U., Calif.
TRAVELING-WAVE AMPLIFICATION IN THE IONOSPHERE, by T. F. Bell and R. A. Helliwell. Technical rept. no. 2 on Contract AF 18(603)126. 15 Sep 59, 12p. 1 ref. AFOSR-TN-59-1099.
Order from LC mi$2.40, ph$3.30 PB 145 321

A traveling-wave type of amplification of electromagnetic waves propagating in the "whistler-mode" is presumed to exist in the ionosphere. Streams of electrons moving down the earth's magnetic field lines can enter ionospheric regions in which the stream-velocity spectrum matches approximately the phase velocity of "whistler-mode" waves in that region. Under these conditions amplification of the wave may occur. The present paper deals with the investigation of an analogous, but simplified, situation: a plasma, consisting of a uniform distribution of electrons and positive ions, exists in an extensive zero-temperature region well removed from boundaries.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Army Research Office, Washington, D. C.
PROCEEDINGS OF THE 1959 ARMY SCIENCE CONFERENCE; UNITED STATES MILITARY ACADEMY, WEST POINT, N. Y. 24-26 JUNE 1959. [1959] VOLUME 1. (PRINCIPAL AUTHORS "A" THRU "J"). 406p. 225 refs. AD-220 818.
Order from LC mi$11.10, ph$62.10 PB 145 915-1

The following papers are presented: total water intake using tracer methods; a method for calculating simultaneous homogeneous and heterogeneous equilibria and temperatures of explosion; the number of atoms displaced during heavy particle irradiation of a solid; vigilance, the electroencephalogram and sleep deprivation; a technique for attaining nearly hydrogen-free magnesium samples having certain dimensions; deformation of excavations in the Greenland Ice Cap; radar refraction at low elevation angles; the rotationally symmetric motion of a cylindrical shell due to a constant velocity pressure front; a low altitude FM altimeter; experimental correlation of sintering with several physical properties; growth of single crystals for solid state application; an experimental study of monopulse technique for ground clutter discriminations; a gamma ray pinhole television camera; buckling characteristics of thin cylindrical shells subjected to axial compression and internal pressure; infrared filters of anti-reflected semiconducting materials; a conceptual approach to training research; prophylaxis against acute radiation injury; effects of inter-stimulus interval and aperiodic noise on vigilance behavior; spatial attitude control of Explorer I; the MgO cold cathode; the electrical resistance, and certain magnetic properties, of iron-aluminum alloys; multiple beam antenna system; the production of colored smokes; report of medical experience on acute and repeated exposures in humans with nerve gas (GB) at RMA; nondestructive testing of materials for near-surface defects using delayed ultrasonic pulses; the mechanism of phosphate coating formation; a new wave-guide for millimeter waves; atmospheric propagation errors in guided missile measurement; ionizing radiations in organic synthesis; loop antennas utilizing "mode suppression and selection"; some studies of the jet compressor; a new mechanical resuscitator for military field use; comparison of ballistic data to electrolyte changes in wounded muscle; microwave techniques in measurement of lifetime in germanium; information transfer in image intensifier systems; syntheses of rubber copolymers by some new methods;

Army Research Office, Washington, D. C.
PROCEEDINGS OF THE 1959 ARMY SCIENCE CONFERENCE; UNITED STATES MILITARY ACADEMY, WEST POINT, N. Y. 24-26 JUNE 1959. [1959] VOLUME 2. (PRINCIPAL AUTHORS "K" THRU "Z"). 447p. 225 refs. AD-227 332.
Order from LC mi$11.10, ph$68.10 PB 145 915-2

The following papers are presented: prevention of spontaneous detonation of beta lead azide during crystallization; survival of grid-shielded X-irradiated mice; chemical dosimetry; investigations on the detection of subsoil objects; high-temperature semiconducting materials: boron and aluminum borides; nondestructive testing of cast and sintered components; studies on a biochemical system for the detection of anticholinesterase agents; secondary-electron mixed-radiation dosimeters (SEMIRAD); deep core drilling in glaciers; injury, would healing, and liver regeneration; ultrasonic determination of elastic constants of metals at elevated temperatures; Signal Corps R and D on automatic programming of digital computers; preparation, properties, and applications of reflecting coatings for the vacuum ultraviolet; human lethal dose in biological warfare defense; criterion equivalence technique for test selection to predict performance on undeveloped weapons; frequency-modulated acoustic flowmeter; magneto diffusion effects in germanium; air permeable textiles resistant to wetting by liquid rocket fuels; generalized behavior of toxic clouds in the atmosphere; determination of satellite spatial orientation using Explorer IV as an example; formation of photoptic images in industrial fluoroscopy; a reciprocal phase modulator for rapid-scanning microwave antennas; modified Stodola method including rotary inertia and shear flexibility; contributions of psychiatry; ionized gasses in the presence of rotating electric fields; a variable sensitivity gas thermometer for use at low temperatures; effect of a magnetic field on transfer characteristics of particles in an electric arc; polar hypotheses; protective effect of natural food materials against whole-body irradiation; numerical analysis in aerial delivery; the quasi-parallel light principle; hollow-conical or flat radiation or detection patterns; deductions from the thermodynamics of the transition metals and alloys; experiments in combat operations; new dialysis technics in treatment of acute kidney failure; the interaction of technology, field experiments and operational planning. (See also PB 145 915-1)

Arnold Engineering Development Center [Tullahoma Tenn.]
REPORT WRITING GUIDE FOR ARNOLD ENGINEERING DEVELOPMENT CENTER (REVISED EDITION) by C. B. Kestler. Rept. on ARO, Inc., Contract AF 40(600)700. May 58, 59p. 36 refs. AEDC-TN-58-28; AD-157 134.
Order from LC mi$3.60, ph$9.30 PB 146 056

This report consists of an A-W encyclopedia followed by a bibliography and two appendixes. In the A-W arrangement, there are short articles on the more detailed subjects pertaining to the production of AEDC reports. The headings for these main entries are capitalized in the index. Basic questions of AEDC report procedures, practices, techniques, and available services are answered in the brief entries scattered throughout in the appropriate alphabetical spot. This material has been arranged and indexed to facilitate the reader's finding the answers to specific questions and to insure that no essential details pertaining to the production of AEDC reports have been overlooked.

Avco-[Everett] Research Lab. [Mass.]
ON THE EFFECT OF ATTENUATION ON GAS DYNAMIC MEASUREMENTS MADE IN SHOCK TUBES, by P. H. Rose and W. Nelson. Rept. on Contract AF 04(645)18. Apr 58, 43p. 27 refs. Research rept. 24; AD-212 016.
Order from LC mi$3.30, ph$7.80 PB 146 206

The attenuation of the shock strength of strong shock waves produced in air in high pressure shock tubes is considered. Data on the attenuation experienced in several sizes of shock tubes over a large range of conditions are presented. Experiments are performed to measure the critical flow quantities directly to establish the trends and limits of the changes in the properties of the shock compressed air. The results are analyzed and the effect on some of the gas dynamic measurements are estimated.

Massachusetts Inst. of Tech., Cambridge.
A CLASS OF QUEUEING PROBLEMS, by Hirsh Newton Garber. Doctoral thesis. Interim technical rept. no. 13 on Fundamental Investigations in Methods of Operations Research, Contract DA 19-020-ORD-2684. Oct 59, 131p. 23 refs. OOR rept. 968. 28-M.
Order from LC mi$6.90, ph$21.30 PB 145 177

A situation which gives rise to a queueing (waiting line) problem is one in which units (or "customers") arrive at a facility desiring some type of service which that facility offers, and where units will wait for service if, on arrival, the facility cannot offer immediate service due to the presence of other units being served. If the exact arrival time of all units and the exact servicing time of each unit is known, no real problem arises since the behavior of the system is completely specified. Thus, only when one or both of these quantities is statistical in nature does the problem become interesting. The statistical distribution of arrival times and of servicing times will thus be two conditions by which classification of queueing problems can be made.

Princeton U., N. J.
STOCHASTIC PROPERTIES OF ELEMENTARY LOGISTIC COMPONENTS, by Harlan D. Mills. Research Memo. no. 9 on Econometric Research Program, Contract Nonr-1858(16). 27 Feb 59, 14p. 15 refs. AD-226 009.
Order from LC mi$2.40, ph$3.30 PB 145 593

Princeton U., N. J.
STRUCTURES IN LOGISTICS OPERATIONS, by Harlan D. Mills. Research memo. no. 8 on Econometric Research Program, Contract Nonr-1858(16). 27 Feb 59, 28p. 7 refs. AD-226 132.
Order from LC mi$2.70, ph$4.80 PB 145 592

Rome Air Development Center, Griffiss AFB, N. Y.
RADC TECHNICAL REVIEW. Dec 58, 59p. RADC-TN-58-310; AD-148 980.
Order from LC mi$3.60, ph$9.30 PB 145 493

Contents:
Nuclear magnetic resonance studies
Point-to-point communication using the moon as a passive reflector
Information processing
New discoveries in propagation with associated aspects of modulation and detection techniques
Electromagnetic interference
Space vehicle communications and ranging systems

Communication Theory

Baird-Atomic, Inc., Cambridge, Mass.
OPTICAL FILTER TEXT READER STUDY, by John A. Fitzmaurice, Edward N. Sabbagh, and William G. Elliott. Rept. on Contract AF 30(602)1828. 20 Aug 59, 41p. 11 refs. B-A Document no. 3055; RADC-TR-59-95; AD-217 675.
Order from LC mi$3.30, ph$7.80 PB 145 529

The use of aperture-stops to perform general two-dimensional, linear, filtering operations is described. This theory has been applied to the problem of building an automatic print reader. A breadboard model was built and used to demonstrate the feasibility of this method of print reading. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
WORD CORRELATION STUDY, by R. P. Mitchell and E. Greer. Rept. on Contract AF 30(602)1889. [1959] 15p. 4 refs. RADC-TN-59-6; AD-208 288.
Order from LC mi$2.40, ph$3.30 PB 145 528

A discussion is presented of word correlation with respect to the syntax of English. Word correlation is feasible if a normalized English language is formulated in terms of which all other words are syntactically defined. Correlation factors are computed by counting primitive words occurring in certain syntactic reduction strings. A method is indicated for correlating sentences. Adaptations of this method to less sophisticated systems are discussed. (Author)

Photographic Equipment

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A HIGH SPEED ROTATING MIRROR CAMERA, by B. Leo DeMaré, H. G. McGuire and E. L. Bonhage. Feb 59, 29p. 2 refs. Rept. no. 1069.
Order from LC mi$2.70, ph$4.80 PB 145 699

This camera was designed for recording projectile velocity data from a microwave interferometer, presented by a cathode ray oscilloscope. A mirror, consisting of a block of stainless steel with 4 faces, each 3 inches in width, is rotated at a speed of 10,000 rpm. Light from the lens is swept over a length of 70 mm film mounted, emulsion side down, on a stationary transparent drum 36 inches in diameter. A mechanism is provided for transporting the film onto the drum from a magazine and returning it after exposure. The camera has a linear writing speed of 39 in/ms at CRT spot frequencies up to 500 KC, on Kodak Tri-X pan film. (Author)

Institute of Optics, U. of Rochester, N. Y.
LENS DESIGN FOR THE MINICARD CAMERA, by Robert E. Hopkins and Robert R. Shannon. Final rept. on Contract AF 30(635)2870. 1 July 57, 28p. RADC-TR-57-160; AD-131 298.
Order from LC mi$2.70, ph$4.80 PB 145 546

The Minicard process would be used to reduce aerial photographs with limiting resolutions of around 40 lines/mm, a lens would therefore have to be capable of resolving around 764 lines/mm. Two types of lenses were completely designed. These were a curved field design and an inverted telephoto design. A sample of the latter design tested photographically showed that this type of lens may suffice for some of the proposed applications.

SOCIAL SCIENCES

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A DYNAMIC THEORY OF CONSUMER'S CHOICE, by Herbert Scarf. Technical rept. no. 10 on Contract Nonr-225(28). 25 Mar 59, 39p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 145 210

A theory of consumer's choice is discussed which is based on the idea of utility maximization, subject to constraints in expenditures. A description is given of those utility functions for which future tastes are independent of past consumption, and an even smaller class is described for which tastes are stationary in time. It is shown that the utility function will have these properties only if it is a discounted sum of functions pertaining to consumption in the separate periods. The discount factor leads to the notion of a personal interest rate, which may be constant, or a function of the consumption level. The question of whether a decreasing ratio of expenditure to total wealth is compatible with such a utility function is discussed. The case of constant personal interest is examined in detail and it is shown that no stationary utility function permits a decreasing ratio of expenditure to wealth for a sufficiently wide range of market interest rates. On the other hand, an example is given of a utility indicator with a variable personal interest rate, which predicts a decreasing ratio of expenditure to wealth for all market interest rates. (Author)

Documentation, Inc. [Washington, D. C.]
AN EXTERNAL INDEX TO A COMPUTER STORE OF ITEMS AND TRANSACTIONS AS ILLUSTRATED BY PROJECT ECHO, by Mortimer Taube. Rept. on Contract AF 49(638)91. Dec 59, 20p. AFOSR-TN-60-8.
Order from LC mi$2.40, ph$3.30 PB 145 509

This paper describes a combined data processing and information retrieval system designed to handle a changing store of information concerning a research and development contract program. The system was designed for the contract program operated by the Air Force Office of Scientific Research but the concepts used in the design were generalized and made applicable to any information problem involving the storage and retrieval of changing sets of information. The concepts used in this analysis are the item, the transaction, and the index. After describing how the system operates with reference to AFOSR research and development contracts, the paper illustrates the operation of a similar system for the Cancer Chemotherapy National Service Center of the National Institutes of Health. In conclusion, the paper presents certain general conclusions relating to the man-machine problem of entering information, maintaining information, modifying information and, finally, removing information from a store.

George Washington U., Washington, D. C.
STRUCTURE AND CLASSIFICATION IN RESOURCE FLOW MODELS, by Stedman B. Noble. Rept. on Logistics Research Project, Contract Nonr-761(05). 19 May 59, 37p. 22 refs. Serial T-100/59.
Order from LC mi$3.00, ph$6.30 PB 145 453

This paper is a study of the structure, both empirical and theoretical, of resource flow models. It defines the kinds of structure that can exist in a model of the economy; it shows how to determine this structure, and describes the structure of several existing models Finally, there is a discussion of the relevance of structure for the uses of models, including the implication for the classification problem of resource flow models. The term "resource flow models", used in the title, requires some explanation. As a model, the most developed analysis of resource flows is the interindustry model also called the input-output model, which makes use of a mathematical matrix.

Minnesota U. School of Business Administration, Minneapolis.
AN IMPORT-EXPORT MODEL, by Richard Savage. Technical rept. no. 4 on Contract Nonr-2582(00). 1 Feb 59, 34p.
Order from LC mi$3.00, ph$6.30 PB 145 253

For a given year and group of countries, the import-export data can be arranged like a contingency table, except the diagonal cells are zero and the other entries are quantities of money, a continuous variable instead of a discrete variable. A model describing the data and techniques for the statistical analysis are presented. This is a "null model" in the sense that the departures from it are of primary interest. The North Atlantic Area (1928) is used as an illustration. (Author)

Stanford U., Calif.
IMPERFECT COMPETITION AND GENERAL EQUILIBRIUM: EXISTENCE AND STABILITY, by Takashi Negishi. Technical rept. no. 68 on Contract N6onr-25133. 4 Feb 59, 13p. 11 refs; AD-211 794.
Order from LC mi$2.40, ph$3.30 PB 145 582

Stanford U., Calif.
IMPUTATIONS, EQUILIBRIUM, AND PROGRAMMING, by Hirofumi Uzawa. Technical rept. no. 73 on Contract N6onr-25133. 24 Mar 59, 34p. 30 refs.
Order from LC mi$3.00, ph$6.30 PB 145 251

The relationship between the optimum allocation and imputed prices of the factors of production in general mathematical programming is investigated. A model of competitive equilibrium is constructed in which quasi-equilibrium prices are precisely the ones imputed by Wieser's principle of the "productive contribution." In later sections, Walras' simultaneous and successive tâtonnement processes are applied to solve mathematical programming problems.

Stanford U., Calif.
WALRAS' TÂTONNEMENT AND THE EXISTENCE OF AN EQUILIBRIUM FOR A COMPETITIVE ECONOMY, by Hirofumi Uzawa. Technical rept. no. 70 on Contract N6onr-251(33). 20 Mar 59, 24p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 145 387

The present note is concerned with the process of tâtonnement introduced by Walras and a proof is given of the existence theorem based on the process of tâtonnement. The existence theorem in the present note is slightly more restricted than the existence theorems in Arrow and Debreu. (See also PB 145 386)

Stanford U., Calif.
WALRAS' TÂTONNEMENT IN THE THEORY OF EXCHANGE, by Hirofumi Uzawa. Technical rept. no. 69 on Contract N6onr-251(33). 11 Mar 59, 28p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 145 386

The theory of tâtonnement by the aid of which Leon Walras developed his theory of general equilibrium seems one of the most valuable techniques in economic analysis. There have been many contributions to the Walrasian theory of tâtonnement. There are, however, important problems in that theory which have not yet been satisfactorily solved. The present article is concerned with tâtonnement processes in the competitive exchange economy, and some of the gaps in that theory are filled, especially with respect to the stability problem. (See also PB 144 672)

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Apr 60.
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Chemistry: Wetting properties of tetrafluorethylene and hexafluoropropylene copolymers. Acoustical spectrum as a tool for investigating the impact sensitivity of explosives. Modification of the NRL colorimetric method for the determination of bis-2(chloroethyl)sulfide with DB-3
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General

Liquid metal fuel reactor experiment, zirconium nitride film theory. The Babcock and Wilcox Company, Atomic Energy Division, Feb 60. Contract AT(30-1)-1940. 34p. Order from OTS. $1.00. BAW-1087

Liquid metal fuel reactor experiment, investigation of precleaning and decontamination methods, by W. S. Leedy. The Babcock and Wilcox Company, Atomic Energy Division, Feb 60. Contract AT(30-1)-1940. 32p. Order from OTS. $1.00. BAW-1094

Liquid metal reactor experiment, quarterly technical report. The Babcock and Wilcox Company, Atomic Energy Division, Apr-Jun 59. Contract AT(30-1)-1940. 60p. Order from OTS $1.50. BAW-1170

Biology and Medicine

Radiation measurements and the spectrum, by Marshall Brucer and Yoichiro Umegaki. Oak Ridge Institute of Nuclear Studies, Inc. Oak Ridge, Tennessee, Aug 59. 29p. Order from OTS. $1.00. ORINS-32

Biology and medicine semiannual report University of California, Lawrence Radiation Laboratory, Berkeley, California, Apr-Sep 59. Contract W-7405-eng-48. 92p. Order from OTS. $2.25. UCRL-8998

The effect of exogenous calcium and ℓ-thyroxine on parturition in the radioiodine-thyroidectomized rat, by Marshall Ward Parrott. University of California, Lawrence Radiation Laboratory, Berkeley, California. Dec 59. Contract W-7405-eng-48. 38p. Order from OTS. $1.25. UCRL-9004

Chemistry—General

Chemical behavior of uranium and thorium in fused salts, by Derek L. Hill and Robert A. Osteryoung. Brookhaven National Laboratory, Associated Universities, Inc. Sep 59. Contract AT 30-2-GEN-16. 9p. Order from OTS. $.50. BNL 588(T-166)

Behavior of a bioling metal thermosiphon loop, by G. Jansen, Jr. Hanford Atomic Products Operation, General Electric, Richland, Washington. Dec 59. Contract AT(45-1)-1350. 38p. Order from OTS. $1.25. HW-63052

Calculation of the composition of reactor-irradiated heavy nuclides, by R. P. Schuman and R. L. Tromp. Phillips Petroleum Co. Idaho Operations Office. Dec 59. Contract AT (10-)-25. 80p. Order from OTS. $1.00. IDO-16571

Chemistry semi-annual summary research report, by Ames Laboratory Staff. Ames Laboratory Research and Development Report, U.S.A.E.C. Jan-Jun 59. Contract W-7405-eng-82. 74p. Order from OTS. $2.00. IS-15

An incinerator for recovery of enriched uranium from graphite powder, by A. C. Dumrose. University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. Mar 60 Contract W-7405-eng. 36. 28p. Order from OTS. $1.00. LA-2372

Infrared specta of biphenyl and several deuterated biphenyls, by J. M. Scarborough. Atomics International, Canoga Park, California. Mar 60. Contract AT(11-1)-GEN-8. 16p. Order from OTS. $.50. NAA-SR-4657

Investigation of tetralin explosion, by J. S. McDonald and J. E. Owens. Atomics International, Canoga Park, Calif. Mar 60. Contract AT(11-1)-GEN-8. 58p. Order from OTS. $1.75. NAA-SR-4803

The radiochemistry of arsenic, by Harold C. Beard. Florida State University, Tallahassee, Florida. Jan 60. 27p. Order from OTS. $.50. NAS-NS-3002

The radiochemistry of francium, by Earl K. Hyde University of California, Lawrence Radiation Laboratory, Berkeley, California. Jan 60. 34p. Order from OTS. $.50. NAS-NS-3003

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Ultraviolet spectrophotometric determination of uranium, by Arno H. A. Heyn and Gurupada Banerjee. Boston University, Boston, Massachusetts. Nov 59. Contract AT(30-1) 1873. 25p. Order from OTS. $.75. NYO-7568

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Purification of Pm^{147} from fission-produced rare earths, by R. S. Pressly. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 11p. Order from OTS. $.50. ORNL-2843

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Nuclear-magnetic-resonance studies of hydrogen bonding, by Jefferson Clark Davis, Jr. (thesis) University of California, Lawrence Radiation Laboratory, Berkeley, California. Oct 59. Contract W-7405-eng-48. 76p. Order from OTS. $2.00 UCRL-8909

Nuclear quadrupole resonance of some inorganic chlorine compounds, by Allan Harvey Reddoch (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. 175p. Order from OTS. $3.00. UCRL-8972

Downflow boiling and nonboiling heat transfer in a uniformly heated tube, by Robert LeRoy Sani (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Jan 60. Contract W-7405-eng-48. 88p. Order from OTS. $2.50. UCRL-9023

Chemical properties of astatine, by Evan H. Appelman (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Jan 60. Contract W-7405-eng-48. 113p. Order from OTS. $2.50. UCRL-9025

Bio-organic chemistry, quarterly report, September, October, November 1959. Univ. of Calif. Lawrence Radiation Lab., Berkeley, Calif. Dec 59. Contract W-7405-eng-48. 61p. Order from OTS. $1.75. UCRL-9041

Chemistry—Radiation and Radiochemistry

The determination of zirconium-95 plus niobium-95 by anion exchange separation from other fission products, by A. C. Leaf Hanford Atomic Products, General Electric, Richland, Washington. Oct 59. Contract AT(45-1)-1350. 20p. Order from OTS. $.75. HW-62188

Chemistry—Separation Processes for Plutonium and Uranium

Dissolution of irradiated Consolidated Edison power-reactor fuel by the sulfex and darex processes, by Robert A. Ewing and others. Battelle Memorial Institute, Columbus, Ohio. Mar 60. Contract W-7405-eng-92. 22p. Order from OTS. $.75. BMI-1427

An improved acid saturation method for the determination of tri-n-butyl phosphate, by W. E. Shuler. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Aiken, South Car.

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Modified zirflex process for dissolution of 1-10% U-Zr alloy fuels in aqueous NH_4F-NH_4NO_3-H_2O_2: laboratory development, by T. A. Gens. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 24p. Order from OTS. $.75. ORNL-2905

Controlled Thermonuclear Processes

Zeus control system, by A. E. Binder, 1313. Scandia Corporation. Feb 60. 21p. Order from OTS. $.75. SCTM 44-60(12)

Energy loss of fast ions to a sea of constant temperature electrons, by Francis C. Gilbert. University of California, Lawrence Radiation Laboratory, Livermore Site, Livermore, California. Nov 59. Contract W-7405-eng-48. 8p. Order from OTS. $.50. UCRL-5697

Controlled thermonuclear research quarterly report June, July, August 1959. University of California, Lawrence Radiation Laboratory, Livermore and Berkeley, California. Sep 59. Contract W-7405-eng-48. 143p. Order from OTS. $2.75. UCRL-8887

Photoprotons produced by 245±15-mev gamma rays on carbon, by Robert J. Cence (thesis). University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. Contract W-7405-eng-48. 52p. Order from OTS. $1.50. UCRL-8921

The elastic scattering of 5-bev π^- mesons on hydrogen, by Richard Garland Thomas, Jr. (thesis) University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. Contract W-7405-eng-48. 63p. Order from OTS. $1.75. UCRL-8965

5-bev neutron cross sections in hydrogen and other elements, by John H. Atkinson (thesis) University of California, Lawrence Radiation Laboratory, Berkeley, California. Nov 59. Contract W-7405-eng-48. 80p. Order from OTS. $2.25. UCRL-8966

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Criticality Studies

Multi-region reactor lattice studies, quarterly progress report for the period October 1, to December 31, 1959, by Ira H. Coen. Westinghouse Electric Corporation, Atomic Power Department, Pittsburgh, Pennsylvania. Jan 60. Contract AT(30-1)-2176. 13p. Order from OTS. WCAP-1408

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Toroid rotator for small-scale dynamic corrosion studies- design, fabrication, and operation, by R. M. Warner and others. Oak Ridge National Laboratory, operated by Union Carbide Corporation. [nd] Contract W-7405-eng-26. 24p. Order from OTS. $1.00. ORNL-2870

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Behavior of rubbing molybdenum surfaces in sodium environments, by J. W. Kissel and others. Battelle Memorial Institute, Columbus, Ohio. Jan 60. Contract W-7405-eng-92. 23p. Order from OTS. $1.00. BMI-1405

Examination of a nonregenerative heat exchanger from the U. S. S. Nautilus (SSN-571), by Warren E. Berry and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract NObs-67500. 54p. Order from OTS. $1.75. BMI-1416

Brief review of heat transfer problems encountered in the production of magnetic fields, by L. G. Alexander. Oak Ridge National Laboratory, Oak Ridge, Tennessee. May 59. Mi. $2.40 Ph. $3.30. 11p. Order from LC. CF-59-5-87

An autographic elevated temperature creep testing facility, by Robert L. Hammel and Robert E. Uhrig. Ames Laboratory, Research and Development Report U.S.A.E.C. Iowa State University. Nov 59. Contract W-7405-eng-82. 23p. Order from OTS. $.75. IS-66

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Fatigue damage in materials employed in pressure equipment, Progress Report no. 3 for July 1, 1959 through October 31, 1959. by, L. U. Rastelli. Nov 59. Contract AT(30-1)-2146. 77p. Order from LC. Mi. $4.50 Ph. $12.30. NYO-2328

Underground exploration of the quartzite cap claims, Yellow Jacket area, Marysvale, Utah, by Stephen R. Steinhauser and Bert L. Myerson. Salt Lake Branch Office, AEC, Grand Junction Operations Office, Salt Lake City, Utah. Aug 55. 10p. Order from OTS. $.50. RME-2038

Final report for June 1949 to the end of contract, June 30, 1958, by John W. Gruner. University of Minnesota, Minneapolis, Minnesota. May 59. Contract AT(30-1-610). 39p. Order from OTS. $1.25. RME-3159

Health and Safety

Natural aerosols and nuclear debris studies, progress report no. 1. GRD research notes no. 8., by P. J. Drevinsky and others. Air Force Cambridge Research Center. Geophysics Research Directorate, Mass. Sep 58. Contract AT(49-7)-1431. 49p. Order from LC. Mi. $3.30 Ph. $7.80. AFCRC-TN-58-652

Monitoring for air-borne radioactive materials at Hanford Atomic Products Operation, by J. K. Soldat. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Jun 59. 20p. Order from LC. Mi. $2.40 Ph. $3.30. HW-SA-38

Fission product release by the high temperature uranium-steam reaction, by A. J. Scott. General Electric, Hanford Atomic Products Operation, Richland, Washington. Nov 59. Contract AT(45-1)-1350. 42p. Order from OTS. $1.25. HW-62604

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Nuclear incident at the Idaho chemical processing plant, by William L. Ginkel and others. Phillips Petroleum Company, Idaho Operations Office, Idaho Falls, Idaho. Oct 59. 100p. Order from OTS. $2.25. IDO-10035

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Fate of radioactive contaminants in water, progress report no. 1. (for the period Apr 7, 1957 to May 1, 1958). U. S. Dept. of Health, Education, and Welfare. Robert A. Taft Sanitary Engineering Center. Cincinnati, Ohio. 1959. Contract AT(49-5)-1288. 56 p. Order from LC. Mi. $3.60 Ph. $9.30 R59-2

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Petrographic studies of fallout material from the surface and undergroung shots, by Irvin C. Brown and Lyle T. Alexander. Bureau of Plant Industry, Soils, and Agricultural Engineering. May 53 decl Dec 54. Order from LC. Mi. $3.90 Ph. $10.80. WT-423

Radiological safety, by Tom D. Collison. Armed Forces Special Weapons Project. Field Command, Albuquerque, N. Mex. May 55. 175p. Order from LC. Mi. $8.40 Ph. $28.80 WT-1166(Del.)

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Instruments

Response of pressure gauges to dust-laden shock waves, by J. R. Banister and C. D. Broyles. Sandia Corp., Albuquerque, N. Mex. [nd] Decl. Feb 59. Contract W-7405-eng-36. 10p. Order from LC. Mi. $1.80 Ph. $1.80. AECD-4290

A high current switch of low inductance, by C. D. Nail. University of California, Livermore Radiation Laboratory. Mar 59. Contract (LE-306-1). 5p. Order from LC. Mi. $1.80 Ph. $1.80 AECU-4308

Switching circuitry for high-intensity, intensity pulsed magnetic field apparatus, by Y. B. Kim and E. D. Platner. University of Washington, Seattle, Washington. Jun 59. Contract Nonr 477(12). 21p. Order from LC. Mi. $2.70 Ph. $4.80 AECU-4310

Design of the core storage unit, report no. 91, by S. R. Ray. University of Illinois., Urbana. Digital Computer Laboratory. Aug 59. Contract AT(11-1)-415. 33p. Order from LC. Mi. $3.00 Ph. $6.30. AECU-4315

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Backscatter gaging device, mid-term status report, by B. C. Rusche. Lockheed Nuclear Products, Marietta, Georgia. Nov 59. Contract AT(30-1) 2428. 20p. Order from LC. Mi. $2.40 Ph. $3.30 AECU-4454

Research and investigation leading to methods of generating and detecting radiation in the 100 to 1000 micron wavelength range of the spectrum. Quarterly Progress Report no. 14 [for] June 1, 1959 to September 1, 1959, by P. D. Coleman and others. University of Illinois, Urbana. Engineering Experiment Station. Oct 59. Contract AT(11-1)-392. 78p. Order from LC. Mi. $4.50 Ph. $12.30 AECU-4458

On the dynamic design of non-regenerative transistor circuits, rpt. no. 94, by Toshiro Kunihiro University of Illinois, Urbana. Digital Computer Laboratory. Nov 59. Contract AT(11-1)-415. 41p. Order from LC. Mi. $3.30 Ph. $7.80. AECU-4505

Transistor scintillation spectrometer, by Michael G. Strauss. Argonne National Laboratory, Lemont, Illinois. Feb 60. Contract W-31-109-eng-38. 28p. Order from OTS. $1.00. ANL-6123

Magnetic recorder for nuclear pulse application, period covered: June 5, 1959 to August 5, 1959, by G. M. Burgwald. Illinois Inst. of Tech., Chicago. Armour Research Foundation. Aug 59. Contract AT(11-1)-702. 8p. Order from LC. Mi. $1.80 Ph. $1.80 ARF-1151-1

Magnetic recorder for nuclear pulse application, covering periods: August 6, 1959 to October 5, 1959, by G. M. Burgwald and C. A. Stone. Illinois Inst. of Tech., Chicago. Armour Research Foundation. [nd] Contract AT(11-1)-702. 27p. Order from LC. Mi. $2.70 Ph. $4.80. ARF-1151-2

An improved nuclear density gauge, period covered: October 2 to November 1, 1959, by G. M. Burgwald. Illinois Inst. of Tech., Chicago. Armour Research Foundation. [nd] Contract AT(11-1)-745. 3p. Order from LC. Mi. $1.80 Ph. $1.80. ARF-1152-5

Test results and design comparisons for liquid metal-to-air radiators, by H. J. Stumpf and others. Oak Ridge National Lab., Tenn. Jul 54 Decl. Oct 59. Contract W-7405-eng-26. 84p. Order from LC. Mi. $4.80 Ph. $13.80 CF-54-7-187

Calibration of the revalet, a remotely variable lead-transmission gamma-ray dosimeter, by D. L. Gilliland. Oak Ridge National Lab., Tenn. [1955]. Decl. with deletions Feb 57. Contract W-7405-eng-26. 14p. Order from LC. Mi. $2.40 Ph. $3.30. CF-55-2-111(Del.)

A 2000 channel analyzer for neutron spectroscopy, by J. Hahn, and W. W. Havens, Jr. Pupin Cyclotron Laboratory, Columbia University

New York, New York and George B. Pegram Laboratory, Columbia University, New York, New York. Nov 59. Contract AT(30-1)-GEN-72. 41p. Order from OTS. $1.25. CU-198

A remotely controlled metallograph-II, by W. H. Leith. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Aiken, South Carolina. Dec 59. Contract AT(07-2)-1. 15p. Order from OTS. $.50. DP-450

Remote area scintillation monitoring system, by W. G. Spear. General Electric Co. Hanford Atomic Products Operation, Richland, Washington. Apr 59. 15p. Order from LC. Mi. $2.40 Ph. $3.30. HW-59834

ETR nuclear instrumentation final report, by D. C. Hanson. Phillips Petroleum Co. Idaho Operations Office. Feb 60. Contract AT(10-1)-205). 28p. Order from OTS. $1.00. IDO-16566

Self-balancing resistivity measuring set, by T. J. Boland. Phillips Petroleum Co. Idaho Operations Office. Feb 60. Contract AT(10-1)-205. 24p. Order from OTS. $.75. IDO-16573

A remotely operable controlled radius bend fatigue apparatus, by G. L. Cutler. Knolls Atomic Power Lab., Schenectady, N. Y. Oct 59. Contract W-31-109-Eng-52. 11p. Order from LC. Mi. $2.40 Ph. $3.30 KAPL-M-GLC-4

Liquid scintillator radiation rate meters for the measurement of gamma and fast neutron rates in mixed radiation fields, by D. L. Williams and F. N. Hayes. University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. Mar 60. Contract W-7405-ENG. 36 59p. Order from OTS $1.75. LA-2375

Preliminary investigation of a five-crystal scintillation gamma-ray spectrometer, by Roger E. Mills and Robert M. Kloepper. Los Alamos Scientific Lab., N. Mex. Sep 58. Contract W-7405-eng-36. 35p. Order from LC. Mi. $3.00 Ph. $6.30 LAMS-2257

A rotary vacuum seal, by Richard W. Roberts. Brown University, Providence. Jan 59. Contract AT(30-1)-2101. 4p. Order from LC. Mi. $1.80 Ph. $1.80 M-6845

Time base generator for OMR critical experiment, by L. S. Beller. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Oct 58. 8p. Order from LC. Mi. $1.80 Ph. $1.80 NAA-SR-MEMO-3138

Scintillation detector and preamplifier unit for general counting room use, A.I. critical experiment laboratory. by L. S. Beller. Atomics International Div. North American Aviation, Inc., Canoga Park, Calif. Dec 58. 7p. Order from LC. Mi. $1.80 Ph. $1.80 NAA-SR-MEMO-3308

Method for determination of liquid density and viscosity of organic coolants over the temperature range (m. p. to 850°F), by G. Asanovich Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. May 59. 12p. Order from LC. Mi. $2.40 Ph. $3.30 NAA-SR-MEMO-3863

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The development of a beta-ray particle size analyzer, quarterly technical status report[for] July 16-October 15, 1959. [nd] Contract AT(30-1)-2372. 11p. Order from LC. Mi. $2.40 Ph. $3.30 NYO-2654

Development of an instrument and technique utilizing carbon-14 for measuring very low concentrations of oxygen in high purity metals, quarterly status report no. 3 [for] period August 1, 1959 through October 31, 1959, by Roger A. Covert. Alloy Research Corp., Watertown, Mass. Nov 59. Contr AT(30-1)-2335. 8p. Order from LC. Mi. $1.80 Ph. $1.80. NYO-8911

Development of high speed electron accelerator structures, interim report no. 9, by J. A. Baicker and others. David Sarnoff Research Center, Princeton, N. J. Oct 59. Contract AT (30-1)-1958. 16p. Order from LC. Mi. $2.40 Ph. $3.30. RIB-42

Project DeHenry, the study of a new type of explosive-to-electric transducer, by G. W. Anderson and S. E. Whitcomb. Sandia Corp., Albuquerque, N. Mex. Jul 58. Contract AT(29-1)-789. 109p. Order from LC. Mi. $6.90. Ph. $21.30 SCTM-150-58(51)

Self-limiting charger for nickel-cadmium batteries, by E. B. Pearson. Sandia Corp., Albuquerque, N. Mex. Aug 55. Changed from Official Use Only Oct. 21, 1959. 7p. Order from LC. Mi. $1.80 Ph. $1.80 SCTM-170-55-55

Certification of five-dial wheatstone bridges, by G. R. Fahrbach. Sandia Corp., Albuquerque, N. Mex. Dec 59. 24p. Order from LC. Mi. $2.70 Ph. $4.80 SCTM-181-59-(16)

Transistor driven beam switching tube decade counter, by Richard H. Graham. University of California, Livermore. Lawrence Radiation Lab. Aug 59. Contract W-7405-eng-48. 15p. Order from LC. Mi. $2.40 Ph. $3.30 UCRL-5656

Design limitations of a breakdown diode coupled transistor flip flop, by Thomas Archie Nunamaker (Thesis). University of California, Lawfence Radiation Laboratory, Berkeley, California. Jan 60. Contract W-7405-eng-48. 55p. Order from OTS. $1.50 UCRL-9046

Nuclear materials control system (nmcs), phase II. alarm transmitting systems and the protection of communications, by J. N. Ellyson and G. Kivenson. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. 68p. Order from LC. Mi. $4.80 Ph. $13.80 WCAP-6022

Nuclear materials control system (nmcs). Phase II, miscellaneous devices for plant security, by G. Kivenson and J. N. Ellyson. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. 23p. Order from LC. Mi. $2.70 Ph. $4.80 WCAP-6023

Nuclear materials control system (nmcs). Phase II, miscellaneous devices for safeguarding a fuel reprocessing plant, by W. E. Foster. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. 22p. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6024

Nuclear materials control system (nmcs), Phase II, liquid samplers for safeguards use, by W. E. Foster. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176. 13p. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6025

Nuclear materials control system (nmcs), Phase II, neutron flux monitors for safeguards use, by R. E. Kronk. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176. 23p. Order from LC. Mi. $2.70 Ph. $4.80 WCAP-6027

Nuclear materials control system (nmcs), Phase II, a thermal power meter for safeguards use, by C. C. Webster. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. 15p. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6028

Nuclear materials control system, Phase II, general activity detectors for safeguards use, by F. J. Arsenault. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Oct 59. Contract AT(30-1)-2176, Task I. Order from LC. Mi. $2.40 Ph. $3.30 WCAP-6029

Metallurgy and Ceramics

Corrosion investigations on high-temperature aluminum alloys, February 1955-October 1957, by C. R. Breden and N. R. Grant. Argonne National Laboratory, Lemont, Illinois. Feb 60. Contract W-31-109-eng-38. 72p. Order from OTS. $2.00. ANL-5546

The manufacture of the graphite-urania fuel matrix for treat, by J. H. Handwerk and R. C. Lied. Argonne National Laboratory, Lemont, Illinois. Jan 60. Contract W-31-109-eng-38. 26p. Order from OTS. $.75. ANL-5963

Plastic flow during extrusion of tubing, by Henry A. Saller and others. Battelle Memorial Institute, Columbus, Ohio. Jul 55. Contract W-7405-eng-92. 18p. Order from OTS. $.50. BMI-1021

Plastic deformation in grooved rolls, by Henry A. Saller. Battelle Memorial Institute, Columbus, Ohio. Sep 55. Contract W-7405-eng-92. 50p. Order from OTS. $1.00. BMI-1040

Progress relating to civilian applications during July, 1959, by Russell W. Dayton and Clyde R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Aug 59. Contract W-7405-eng-92. 104p. Order from OTS. $2.50. BMI-1366

Gas-pressure bonding of Zircaloy-clad flat-plate uranium dioxide fuel elements, by Stan J. Paprocki. Battelle Memorial Institute, Columbus, Ohio. Aug 59. Contract W-7405-eng-92. 106p. Order from OTS. $2.50. BMI-1374

Progress relating to civilian applications during October, 1959, by Russell W. Dayton and Clyde R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Nov 59. Contract W-7405-eng-92. 100p. Order from OTS. $2.50.
BMI-1391(Rev.)

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BMI-1398

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BMI-1403

A method of correlating irradiation effects in dispersion fuels, by Donald L. Keller and others. Battelle Memorial Institute, Columbus, Ohio. Jan 60. Contract W-7405-eng-92. 16p. Order from OTS. $.75. BMI-1408

Progress relating to civilian applications during January, 1960, by Russell W. Dayton and Clyde R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 102p. Order from OTS. $2.50.
BMI-1409

Development of high-strength niobium alloys for elevated-temperature applications, by John A. DeMastry. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 22p. Order from OTS. $.75. BMI-1417

Development of high-strength corrosion resistant zirconium alloys, by John A. De Mastry and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 18p. Order from OTS. $.75. BMI-1418

High-temperature irradiation of metals and graphite in flowing helium, by Neil E. Miller and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 16p. Order from OTS. $.75. BMI-1419

Effects of yttrium on the fabrication and tensile properties of two modified stainless alloys, by John A. DeMastry and others. Battelle Memorial Institute, Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 16p. Order from OTS. $.75.
BMI-1420

The diffusion of hydrogen in zirconium hydride, by William M. Albrecht and W. Douglas Goode, Jr. Battelle Memorial Institute, Columbus, Ohio. Mar 60. Contract W-7405-eng-92. 10p. Order from OTS. $.50. BMI-1426

Extrusion of uranium for hanford cored slug program-I, by R. M. Treco and others. Bridgeport Brass Company, Bridgeport, Conn. Dec 54. Contract AT(30-1)-1405. 65p. Order from OTS. $.50. BRB-3

Hardness evaluation of alpha hot-rolled uranium rod for drawing, by M. T. McGowan and others. Bridgeport Brass Company, Bridgeport, Conn. Aug 55. Decl. Feb 60. Contract AT(30-1)-1405. 28p. Order from OTS. $.50. BRB-7

Investigation of resistance to heat flow through clad plates, by Earl E. Coulter and D. L. Mayer. Babcock and Wilcox Co. Research and Development Dept., Alliance, Ohio. Apr 51. Subcontract 14-302. 21p. Order from LC. Mi. $2.40 Ph. $3.30. BW-5406

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Fabrication of WCAP-4 in-pile loop irradiation test assemblies, by R. Schettig and R. King. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh. Aug 59. Contract AT(30-3)-222, Subcontract No. 1. 20p. Order from LC. Mi. $2.40 Ph. $3.30. YAEC-148

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Ground motion measurements, operation hardtack, phase II, Project 26.3. U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va. Feb 59. 22p. Order from OTS. $.75. ITR-1704

Nuclear explosions as neutron sources, by George A. Cowan. University of California, Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 15p. Order from OTS. $.50. LAMS-2391

Leaching of tamalpais debris, by W. D. Bond and W. E. Clark. Oak Ridge National Lab. Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 11p. Order from OTS. $.50. ORNL-2810

Crater scaling laws for desert alluvium, by A. J. Chabai, 5112. Sandia Corp., Albuquerque, N. Mex. Dec 59. 29p. Order from OTS. $1.00. SC-4391(RR)

Soil mechanics considerations pertinent to predicting the immediate and eventual size of explosion craters, by Robert V. Whitman. Sandia Corp. Albuquerque, N. Mex. Dec 59. 31p. Order from OTS. $1.00. SC-4405(RR)

The possibilities of reducing neutron-induced contamination of underground bursts, by J. R. Banister. Sandia Corp. Albuquerque, N. Mex. Aug 57. 12p. Order from OTS. $.50. SCTM-385-59(51)

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Particle Accelerators and High-Voltage Machines

Phase plots and fixed points obtained computationally for several equations affected by the $\nu/N=1/3$ resonance, by L. Jackson Laslett. Midwestern Universities Research Association, Madison, Wisconsin. Oct 59. 13p. Order from OTS. $.50. MURA-515

Arbitrary control of the radial position of the internal beam of the bevatron, by H. G. Beard. University of California, Lawrence Radiation Lab., Berkeley, California. Jan 60. Contract W-7405-eng-48. 13p. Order from OTS. $.50. UCRL-9006

Bevatron operation and development. XXII May, June, July 1959, by Walter D. Hartsough. University of California, Lawrence Radiation Laboratory, Berkeley California. Dec 59. Contract W-7405-eng-48. 13p. Order from OTS. $.50. UCRL-9011

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Radiant heat transfer in a flowing radiating medium, by V. N. Adrianov and S. N. Shorin. Technical Information Service Extension, Oak Ridge, Tenn. [nd]. 11p. Order from OTS. $.50. AEC-tr-3928

Two-phase heat transfer, two-phase burnout. Final report, by Herbert S. Isbin. Minnesota. Univ., Minneapolis. Inst. of Tech. Aug 59. Contract AT(11-1)-433. 41p. Order from LC. Mi. $3.30 Ph. $7.80. AECU-4305

Circuit design for the new illinois computer, Report no. 90, by W. J. Poppelbaum and N. E. Wiseman. Illinois. Univ., Urbana. Digital Computer Lab. Aug 59. Contract AT(11-1)-415. 110p. Order from LC. Mi. $5.70 Ph. $16.80 AECU-4314

Beta-Gamma Angular correlation measurements on Au^{198}. I. directional circular polarization correlation, by Rolf M. Steffen. II. Transverse polarization of the beta particles, by R. C. Simms and Rolf M. Steffen. Purdue Univ., Lafayette, Ind. 59. Contract [AT(11-1)-122]. 29p. Order from LC. Mi. $2.70 Ph. $4.80. AECU-4316

Neutron activation cross-sections with 14.8 mev neutrons in the region of the 82-neutron closed shell (thesis), by Raymond George Wille. Arkansas. Univ., Fayetteville. 59. 107p. Order from LC. Mi. $6.00 Ph. $18.30 AECU-4320

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Megatron accelerator progress report-investigation of plasma acceleration. Quarterly Progress Report no. 2 [for] Oct 1, 1958-Dec. 31, 1958, by K. C. Rogers and others. Stevens Inst. of Tech., Hoboken, N. J. [nd]. Contract DA 36-039SC-78097. 19p. Order from LC. Mi. $2.40 Ph. $3.30. AECU-4348

Graphs of x-ray absorption coefficients for fourteen substances, by Forrest R. Gilmore. Rand Corp., Santa Monica, Calif. Apr 59. Contract AT(11-1)-135, Project agreement no. 5. 21p. Order from LC. Mi. $2.70 Ph. $4.80. AECU-4353

The lateral distribution of penetrating particles in cosmic ray extensive air showers. Technical report no. 70, by James Arthur Earl. Mass. Inst. of Tech., Cambridge. Lab. for Nuclear Science. Aug 59. Contract Nonr-1841-(16). Order from LC. Mi. $5.40 Ph. $15.30. AECU-4356

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Annual report. Part A: studies in k-capture positron branching ratios. Part B: search for a low-lying O^+ state in gallium-68, by L. Madansky and M. Ramaswamy. Johns Hopkins Univ., Baltimore. Aug 59. Contract AT(30-1)-2028. 63p. Order from LC. Mi. $3.90 Ph. $10.80. AECU-4437

Periodic radiation survey of reactor plant container and components after shutdown "A" survey. Section I. fourth performance. Core I-seed I. Test Results DL-S-184 (T-612076). Duquensne Light Co., Shippingport, Penna. First Issue Oct 59. 8p. Order from LC. Mi. $1.80 Ph. $1.80. AECU-4462

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Scattering studies with the ohio state university cyclotron. Annual Report for the period October 1, 1958-September 30, 1959. (Report no. 3), by H. J. Hausman. Ohio State Univ. Research Foundation, Columbus. Sep 59. Contract AT(11-1)-503. 74p. Order from LC. Mi. $4.50 Ph. $12.30. AECU-4470

Effect of reflectors on resonance escape probability, by J. M. Stein. General Atomic Div., General Dynamics Corp., San Diego, Calif. Dec 58. 8p. Order from LC. Mi. 1.80 Ph. $1.80. AECU-4482

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Estimation of effective cross sections from Westcott's correlation in AECL-407, by T. H. Pigford. General Atomic Div., General Dynamics Corp., San Diego, Calif. Mar 59. Order from LC. Mi. $1.80 Ph. $1.80. AECU-4487

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On the application of multigroup diffusion theory to fast critical assemblies, by David Okrent. Argonne National Laboratory, Lemont, Illinois. Sep 54. Contract W-31-109-eng-38. 35p. Order from OTS. $.35. ANL-5321(Rev.)

A general program for calculating cross-sections in wave mechanics, by Kenneth Smith. Argonne National Laboratory, Lemont, Illinois. Jan 60. Contract W-31-109-eng-38. 16p. Order from OTS. $.50. ANL-6095

Numerical solution of the one-group, space-independent reactor kinetics equations for neutron density given the excess reactivity, by J. J. Kaganove. Argonne National Laboratory, Lemont, Illinois. Feb 60. Contract W-31-109-eng-38. 14p. Order from OTS. $.50. ANL-6132

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Neutron cross sections for zirconium and yttrium, by N. Tralli. Nuclear Development Corp. of America, White Plains, N. Y. Jun 58 Decl Aug 59. Contracts AF33(600)-38062 and AT(11-1)-171. 47p. Order from LC. Mi. $3.30 Ph. $7.80. APEX-466

F_2 two-group neutron diffusion program, by F. B. Smith. General Electric, Atomic Products Div., Cincinnati, Ohio. Aug 58. Contract AF33(600)-38062 and AT(11-1)-171. 69p. Order from OTS. $2.00. APEX-539

Isotopic sources of secondary radiation. Interim Technical report no. 2 covering the period from March 1 to July 1, 1959, by L. Voyvodic. Illinois Inst. of Tech., Chicago. Armour Research Foundation. Aug 59. Contract AT(11-1)-657. 51p. Order from LC. Mi. $3.60 Ph. $9.30. ARF-1122-13

RBU: A combined Monte Carlo reactor-burnup program for the IBM 709, by E. J. Leshan. Advanced Technology Laboratories, Div. of American-Standard, Mountain View, Calif. Sep 59. Contract AT(04-3)-109. 243p. Order from OTS. $4.00. ATL-A-101

Liquid metal fuel reactor experiment, alpha-gamma analytical facilities for B&W radiation loop no. 2-ETR, by M. M. Rubright and N. R. Johanson. The Babcock and Wilcox Co. Atomic Energy Div. Feb 60. Contract AT(30-1)-1940. 89p. Order from OTS. $2.25. BAW-1096

A recirculating supercritical water loop, by H. M. Epstein and others. Battelle Memorial Inst., Columbus, Ohio. Oct 54. Decl Aug 59. Contract W-7405-eng-92. 20p. Order from LC. Mi. $2.40 Ph. $3.30. BMI-918

Numerical solution of fuel-element thermal-stress problems, by Robert F. Redmond. Battelle Memorial Institute., Columbus, Ohio. Feb 60. Contract W-7405-eng-92. 46p. Order from OTS. $1.50. BMI-1422

Applications of distributions, by Prof. B. Friedman. Brookhaven National Lab., Upton, N. Y. Jun 59. 12p. Order from OTS. $.50. BNL-575(T-158)

A study of the wind profile in the lowest 400 feet of the atmosphere. Progress report no. 4 June 15, 1959-October 15, 1959, by Irving A. Singer and Gilbert S. Raynor. Brookhaven National Lab., Upton, N. Y. Oct 59. Contract R-65-8-99812 SC-04-91. 10p. Order from OTS. $.50. BNL-578(T-160)

Thermal characteristics of the art fuel-to-NaK-heat exchanger, by J. L. Wantland. Oak Ridge National Lab., Tenn. Dec 55. Decl Sep 59. 32p. Order from LC. Mi. $3.00 Ph. $6.30. CF-55-12-120

Transverse pressure difference across staggered and inclined spacers in the art fuel-to-Nak heat exchanger, by J. L. Wantland. Oak Ridge National Lab., Tenn. Jun 56. Decl Sep 59. Contract [W-7405-eng-26]. 11p. Order from LC. Mi. $2.40 Ph. $3.30. CF-56-6-143

Effect of spacer density on heat transfer and pressure drop in the art fuel-to-Nak heat exchanger, by J. K. Wantland. Oak Ridge National Lab., Tenn. Oct 56. Decl. Sep 59. 10p. Order from LC Mi. $1.80 Ph. $1.80. CF-56-10-39

Calculation of transport cross sections, by C. W Nestor. Oak Ridge National Lab., Tenn. Aug 59. Contract [W-7405-eng-26]. 5p. Order from LC. Mi. $1.80 Ph. $1.80. CF-59-8-24

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Unclassified cross sections for fast reactor calculations, by F. E. Bjorklund. California Research and Development Co., Livermore, Calif. Jan 53. 18p. Order from LC. Mi. $2.40 Ph. $3.30. CRD-R-31

Paramagnetic resonance absorption in neptunium hexafluoride, by Clyde A. Hutchison, Jr., and Bernard Weinstock. Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies and Argonne National Lab., Lemont, Ill. 1959. 25p. Order from LC. Mi. $2.70 Ph. $4.80. EFINS-59-35

Mathematical formulation of the one-dimensionalized dynamics of a diffusing binary gas, by V. Fillipenko. California. Univ., Berkeley. Inst. of Engineering Research. Dec 57. Contract AT(11-1)-34. 22p. Order from LC. Mi. $2.70 Ph. $4.80. HE-150-151

Lamb waves at ultrasonic frequencies, by D. C. Worlton. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Jun 59. Contract W-31-109-Eng-52. 58p. Order from LC. Mi. $3.60 Ph. $9.30. HW-60662

Nuclear physics research quearterly report July, August, September 1959. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct 59. Contract AT(45-1)-1350. 71p. Order from OTS. $2.00. HW-62727

Double P-1 spherical harmonics approximation in slab geometry, by D. R. Metcalf and G. A. Cazier. Phillips Petroleum Co. Idaho Operations Office. Mar 60. Contract AT(10-1)-205. 28p. Order from OTS. $1.00. IDO-16572

A survey and preliminary analysis of the problem of collapse of fuel plates, by J. D. Lubahn and W. D. Fowler. Knolls Atomic Power Lab., Schenectady, N. Y. Aug 59. Contract W-31-109-Eng-52. 58p. Order from LC. Mi. $3.90 Ph. $10.80. KAPL-M-JDL-2

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A one dimensional intermediate reactor computing program, by Forrest Brinkley. University of California, Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 88p. Order from OTS. $2.25. LA-2161

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The solution of the general least squares problem with special reference to high-speed computers by R. H. Moore and R. K. Zeigler. University of Calif. Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 94p. Order from OTS. $2.25. LA-2367

Molybdenum cross sections and their temperature dependence, by Joseph J. Devaney and others. University of Calif. Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 128p. Order from OTS. $2.75. LA-2373

Calculated properties of mu-mesonic atoms, by Kenneth W. Ford and John G. Wills. University of California. Los Alamos Scientific Lab., Los Alamos, N. Mex. Mar 60. Contract W-7405-Eng. 36. 46p. Order from OTS. $1.25. LAMS-2387

Neutron thermalization in a heavy moderator with an absorption resonance, by E. R. Cohen and others. Atomics International., Div of North American Aviation, Inc. Canoga Park, Calif. Mar 60. Contract AT(11-1)-GEN-8. 17p. Order from OTS. $.75. NAA-SR-4059

Exponential experiment with a thorium-uranium fuel in graphite, by C. H. Skeen. Atomics International., Div. of North American Aviation, Inc. Canoga Park, Calif. Mar 60. Contract AT(11-1)-GEN-8. 19p. Order from OTS. $.75. NAA-SR-4238

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An extension of small source theory to include epithermal fission, by J. W. Zink. Atomics International. Div. of North American Aviation, Inc. Canoga Park, Calif. Jan 60. Contract AT(11-1)-GEN-8. 9p. Order from OTS. $.50. NAA-SR-4457

Flux hardening in fuel rods, by E. U. Vaughan. Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif. Mar 60. Contract AT(11-1)-GEN-8. 12p. Order from OTS. $.50. NAA-SR-4780

Nuclear parameter survey of 100 EMW OMR, by W. D. Leggett. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jan 58. 6p. Order from LC. Mi $1.80 Ph. $1.80. NAA-SR-MEMO-2420

Stress analysis of the OMR core vessel support structure, by Charles Pernado. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Feb 58. 34p. Order from LC. Mi. $3.00 Ph. $6.30 NAA-SR-MEMO-2502

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Multigroup cross sections for U^{234}, U^{236}, and Th^{232}, by Von E. Kistler. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Aug 58. 6p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-3013

Resonance capture for the Th-U alloy fuel, by C. H. Skeen. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jul 59. 5p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-3926(Rev.)

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Least squares analyses of axial neutron flux distribution in exponential assemblies, by G. W. Rodeback. Jul 59. 7p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-4189

Maritime OMCR burnup study, by R. W. Hardy and R. Tanaka. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sep 59. 4p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-4380

Calculations with multigroup adjoints, by F. H. Clark. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sep 59. 10p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-4327

Tables of O^n for reactor slabs, cylinders, and spheres, n= 1 to n = 20, by Raymond L. Murray. North Carolina State College, Dept., of

Engineering, Raleigh, N. Carolina. Nov 58. 56p. Order from OTS. $1.50. NCSC-B-70

Conservation laws in weak interactions, by T. D. Lee. Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs. Mar 57. Contract N6-ori-110, Task no. 1 and AT(30-1)-1932. 61p. Order from LC. Mi. $3.90 Ph. $10.80. NEVIS-50

The interactions of 173 mev negative pions in deuterium (thesis), by Robert L. Bingham. Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs. Dec 58. Contracts N6-ori-110 and AT(30-1)-1932. 44p. Order from LC. Mi. $3.30 Ph. $7.80. NEVIS-73

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Endurance test of mark II control rod drive, by R. J. Tuttle. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jan 58. 3p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-2441

Maximum thermal stresses or strains induced in the OMR core vessel by coolant temperature transients, by Charles O. Peinado. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 58. 30p. Order from LC. Mi. $2.70 Ph. $4.80. NAA-SR-MEMO-2598

Development of a fast scram instrument of OMR critical experiment, by L. S. Beller. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jul 58. 15p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-2919

Pressure drop measurements of OMRE and OMR type fuel elements adapted to OMRE, by R. R. Hargrove. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sep 58. 11p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-3119

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Reliability test of pressure relief devices for orgainic fluids, by A. N. Gallegos and S. C. Spencer. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Feb 59. 11p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-3318

Nuclear analysis of the circular high burnup element to be tested in the OMRE, by E. Specter. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Feb 59. 5p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-3502-A

Burnup of OMR fuel elements, HB-1 and HT-1, by G. D. Calkins. Atomics International Div., North American Aviation., Inc., Canoga Park, Calif. Mar 59. 4p. Order from LC. Mi. $1.80. Ph. $1.80. NAA-SR-MEMO-3671

Calibration of OMRE fuel-element surface thermocouple assembly, by S. Sudar. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Mar 59. 22p. Order from LC. Mi. $2.70 Ph. $4.80. NAA-SR-MEMO-3671

Gases from OMRE purification system (Run 40-10), H. M. Gilroy and D. N. Day. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 59. 14p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-3746

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Control rod guide for OMR critical assembly, by H. E. Scarlett. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Aug 59. 6p. Order from LC. Mi. $1.80 Ph. $1.80. NAA-SR-MEMO-3866

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Parameter study of the dose rates on OMR system piping, by P. J. Legendre. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jun 59. 27p. Order from LC. Mi. $2.70 Ph. $4.80. NAA-SR-MEMO-4007

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OCR power distributions, by L. M. Maki and R. H. Sevy. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jul 59. 30p. Order from LC. Mi. $3.00 Ph. $6.30. NAA-SR-MEMO-4157

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Calibration of OMR test element anemometers, by M. Starr. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Jul 59. 11p. Order from LC. Mi. $2.40 Ph. $3.30. NAA-SR-MEMO-4201

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ORNL-1868

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SRIA-17

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ACNP-5921

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AECU-4276

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AECU-4278

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Summary of the initial 1500 hours of operation for extended boiling test no. 6 with irradiated OMRE coolant, by D. A. Huber and J. L. Kortenhoeven. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Aug 59. 16p. Order from LC. Mi. $2.40 Ph. $3.30.
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NDA-84-25

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Stable Isotope Separation

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AFOSR-TN-59-36	674
AFOSR-TN-59-37	543
AFOSR-TN-59-40	54
AFOSR-TN-59-47	692
AFOSR-TN-59-64	93
AFOSR-TN-59-84	422
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AFOSR-TN-59-108	540
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AFOSR-TN-59-164	115
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AFOSR-TN-59-712	186
AFOSR-TN-59-713	186
AFOSR-TN-59-714	562
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AFOSR-TN-59-716	92
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AFOSR-TN-59-722	211
AFOSR-TN-59-723	211
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AFOSR-TN-59-893	246
AFOSR-TN-59-895	560
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AFSAM-AR-4-59	23
AFSAM-AR-5-59	238
AFSAM-AR-8-58	23
AFSWC-SWR-TM-57-2	571
AFSWC-SWR-TM-58-3	572
AFSWC-SWR-TM-59-2	572
AFSWC-TR-57-3	677
AFSWC-TR-58-36	571
AFSWP-768	434
AGC-1282-9	403
AGC-TN-14	401
AGC-TN-26	606
AGC-TN-33	650
AI-3051	425
Airtron-6035-1	494
AMC-TR-7-665	360
AMC-TR-59-7-617	416
AMC-TR-59-7-694	669
AMFED-Ref-262P-9	148
AMP-24.1	532
AMNL-227	21
AMNL-228	517
AMNL-229	24
AMRG-PM-17	252
AMRL-281	245
AMRL-294	463
AMRL-318	457
AMRL-323	240
AMRL-328	236
AMRL-329	465
AMRL-333	242
AMRL-339	361
AMRL-349	86
AMRL-358	21
AMRL-370	241
AMRL-376	239
AMTC-SR-12	646
AN/AKT-14	159
AN/GRR-7	161
AN/TSQ-13(XD-1)	148
AN/UKR-7(XA-2)	159
AOHEL-TM-2-59	116
AOHEL-TM-6-59	389
AOHEL-TM-7-59	118
AOHEL-TM-8-59	10
AOHEL-TM-9-59	495
AOHEL-TM-10-59	275
AOHEL-TM-11-59	357
APAE-22	198
APAE M-44	198
APAE M-82	422
APGC-TN-59-21	75
APGC-TN-59-59	520
APGC-TR-58-82	162
APGC-TR-59-52	617
APL/JHU BB-270	555
APL/JHU BB-276	512
APL/JHU BB-283	677
APL/JHU CM-576	540
APL/JHU CM-717A	651
APL/JHU CM-915	427
APL/JHU CM-942	29
APL/JHU CM-945	389
APL/JHU-TG-323	397
APPR	198
APRL-TR-5903	526
AQB-1	453
ARA-528	275
APRL-TR-5838	403
ARDC-TR-58-51	361
ARDC-TR-58-58	359
ARDC-TR-59-17	88
ARF-3133-11	495
ARF-3142-1	680
ARGMA 2R24F	288
ARGMA-2R28P	512
ARGMA-3Y12	275
ARGMA-DSD-TR-3-58	641
ARGMA TN 1H 1N-1	297
ARGMA TN 1H 1N-2	664
ARINC-110-1-136	623
ASESA-49-2B	148
ASI U-238	131
ASI U-461	426
ASI U-503	316
ASI-U-698	388
ASRDL-1961	624
ASRDL-1964	623
ASRDL-1969	44
ASRDL-1976	624
ASRDL-1979	58
ASRDL-1985	44
ASRDL-1993	149
ASRDL-2014	623
ASRDL-2016	496
ASRDL-2038	684
ASRDL E-1228	44
ASRDL-M-1453	370
ASRDL M-1893	149
ASRDL M-1905	262
ASRL TN-74-1	539
ASRL-TN-74-3	187
ASRL TR-25-28	492
ASRL-TR-71-2	539
ASRL-TR-74-2	296
ASRPA-636	32
ASRPA TR-2	43
ASRPA TR-3	44
ASRPA TR-9	148
ASRPA-419	136
ASRPA-636A	149
ASRPA-646	149
ASRPA-664	149
ATI-21-017	382
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ATI-96 073	153
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ATI-122 886	537
ATI-139 916	154
ATI-143 136	208
ATI-150 275	573
ATI-155 272	693
ATI-158 806	67
ATI-158 961	382
ATI-159 366	401
ATI-166 395	377
ATI-171 301	401
ATI-173 898	183
ATI-174 582	183
ATI-175 097	370
ATI-181 247 canceled	361
ATI-184 211	685
ATI-184 781	548
ATI-184 796	68
ATI-188 471	68
ATI-194 010	328
ATI-196 326	151
ATI-200 933	485
ATI-200 949 canceled	401
ATI-200 953, canceled	437
ATI-200 955 canceled	400
ATI-204 300	412
ATI-206 337	368
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Directorate of Labs., Wright Air Development Center, Wright-Patterson AFB, Ohio	513	161 409
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Dodge, Barnett F. and Eshaya, Allen M.	488	161 395
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DuPont de Nemours, E. I., and Co., Inc., Wilmington, Del.	417	144 564
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Dublin Inst. for Advanced Studies, Eire	595	145 678
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Dynamic Properties Lab., Calif. Inst. of Tech., Pasadena	420	137 812
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Electrical Engineering Research Lab., U. of Illinois, Urbana	46	143 515
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Electronic Communications, Inc., Timonium, Md.	377	144 598
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Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.	46	138 564
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Experimental Towing Tank, Stevens Inst. of Tech., Hoboken, N. J.	170	143 133
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Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena	416	145 035
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Institute for Advanced Study, Princeton, N. J.	72	139 073
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Institute for Experimental Cancer Research, U. of Heidelberg (West Germany)	127	143 410
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Instrumentation Lab., Mass. Inst. of Tech., Cambridge	278	144 223
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International Business Machines Corp., Poughkeepsie, N. Y.	662	145 550
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International Resistance Co., Philadelphia, Pa.	50	129 892
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		161 772
	260	147 683
		161 771
	279	147 627
	310	147 626
	334	146 458
	383	146 345
		148 265
	387	146 302
		146 460
	390	161 860
	485	148 228
	487	148 029
	495	148 445
	686	149 906
	533	147 236
		148 909
	536	146 547
		148 908
		148 910
	537	146 459
		146 548
	686	149 970
		150 123
		150 546
	736	161 971
	779	150 103
Army Engineer Arctic Construction and Frost Effects Lab., Boston, Mass.	25	146 024
Army Engineer Research and Development Labs., Fort Belvior, Va.	25	146 022
		146 023
		146 024
	171	146 246
	215	147 462
	280	148 052
	303	147 845
	312	146 279
	419	146 661
	600	147 224
	707	150 200
	732	147 816
	741	150 199
	742	150 231
	766	149 317
Army Engineer Waterways Experiment Station, Vicksburg, Miss.	25	146 022
		146 024
		146 026
	277	147 738
	308	148 085
		148 086
	312	148 089
	417	146 565
		161 869
	548	149 194
	596	149 199
Army Medical Research Lab., Fort Knox, Ky.	119	147 456
	256	146 267
		146 268
	257	146 269
	383	146 314
	529	146 315
	684	149 767
Army Ordnance Corps, Washington, D. C.	434	146 182
Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.	48	146 159
	250	146 160
	257	147 162
	278	147 962
	709	150 087
Army Polar Research and Development Center, Fort Belvoir, Va.	25	146 026
Army Prosthetics Research Lab., Washington, D. C.	13	145 705
	62	146 214
	63	146 854
	127	145 965
	180	147 026
	742	147 818
Army Research Office, Washington, D. C.	96	161 139
Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.	148	147 463
	165	147 590
	205	145 966
	217	147 579
	220	147 151
	496	148 356
	599	149 182
	738	149 440
	766	149 094
Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.	148	146 835
	283	147 521
		147 742
Army Signal Research and Development Lab., Fort Monmouth, N. J.	22	139 075
	49	145 752
	79	145 754
	89	145 753
	116	146 937
	131	147 388
	136	146 932
	149	146 933
		146 934
		146 936
	200	146 935
	206	146 787
	211	146 982
	270	147 995
		148 114
	275	146 265
		147 998
	276	147 999
	282	148 073
		148 074
	283	148 115
		148 544
	284	146 266
		147 977
		148 117
		148 118
		161 821
	299	146 293
	402	146 347
		146 549
		146 550
		147 996
		147 997
		148 543
	403	146 654
	408	146 391
		148 000
		148 001
		148 540
		148 541
	419	148 071
	420	146 590
		146 653
		148 002
		148 112
	434	148 119
		149 384
	490	146 342
	497	148 113
	544	147 564
		148 539
		148 542
	562	149 416
		149 417
	563	147 819
		149 386
		149 414
Army Signal Research and Development Lab., Fort Monmouth, N. J. (con.)	610	149 383
	632	149 418
	634	149 385
	640	149 419
	693	147 820
		147 825
	694	147 823
	709	147 821
		149 415
	710	147 822
		148 120
	726	147 826
		147 827
	736	150 685
	767	147 824
Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.	24	146 499
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		146 023
		146 024
		146 025
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	138	147 184
		147 185
	270	148 469
		148 470
		148 471
	271	148 467
		148 477
	272	148 462
		148 465
		148 466
		148 468
	273	148 460
		148 463
	405	146 560
		148 474
		148 475
	543	147 183
	546	147 353
	547	147 352
		149 125
		149 129
		149 130
		149 131
	548	149 124
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Army Transportation Environmental Operations Group, Fort Eustis, Va.	584	149 222
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Army Transportation Research and Engineering Command, Fort Eustis, Va.	58	145 701
Arnold Engineering Development Center, Tullahoma, Tenn.	29	145 749
	71	145 750
	149	146 763
	165	147 330
	191	146 764
		147 008
		147 145
	192	147 375
	304	146 114
	308	146 113
	321	146 115
		146 332
		147 600
	348	147 728
	466	146 569
	563	148 099
	613	147 879
	614	148 961
		149 197
	702	149 975
	750	150 165
	792	149 976
ARO, Inc., Tullahoma, Tenn.	29	145 749
	71	145 750
	149	146 763
	165	147 330
	191	146 764
		147 008
		147 145
	192	147 375
	308	146 113
	321	146 115
		146 332
		147 600
ARO, Inc., Tullahoma, Tenn. (con.)	348	147 728
	466	146 569
		148 100
	563	148 099
	614	148 961
	702	149 975
	750	150 165
	792	149 976
Associated Engineers, Inc., Springfield, Mass.	171	147 281
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Astro-Electronic Products Div., Radio Corp. of America, Princeton, N. J.	92	145 873
Astrophysical Observatory, Smithsonian Institution, Cambridge, Mass.	523	147 552
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Atlantic Research Corp., Alexandria, Va.	17	145 838
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	540	146 543
	599	148 876
		161 900
Audiology Lab., Northwestern U., Evanston, Ill.	10	146 144
Avco Corp., Nashville, Tenn.	555	149 302
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Avco Corp., Wilmington, Mass.	14	145 827
	214	146 907
	270	147 658
	306	161 830
		161 831
	536	148 887
	699	150 341
Avco-Everett Research Lab., Mass.	93	145 772
	94	146 700
		146 853
	165	147 200
	192	147 434
	333	161 824
	346	161 825
	393	147 208
		147 397
	435	147 198
		147 202
		147 206
		147 212
		147 213
	465	146 651
	466	147 193
		147 203
		147 209
	467	146 649
		146 655
		147 189
		147 190
		147 207
		147 210
		147 398
	468	146 656
		146 658
		147 204
		147 205
		147 214
		147 215
		146 652
	469	147 191
	486	147 395
	501	147 195
	504	146 657
		147 196
		147 211
	511	147 396
	563	147 216
		147 217
	584	147 201
	602	146 650
	614	147 197
	644	147 199
		148 187
	645	146 659
		147 192
	689	147 830
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	387	146 959
	412	146 961
	435	146 346
	533	146 962
	676	148 273
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Aviation Psychology Lab., U. of Illinois, Urbana	252	161 791
Ball Brothers Research Corp., Boulder, Colo.	614	148 476
Ballistic Research Labs., Aberdeen Proving Ground, Md.	49	145 728
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	165	147 051
	166	147 485
	192	146 770
		147 105
	201	147 490
	284	147 649
	299	146 116
		147 839
		148 645
	317	148 458
	435	148 513
	436	148 459
	469	148 744
	479	148 517
		148 514
	505	148 238
	551	147 790
	554	148 904
		149 011
		149 012
	555	148 902
	584	148 646
	585	148 903
		148 905
		149 237
	605	149 994
	646	149 238
	689	149 671
	693	150 091
	700	150 093
	726	149 091
		150 092
	738	150 297
	750	147 789
		148 511
	759	149 884
	761	148 913
	788	150 453
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Bally Ribbon Mills, Inc., Pa.	62	146 278
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Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.	205	146 952
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Battelle Memorial Inst., Columbus, Ohio	15	161 551
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	80	145 938
		145 939
	85	145 754
	145	161 766
	180	147 158
	201	161 758
	264	148 094
	279	161 818
	327	147 733
		161 817
	328	161 823
	332	147 980
		147 981
	447	161 891
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	476	161 850
	564	149 169
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Battelle-Institut E. V., Frankfurt-am-Main (West Germany)	337	146 043
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Bausch and Lomb Optical Co., Rochester, N.Y.	598	150 149
Baylor U., Waco, Tex.	393	148 444
Baylor U. Coll. of Medicine, Houston, Tex.	260	147 458
Beach Erosion Board, Corps of Engineers, Washington, D. C.	146	147 492
Beechcraft Research and Development, Inc., Boulder, Colo.	166	147 268
Behavioral Sciences Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	526	161 923
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Bell Aircraft Corp., Buffalo, N.Y.	17	145 906
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Bell Helicopter Corp., Fort Worth, Tex.	278	146 337
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Bell Telephone Labs., Inc., Murray Hill, N. J.	380	148 784
Bell Telephone Labs., Inc., New York	34	145 979
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		147 947
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	556	147 946
	564	149 016
		149 017
		149 024
	565	150 145
	567	147 348
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	608	148 911
	710	148 329
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Bell Telephone Labs., Inc., Whippany, N. J.	565	147 920
Bendix Aviation Corp., Eatontown, N. J.	565	149 117
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Benson-Lehner Corp., Los Angeles, Calif.	226	147 093
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Besler Corp., Emeryville, Calif.	444	146 571
Bio-Mechanics Lab., Tufts U., Medford, Mass.	703	151 702
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Bjorksten Research Labs., Inc., Madison, Wis.	450	161 845
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Blaw-Knox Co., Pittsburgh, Pa.	280	161 819
Bliley Electric Co., Erie, Pa.	299	147 975
Boeing Airplane Co., Seattle, Wash.	140	161 705
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Bolt, Beranek, and Newman, Inc., Cambridge, Mass.	278	161 781
Bonn U. (West Germany)	18	145 848
Booz, Allen, and Hamilton, Chicago, Ill.	727	150 672
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Brookhaven National Lab., Upton, N. Y.	207	161 308
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Brown U., Providence, R. I.	89	145 930
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Brown U. Div. of Applied Mathematics, Providence, R. I.	27	145 796
	69	139 064
		146 174
	70	146 169
	72	145 977
	74	146 255
		146 260
	182	147 089
	189	137 961
	192	147 094
	193	147 403
	197	146 053
	277	138 132
	319	138 131
	321	147 404
	341	147 708
	464	138 003
	465	148 579
	605	149 115
		149 116
	612	149 440
	755	149 804
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Brown U. Div. of Engineering, Providence, R. I.	70	146 169
	193	146 437
		146 438
	466	148 818
	505	148 584
	540	148 819
	614	149 454
	646	149 597
		149 598
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Brush Beryllium Co., Cleveland, Ohio	18	161 683
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Brussells Free U. (Belgium)	129	147 435
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Bulova Research and Development Labs., Inc., Woodside, N. Y.	149	137 442
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Bureau of Mines, Bartlesville, Ohio	394	146 580
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	560	161 959
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Burroughs Corp., Paoli, Pa.	150	146 039
California Forest and Range Experiment Station, Berkeley	685	150 675
California Inst. of Tech., Pasadena	76	145 724
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		149 508
	646	148 895
	755	147 793
		149 514
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California U., Berkeley	22	145 871
	64	146 082
	182	138 282
	183	146 045
	210	137 959
	264	147 837
	301	147 680
	314	147 859
	336	147 699
	377	148 822
		148 823
		148 824
	378	148 825
		148 826
		148 827
		148 828
		148 829
	388	146 531
	394	146 718
	454	146 415
	483	146 745
	501	148 583
	505	146 360
	689	147 577
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California U., Berkeley. School of Medicine.	534	146 625
California U., Los Angeles	89	145 867
	119	146 051
	136	146 931
	226	137 921
		147 128
	252	148 129
		148 130
		148 131
	285	146 376
	378	146 602
	383	146 695
	403	148 592
	406	147 939
	408	146 645
	421	146 735
	511	146 736
	513	146 682
	530	148 888
	534	147 573
	595	148 834
	605	148 831
		148 832
		148 833
		148 839
	631	147 800
	651	148 835
		148 837
		148 838
	674	148 266
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	682	147 888
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Callery Chemical Co., Pa.	392	148 373
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Cambridge U. (Gt. Brit.)	205	146 443
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Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.	66	145 976
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Catalysis Research Lab., Alfred U., N. Y.	265	147 496
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Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio	351	146 386
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Center for Radiophysics and Space Research, Cornell U., Ithaca, N. Y.	116	147 053
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Centre de Physique Electronique et Corpusculaire (France)	34	146 261
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Centro di Studio per la Fisica delle Microonde (Italy)	585	148 779
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		148 223
		148 582
	501	148 416
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Cincinnati General Hospital, Ohio	125	146 010
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Clevite Corp., Cleveland, Ohio	566	161 938
Clevite Research Center, Cleveland, Ohio	59	146 530
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Climax Molybdenum Co. of Michigan, Detroit	77	161 542
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Cloud Physics Lab., U. of Chicago, Ill.	199	137 727
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Coastal Studies Inst., Louisana State U., Baton Rouge	23	146 482
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Coating and Chemical Lab., Aberdeen Proving Ground, Md.	304	161 476
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	265	148 144
	285	148 140
	378	148 564
	606	149 573
	635	148 873
	744	150 195
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Columbia Radiation Lab., New York	711	147 633
Columbia U., New Uork	183	146 429
	201	161 706
	210	147 069
	221	147 156
	314	147 693
		147 702
	394	146 749
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	418	148 573
	455	146 414
		148 577
	606	146 413
		149 852
		149 853
	744	147 892
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Control Systems Lab., U. of Illinois, Urbana	567	149 400
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Convair, Fort Worth, Tex.	206	147 596
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	193	146 973
		147 406
	201	147 018
	202	161 717
	278	146 370
	309	161 826
	412	161 855
	421	148 783
	447	148 739
	469	148 357
	477	148 242
		148 243
	479	148 376
	508	147 909
	556	148 396
	614	146 544
	615	146 541
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		148 773
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Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.	436	161 093-4
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Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.	442	147 083
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Flight Dynamics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	615	161 937
Flight Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	570	150 148
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General Atomic, San Diego, Calif.	89	161 673
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General Electric Co., Cincinnati, Ohio	480	148 927
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General Electric Co., Utica, N. Y.	57	145 725
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General Mills, Inc., Minneapolis, Minn.	38	145 835
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General Motors Corp., Warren, Mich.	456	146 416
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Gilfillan Bros., Inc., Los Angeles, Calif.	570	147 961
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Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.	336	147 761
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Harvard Medical School, Boston, Mass.	10	146 237
Harvard U., Cambridge, Mass.	18	146 765
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Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.	335	147 719
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Hughes Aircraft Labs., Culver City, Calif.	153	147 425
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Hughes Research Labs., Malibu, Calif.	635	148 087
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Human Resources Research Office, George Washington U., Washington, D. C.	118	147 429
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Institute of Flight Structures, Columbia U., New York	30	145 800
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Institute of Geophysics, U. of California, Los Angeles	700	149 535
Institute of Mathematical Sciences, New York U., New York	65	145 743
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	532	148 351
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	608	149 899
	613	148 315
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Brazing for High-Temperature Service

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Thesaurus of ASTIA descriptors, First Edition. 329p.
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U. S. Government RESEARCH REPORTS

U. S. DEPARTMENT OF COMMERCE
BUSINESS AND DEFENSE SERVICES ADMINISTRATION
OFFICE OF TECHNICAL SERVICES

Vol. 34, No. 1 Pages 5 - 98 July 15, 1960

ASTRONOMY

Air Force Missile Development Center, Holloman AFB, N. Mex.
PLANETARY ASTRONOMY FROM SATELLITE-SUBSTITUTE VEHICLES. III. PROGRAM OF NOVEL OBSERVATIONS FROM HIGH ALTITUDE BALLOONS, by F. Zwicky (California Inst. of Tech.). Dec 59, 12p. 10 refs. AFMDC-TN-59-38; AD-232 329.
Order from LC mi$2.40, ph$3.30 PB 145 737

The following three types of basic topics are discussed: (1) observations and experiments concerning the atmosphere above the maximum height of the balloon as well as those dealing with the contents of extraterrestrial space; (2) observations and experiments concerning the physico-chemical properties of the strata through which the balloon flies; and (3) observations in the downward directions. (Author) (See also PB 143 187)

Astrophysics

Colorado U., Boulder.
SOLAR ULTRAVIOLET RESEARCH, by William A. Rense. Final rept. for 1 Jan 57-31 Dec 59 on Contract AF 19(604)2181. [1959] 11p. 9 refs. AFCRC-TR-60-214.
Order from LC mi$2.40, ph$3.30 PB 145 846

Results of several Aerobee rocket flights are given especially with relation to the solar ultraviolet spectrographs. The quantum efficiencies of several new phosphors for far ultraviolet exciting radiation were measured in the laboratory as a continuation of previous work done.

Manchester U. (Gt. Brit.)
STUDIES IN LUNAR TOPOGRAPHY. I. DETERMINATION OF THE HEIGHTS OF MOUNTAINS ON THE MOON, by Zdenek Kopal and Gilbert Fielder. Technical scientific note no. 1 on Contract AF 61(052)168. Mar 59, 31p. 19 refs. AFCRC-TN-59-411; AD-232 260.
Order from LC mi$3.00, ph$6.30 PB 146 132

Following a brief introduction, in which the previous work on the determination of the heights of lunar mountains is summarized and its limitations pointed out, the second part of this paper contains an exhaustive discussion of the geometrical aspects of the problem of determination of the altitudes of lunar elevations by a triangulation of the shadows cast on the surrounding landscape during sunrise or sunset, and formulae are deduced relating explicitly the desired heights with the observed shadows to the requisite degree of accuracy. The second part of the present paper contains then a description of the procedure actually followed in securing the cinematographic data, essential for this purpose, at the Observatoire du Pic-du-Midi, and their subsequent microphotometric measurements at Manchester. (Author)

Stanford Electronics Labs., Stanford U., Calif.
RADAR ECHOES FROM THE SUN, by V. R. Eshleman, R. C. Barthle and P. B. Gallagher. Scientific rept. no. 6 on Contract AF 19(604)2193. 11 Jan 60, 15p. 6 refs. AFCRC-TN-60-135.
Order from LC mi$2.40, ph$3.30 PB 145 751

On April 7, 10, and 12, 1959, 15-minute trains of 30-second pulses were transmitted at 25.6 mc from a 40-kw transmitter. A four-rhombic antenna was used for both transmission and reception. The received data were recorded for later analysis on an electronic digital computer. The echoes were on the order of 40-50 db below the noise level after detection, but

from post-detection integration the presence of echoes has been demonstrated with chances for error on each day of less than 1 in 10^5. Continuing radar studies of the sun should provide important new data on various solar phenomena. (Author)

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
TARGET SIZE AND VISUAL RECOGNITION, by William C. Steedman and Charles A. Baker. Rept. on Criteria for the Design and Arrangement of Displays. Feb 60, 23p. 2 refs. WADD Technical rept. 60-93.
Order from OTS $0.75 PB 161 661

This study was conducted to determine the speed and accuracy of form recognition as a function of the size of target forms for various amounts of detail resolution. The stimulus forms were generated by filling in, on a statistical basis, some of the cells of a 90,000-cell matrix. The subjects were shown a "briefing target" and instructed to locate that target on a display containing numerous other forms. The significant finding is that both search time and errors remain invariant until the visual angle subtense of the targets falls below 12 minutes; at values below 12 minutes performance deteriorates. This effect is independent of the range of resolutions investigated. The implications of these findings to equipment design are discussed. (Author)

Institute for Applied Experimental Psychology Tufts U., Medford, Mass.
HUMAN ENGINEERING BIBLIOGRAPHY 1957-1958. Rept. on Contract Nonr-494(13). Oct 59, 316p. 1400 refs. ONR rept. ACR-43.
Order from OTS $5.00 PB 161 125

This bibliography is one of a planned series of annual bibliographies of literature pertinent to human engineering. Two major considerations - ease of use and appropriate selection of material - strongly influenced this bibliography. As a result, five main parts exist: (1) a topical outline which defines over 300 topic headings established for this bibliography, (2) an index which associates the approximately 1400 bibliographic entries with the topic headings, (3) an alphabetic index of the common search terms which would aid those using this bibliography but who are unfamiliar with the topic headings, (4) an annotated bibliography of some 1400 citations, and (5) an index of the authors of these citations. (See also PB 131 507 and PB 131 507S)

Office of Naval Research, Washington, D. C.
HUMAN ENGINEERING IN THE NAVY, 1959, by Paul G. Cheatham. Mar 60, 14p. ACR-46.
Order from OTS $0.50 PB 161 428

In 1952-53 a survey of human engineering in the Navy was conducted by a Working Group in the Office of Naval Research, with the main purpose of providing a basis for recommendations on improving the over-all Navy human engineering program. In 1958, five years later, a new study was initiated to bring the 1953 report up to date and to show what changes have taken place in the Navy's human engineering effort during this interval. The significant developments which have occurred during the last five years are: (1) a ten-fold increase in the adequacy of coverage, (2) the median value of human engineering level of effort applied to systems has increased to about three man-months per month, (3) the "systems concept" has had a marked influence on the design of man-machine military systems such that human factors considerations have become a part of total systems planning, (4) the human engineer has risen in status so that he is now accepted completely as a professional peer by his fellow engineers and has become an effective member of the interdisciplinary design team. (See also PB 114 150)

Stanford Research Inst., Menlo Park, Calif.
A METHOD FOR PERFORMING HUMAN ENGINEERING ANALYSIS OF WEAPON SYSTEMS, by Albert Shapero and Charles Bates, Jr. (Aerospace Medical Lab.) Rept. on Contract AF 33(616)5688. Sep 59, 71p. 2 refs. WADC Technical rept. 59-784; SRI Proj. IU-2568.
Order from OTS $2.00 PB 161 660

One problem that has faced those charged with responsibility for the human elements of a weapon system is the development of a method of analysis which integrates the analysis of a system's human elements with that of the over-all system analysis. This kind of analysis is required to determine how the human elements affect the over-all system and how the over-all system affects its human elements, and is essential to the development of effective weapon systems. A weapon system analysis and integration model has been developed that includes the system's human elements and that can be employed as an aid in the analysis, synthesis, evaluation, planning, and management control of weapon systems. (Author)

Personnel and Training

Applied Psychology Panel, Office of Scientific Research and Development.
HUMAN FACTORS IN MILITARY EFFICIENCY; TRAINING AND EQUIPMENT. Summary technical rept. vol. 2, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 371p. 522 refs.
Order from LC mi$11.10, ph$57.60 PB 139 779

Contents:
Training of specialized military personnel
Psychological principles in military training
The design and operation of special types of military equipment
Guiding principles for future equipment development

Institute of Personality Assessment and Research, U. of California, Berkeley.
FAKABILITY OF THE AIR FORCE PREFERENCE INVENTORY, by Harrison G. Gough. Rept. on Contract AF 18(600)08. Nov 59, 20p. 5 refs. WADC-TN-59-199; AD-231 379.
Order from LC mi$2.40, ph$3.30 PB 146 143

This study concerns (1) recognition of the possibility of faking responses to the Air Force Preference Inventory in order to present a better impression, (2) a consideration of a possible index for detecting faking, and (3) an analysis of the psychological correlates of this index. An indication of faking was revealed by the comparison of three Air Force Preference Inventory scores made by an experimental sample of 30 college students tested under normal administration and then requested to fake. From Inventory items showing marked differences in the second testing, a dissimulation scoring key was constructed and applied to the college student sample and two Air Force officer samples. Significant differences were found between dissimulation scores of normal versus faked testing of the college student group and there was a negative correlation between the two sets of scores. Testing of additional samples, however, would be needed in order to establish precise cutting points for distinguishing between authentic and faked test protocols. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
RELATIONS BETWEEN ELAPSED TIME SINCE TESTING AND PREDICTION OF SCHOOL ACHIEVEMENT, by John M. Proctor and David Kipnis. Nov 59, 14p. 5 refs. BuPers Technical Bulletin 59-26.
Order from LC mi$2.40, ph$3.30 PB 146 248

The basic question in this research was: Do BTB scores have the same predictive value for career men as for recruits? The data were obtained at the Submarine Nuclear Power School. Prediction of Nuclear Power School grades using the sum of scores on General Classification Test (GCT) and Arithmetic Test (ARI) as the predictor was more accurate in younger (18-21 years of age) and more junior (Seamen) groups than in older and more senior groups. The desirability of a test developed specifically for use with career enlisted personnel is indicated. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
THE VALIDITY OF THE BASIC TEST BATTERY AT NUCLEAR PROPULSION SCHOOLS, by Leonard Wollack. July 59, 15p. 6 refs. BuPers Technical Bulletin 59-23; AD-231 131.
Order from LC mi$2.40, ph$3.30 PB 146 247

General Classification Test (GCT) was the best single predictor of school performance ($r_C = .44$). Mechanical Comprehension (MECH) was the poorest ($r_C = .31$). GCT+ARI (ARI = Arithmetic Test) was the most valid two-test combination ($r_C = .51$), and GCT+ARI+MECH produced a few more points of validity ($r_C = .55$). Tests of the BTB gave better prediction of school performance in the fast sections than in the slow sections although the differences in prediction of fast and slow sections by individual tests were not statistically significant. It would seem that if the BTB is to be continued as the selection instrument for the NP program, better validity would be obtained with GCT+ARI instead of the current combination of ARI+MECH.

Naval Radiological Defense Lab., San Francisco, Calif.
QUANTIFICATION OF BODY CONFIGURATION IN GEOMETRICAL TERMS, by A. R. Behnke, O. E. Guttentag, and C. Brodsky. 1 Dec 57, 36p. 15 refs. Research and development technical rept. USNRDL-TR-204; AD-160 462.
Order from LC mi$3.00, ph$6.30 PB 146 221

Circumferential anthropometric measurements and the bideltoid diameter make possible in healthy men: (a) an accurate estimate of body weight, (b) a quantification of body configuration, (c) an estimate of excess fat, muscular development, and degree of leanness, (d) a body pattern analysis showing intra-individual variations and inter-individual score comparisons.

Office of Scientific Research and Development. Div. 6.
METHODS AND DEVICES DEVELOPED FOR THE SELECTION AND TRAINING OF SONAR PERSONNEL. Summary technical rept. vol. 4, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 244p. 230 refs.
Order from LC mi$11.10, ph$37.80 PB 139 778

Ohio State U. Research Foundation, Columbus.
CONTRIBUTION OF STANDARD SEQUENCE TO AN AIR DEFENSE TASK, by Henry M. Moser, John J. Dreher, and Susan M. Wolfe. Technical rept. no. 39 on Contract AF 19(604)15?7. Jan 57, 23p. 5 refs. AFCRC-TN-56-73; AD-110 059.
Order from LC mi$2.70, ph$4.80 PB 137 945

Typical Air Defense surveillance messages were read with elements in standard order and in random order to two groups of listeners. Each group practiced logging data in one particular type of sequence for seven hour-long training periods, at which time the standard and random orders were interchanged to assess the performance of listeners on an unfamiliar type of presentation. A final proficiency test consisting of extremely rapid telling of messages in regular order was administered to both groups to evaluate the two types of training. Results indicated: (1) When using standard vocabulary and one type of message, the message items may be presented in different sequence to trained groups without seriously affecting reception. (2) Initial results produced better intelligibility scores for the standard-ordered material. However, training appeared to negate this original advantage. (3) Groups trained in standard and random sequence, respectively, showed no significant difference when the presentation method was interchanged. (4) Groups trained in standard and random sequence, respectively, showed no significant difference when subjected to speed tests of standard-ordered messages. (Author)

Personnel Lab., Wright Air Development [Division] Lackland AFB, Tex.
PERSONALITY TRAITS RELATED TO EFFECTIVENESS OF JUNIOR AND SENIOR AIR FORCE OFFICERS, by Ernest C. Tupes. Nov 59, 13p. 4 refs. WADC-TN-59-198; AD-231 256.
Order from LC mi$2.40, ph$3.30 PB 146 142

It has been determined that officer candidates in training can produce reliable personality ratings of their peers that are predictive of effectiveness ratings as Air Force junior officers. This study repeats the investigation with field-grade officers. It was found that the factor structure underlying peer ratings of personality traits of senior officers closely resembled that of the junior officers. With one exception, there was agreement between junior and senior officers on the relative importance for officer effectiveness of 30 personality traits. The two groups showed even greater similarity in the relationships of the personality trait ratings to Officer Effectiveness Reports. Hence any officer selection program which screens on personality variables essential to junior-officer success will also select for traits characteristic of effective field grade officers. (Author)

Personnel Lab., Wright Air Development [Division] Lackland AFB, Tex.
PREDICTION OF CRITERIA FOR MEDICAL AND DENTAL SPECIALTIES FROM AIRMAN CLASSIFICATION BATTERY AC-2A, by Leland D. Brokaw. Dec 59, 11p. 2 refs. WADC-TN-59-202. AD-231 257.
Order from LC mi$2.40, ph$3.30 PB 146 141

Validation of Airman Classification Battery AC-2A for training grades in five medical and one dental specialty, and for Airman Proficiency Test scores in two medical career fields, Pharmacy Specialist, and Medical Administrative Specialist, reveals a satisfactory predictive efficiency for the General Aptitude Index. Although the Electronics Aptitude Index seems of comparable validity, there is no basis for recommending a change in the selective aptitude index.

Psychology

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
GUIDE TO DESIGN OF AIR FORCE CHECK-LIST PUBLICATIONS, by David W. Rees. Rept. on Human Factors in Advanced Flight. Dec 59, 61p. 9 refs. WADC Technical rept. 59-758.
Order from OTS $1.75 PB 161 665

Many problems face the designer who wants to present job information in check-list form. Perhaps the major problem is that of condensing complex job information into the abbreviated form. Another important problem involves how best to lay out check-lists so as to maximize their effectiveness on the job. This guide is intended to help alleviate these problems by providing a handbook of background information and general principles for the guidance of the designer. The purpose and function of check-list publications are discussed, and a general concept for design is advanced. A method for analyzing and determining the essential information requirements of complex procedures is presented, and a systematic method for condensing these requirements into check-list items is proposed. Specific recommendations pertaining to organization, layout, and legibility of check-list publications are made. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
SOME ASYMPTOTIC PROPERTIES OF LUCE'S BETA LEARNING MODEL, by John Lamperti and Patrick Suppes. Technical rept. no. 22 on Contract Nonr-225(17). 24 Apr 59, 15p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 146 063

The point of the present paper is to study asymptotic properties of the beta model for certain standard probabilistic schedules of reinforcement.

Illinois U. Coll. of Education, Urbana.
SOME EMPIRICAL STUDIES OF THE RELIABILITY OF INTERPERSONAL PERCEPTION SCORES, by Stanley A. Rudin, Irving Lazar and others. Technical rept. no. 4 on Contract N6ori-07135. May 52, 13p. 5 refs. ATI-152 796.
Order from LC mi$2.40, ph$3.30 PB 146 609

This study is an attempt to determine whether such reliable individual differences exist. Specifically, it is an investigation of the reliabilities of the measures used in a study of effectiveness of basketball teams, reported by Fiedler, Hartmann, and Rudin. Consistency of the similarity measures can be demonstrated in these ways: (1) over items; (2) over persons ("perceivees"; the objects of perceptions); (3) over time. The first two methods have been applied to Assumed Similarity scores in this study. Only the first type of reliability was studied for Real Similarity.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
A SIMPLIFIED ELECTRONIC TRACKING APPARATUS (SETA), by Peter Gain and Paul M. Fitts. Rept. on Contract 41(657)70. Nov 59, 17p. 4 refs. WADC Technical rept. 59-44.
Order from OTS $0.50 PB 161 550

This report describes a simplified electronic tracking apparatus (SETA) which is compact, economical, and portable. The subject's task is to keep the pointer of a zero-center meter at the null point by manipulating a control device. The movements of the meter-pointer for which the subject attempts to compensate are introduced by a voltage across a potentiometer driven by a rotary cam. This voltage is compared with a corresponding voltage generated by the subject. This comparison is made by one of three K2X Philbrick operational amplifiers in cascade. The output of the comparison is simply the sum of the voltages, or error. Error is then introduced to the subject's display and to a second amplifier, which rectifies it, resulting in an output of absolute value of the error which is integrated by the third amplifier and displayed on a voltmeter on the experimenter's console. (Author)

Michigan U. [Research Inst.] Ann Arbor.
AN APPLICATION OF A NONMETRIC MODEL FOR MULTIDIMENSIONAL ANALYSIS OF SIMILARITIES, by C. H. Coombs. Rept. on Project Michigan, Contract DA 36-039-sc-52654. June 58, 14p. 9 refs. Rept. no. 2144-269-T; AD-202 609.
Order from LC mi$2.40, ph$3.30 PB 145 787

A nonmetric multidimensional model for analyzing similarities data is presented and its application to a confusion matrix on Morse Code signals is recounted. Some of the major problems remaining in the development of the model are summarized. (Author)

Minnesota U., Minneapolis.
AN ATLAS OF SEMANTIC PROFILES FOR 360 WORDS, by James J. Jenkins, Wallace A. Russell, and George J. Suci. Technical rept. no. 15 on Studies on the Role of Language in Behavior, Contract N8onr-66216. Mar 57, 42p. 10 refs. AD-129 903.
Order from LC mi$3.30, ph$7.80 PB 146 353

The semantic differential introduced by Osgood (Psychol. Bull. 49:197-237, 1952 and J. Exp. Psychol. 50:325-338, 1955) was studied to relate it to other associative techniques and to mediation and transfer phenomena. A group of 360 words (concepts) from "abortion" to "zenith" was assembled. Each concept was rated by 15 male and 15 female subjects on a set of twenty 7-point descriptive scales. Each scale was a set of paired opposites, such as hard vs soft, cruel vs kind, etc. In each scale, the number 1 represented the ultimate in one of the descriptions (such as cruelty) and 7 represented the ultimate in its opposite (such as kindness). Profiles of the mean scale ratings are presented to 2 decimal places for each concept. Application for the above "atlas" of concepts is suggested for testing the associative-clustering hypothesis of Jenkins and Russell (J. Abnormal Social Psychol. 47:818-821, 1952) and the perceptual-facilitation hypothesis of O'Neil, and the learning and generalization hypothesis of Russell and Storms (J. Exp. Psychol. 49:287-293, 1955), and for examining the interrelationships of the semantic differential data to the simple word association data of Russell and Jenkins (PB 117 888) and the index of meaningfulness of Nobel (Psychol. Rev. 59:421-430. 1952).

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES IN SELECTION LEARNING. IV. THE ACQUISITION AND RETENTION OF INCIDENTAL ITEMS IN SELECTION LEARNING, by Eugene Burnstein. Technical rept. no. 4 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. Oct 59, 11p. 5 refs. AFOSR-TN-60-265.
Order from LC mi$2.40, ph$3.30 PB 146 231

Previous studies on selection learning have demonstrated superior retention of selection learners utilizing informative cues (IS) to those utilizing uninformative cues (US). These findings were accounted for by assuming that interference due to the learning of incidental items dissipates during the interpolated interval The hypothesis was advanced that selection learners using informative cues will show higher incidental learning than selection learners using uninformative cues, but that they will also show a faster rate of forgetting of the incidental material. Experimental confirmation was obtained with respect to the differences in acquisition. Although the results pertaining to the retention of incidental items were in the predicted direction they failed to reach the acceptable level of significance. (Author) (See also PB 145 101)

Willow Run Lab., U. of Michigan, Ann Arbor.
PSYCHOLOGICAL MEASUREMENT AND A THEORY OF DATA, by C. H. Coombs. Rept. on Project Michigan, Contract DA 36-039-sc-78801. Sep 59, 32p. 56 refs. Rept. no. 2900-23-T; AD-226 335.
Order from LC mi$3.00, ph$6.30 PB 145 830

A theory of data is presented which characterizes behavioral data in terms of three basic dichotomies and leads to an eightfold classification of models in abstract terms. This classification greatly simplifies the apparently complex variety of psychological measurement models. The models within each of these eight classes are presented and compared with respect to the kinds of assumptions they make about the same kind of data. The mathematical character of each model is discussed, with numerous psychological examples of the kind of data for which each is designed. For each model, references are indicated which provide instructions on details of the procedures to be followed in their application. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
SUBJECTIVE PROBABILITY IN DECISION THEORIES, by Ward Edwards, Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 20p. 26 refs. Rept. no. 2144-361-T.
Order from LC mi$2.40, ph$3.30 PB 145 831

This report is concerned with theories which explain choices among risky alternative courses of action by means of the concepts of utility, or subjective value, and subjective probability. If the subjective probabilities of a set of events of which some one must happen and not more than one can happen must add up to 1, then utility can be measured on an interval scale and subjective probability on a ratio scale. But if subjective probabilities do not have this additivity property, then both utility and subjective probability must be measured on a ratio scale. If subjective probabilities do have the additivity property, and if the decision model in which they are used is in principle applicable to any conceivable set of events, then, whenever objective probabilities are defined, subjective probability must equal objective probability. This means that the concept of subjective probabilities which must add to 1 and decision models based on that concept, cannot be very helpful in explaining decision making; a large amount of data indicates that subjective probability cannot always equal objective probability. One alternative is to use a decision model in which subjective probabilities need not add up to any particular constant. One property of such a model is that utility must have a true zero point. The only reasonable zero point for utility is where one now is. Any form of the expected utility maximization hypothesis implies a strong relationship among the slopes of indifference curves for simple bets. This relationship leads to an experimental test of the applicability of models of this class. (Author)

BIOLOGICAL SCIENCES

Harvard Medical School, Boston, Mass.
CHANGES IN CIRCULATION DURING THE HIBERNATING CYCLE, by Charles P. Lyman. Rept. for 1 Feb-30 Apr 59 on Contract AF 41(657)190. June 59, 6p. Technical note AAL-TN-59-13, AD-230 849.
Order from LC mi$1.80, ph$1.80 PB 146 237

As hibernation begins, heart rate and blood pressure drop rapidly, followed by a drop in body temperature. As the animal enters deeper into the hibernating state, the peripheral resistance increases linearly with temperature, and the pulse pressure becomes greater. By the time the deeply hibernating state has been reached, the heart rate may be as low as four beats a minute; but, because of the high pulse pressure and high peripheral resistance, a rather remarkably high mean blood pressure is maintained. At this time usually the systolic pressure varies between 60 and 90 mm. Hg., and the diastolic pressure varies between 30 and below 10 mm. Precise measurements of the lowest diastolic pressures have not been possible because of slight drifts in the recording apparatus.

Illinois U. [Urbana].
STUDIES ON THE EIGHTH CRANIAL NERVE OF BIOLOGICAL SUBJECTS, by F. R. Steggerda. Jan 60, 14p. 10 refs. AFMDC Technical rept. 60-2.
Order from LC mi$2.40, ph$3.30 PB 146 191

Various techniques for implanting recording electrodes on the cortical projection areas for the vestibular system and on various branches of the eighth cranial nerve are presented. Preliminary evidence indicates that ablation of the vestibular-cortical area as well as sectioning of the eighth cranial nerve allows the cat to become less disoriented and uncoordinated than the normal unoperated cat when exposed to zero or subgravity states. It appears that complete bi-labyrinthectomy is more effective in producing freedom from disorientation and uncoordination than complete ablation of the vestibular-cortical area in the cerebrum when the animals are exposed to zero or subgravity conditions. (Author)

Anatomy and Physiology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE EFFECT OF TEMPERATURE ON MYOCARDIAL ADENINE NUCLEOTIDE LEVELS AND THE ACTIVITY OF VARIOUS OXIDASES IN RABBITS AND ARCTIC GROUND SQUIRRELS, by John P. Hannon. Nov 59, 18p. 12 refs. Technical rept. 59-2.
Order from LC mi$2.40, ph$3.30 PB 146 262

Certain physiological and biochemical properties of the hearts of rabbits (non-hibernators) and active arctic ground squirrels (hibernators) were compared. When the anesthetized intact animals were rendered hypothermic in ice water, ventricular tissue removed from rabbits with rectal temperatures of 15° C showed that a conversion of ATP to ADP had occurred. Lowering the body temperature to 15° C in squirrels had no effect on ventricular ATP levels. At both normal and hypothermic temperatures, squirrel ventricles contained considerably more adenine nucleotide (ATP and AMP) than rabbit ventricles. Measurements were made of the levels of several different ventricular oxidase activities at 38° and at 15°. At 38° squirrels exhibited a higher glutamic but a lower β-hydroxybutyric-, malic-, and succinic-oxidase activity than rabbits. At 15° similar species differences were found. (Author)

Audiology Lab., Northwestern U., Evanston, Ill.
THE ALTERNATE AND SIMULTANEOUS BINAURAL BALANCING OF PURE TONES, by James F. Jerger and Earl R. Harford. Jan 60, 13p. 18 refs. AFSAM rept. no. 60-30; AD-232 649.
Order from LC mi$2.40, ph$3.30 PB 146 144

The interaural intensity relations producing equal loudness when pure tones were presented alternately, and median-plane-localization when they were presented simultaneously to the two ears, were studied in normals monaurally masked normals, and patients with unilateral sensorineural hearing loss, both with and without loudness recruitment. Results indicate that the two types of judgment do not yield equivalent results. In general, median-plane-localization requires more nearly equivalent SPLs at the two ears than does equal loudness, but there are important qualifications. A significant clinical implication arising from these findings is that loudness recruitment must always be measured by alternate, never by simultaneous, stimulation of the two ears. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
NADC BIOLOGICAL INSTRUMENTATION SYMPOSIUM OF 10 DECEMBER 1958; FOURTH LETTER REPORT CONCERNING, by J. Gordon, R. Jensen and others. Rept. on Proj. MR 005.15-0002.2. 28 Dec 59, 8p. 4 refs. TED ADC AE 1412.1; TED NAM AE 1403.1.
Order from LC mi$1.80, ph$1.80 PB 145 700

The present communication constitutes a preliminary report on the usefulness of the EEG, electroencephalograph, as a means of monitoring certain aspects of cerebral function in air-and spacecraft pilots while in flight and constitutes a feasibility study.

Dunlap and Associates, Inc. [Stamford, Conn.]
RELATIVE MOTION II. THE NATURE OF RELATIVE MOTION SITUATIONS, by Charles R. Kelley, Hugh M. Bowen and others. Rept. on Contract N61339-316. 19 Nov 59, 113p. 36 refs. Technical rept. NAVTRADEVCEN-316-1.
Order from LC mi$6.00, ph$18.30 PB 145 756

The study defined relative motion as the change in the relative position of two moving objects which can be perceived or understood in terms of more than one frame of reference. A groundwork for psychological theory was developed which yielded guidlines for selecting the "outside-in" versus the "inside-out" reference frame for operator tasks. The appropriateness of a reference frame was found to be a function of (a) The speed with which a given task must be carried out and other operator requirements. (b) The physical environment, especially as it affects the richness and size of visual cues. (c) The nature of accessory cues (e.g. instrumentation). The experimental portion of the study identified shape of a target as one of the crucial clues to its movement when observed by a moving observer. It also identified an important constant error in the judgment of a moving target by a moving observer.

George Washington U. School of Medicine, Washington, D. C.
EFFECT OF LIPOTROPIC FACTORS ON COLD PHYSIOLOGY. II. PREVENTIVE AND CURATIVE EFFECTS OF COLD ON FATTY LIVERS, by Carleton R. Treadwell. Rept. on Contract AF 18(600)463. Sep 57, 20p 5 refs. Technical note AAL-TN-57-24; AD-230 834.
Order from LC mi$2.70, ph$4.80 PB 146 243

Four experiments are reported: (1) effect of cold on growth, efficiency ratio, and liver fat in adult rats; (2) curative effect of cold on fatty livers; (3) preventive and curative effect of cold on cholesterol fatty livers; and (4) effect of high dietary fat levels on liver fat in the cold. Results indicate that (1) cold is an effective lipotropic agent in both young and adult animals; (2) cold has a curative as well as a preventive effect on fatty livers; (3) cold does not have preventive or curative effects on the blood or liver cholesterol in cholesterol-fed rats; (4) cold has a preventive and curative effect on the neutral fat fraction of the liver in cholesterol-fed rats in the cold; and (5) the lipotropic effect of cold appears to be due to an effect on the neutral fat fraction with all of the diets studied.

School of Aviation Medicine, Brooks AFB, Tex.
CARBON MONOXIDE CAPACITY MEASUREMENTS ON HUMAN AND RAT SKELETAL MUSCLE, by James P. Ellis, Jr., Robert T. Clark and others. Oct 59, 7p. 9 refs. Rept. 59-25. AD-231 541.
Order from LC mi$1.80, ph$1.80 PB 146 189

Two methods were comparatively evaluated for subsequent use as a measure of the CO capacity of animal tissues. One method was based on measurement of the volume of carbon monoxide extracted from muscle homogenates which had previously been equilibrated with known $CO-N_2$ mixtures; the other method was based on estimation of the CO capacity from the spectrophotometric differential determination of the hemoglobin and myoglobin content of the muscle. A comparative analysis, employing the two methods, was also carried out on human and rat muscle.

School of Aviation Medicine, Brooks AFB, Tex.
A STUDY OF THE REFERENCE AND 90-DAY AUDIOGRAMS OF A GROUP OF AIR FORCE AIRCRAFT AND ENGINE MAINTENANCE MEN, by Daryle L. Waldron. Oct 59, 14p. 7 refs. Rept. 59-96.
Order from LC mi$2.40, ph$3.30 PB 146 187

This report presents a descriptive analysis of these audiograms and of the differences between them.

Tufts [U.] School of Medicine, Boston, Mass.
METABOLISM OF FATTY ACIDS AND KETONE BODIES IN ANIMALS EXPOSED TO COLD, by David Rapport. Rept. for 31 Jan-30 Apr 58 on Contract AF 18(600)583. June 58, 15p. 3 refs. Technical note AAL-TN-58-5; AD-230 837.
Order from LC mi$2.40, ph$3.80 PB 146 239

Contents:
- Development of a method of isolating non-phosphorus containing esters of fatty acids
- Standardization of a method for paper chromatography of phospholipids
- Gas chromatography of lipids and derivatives
- Methods developed for oxidative phosphorylation studies
- Adenosinetriphosphatase incubation procedure
- Measurement of inorganic phosphate from ATP breakdown
- Further work on the volatile lipid formed during the metabolism of albumin-palmitate-1-C^{14}
- Metabolic effects of hypothermia in vitro
- Continuation of studies on acetate oxidation by a homogenate system

Tufts U. School of Medicine, Boston, Mass.
METABOLISM OF FATTY ACIDS AND RELATED SUBSTANCES IN ANIMALS EXPOSED TO COLD, by David Rapport. Rept. for 1 Feb-30 Apr 59 on Contract AF 41(657)145. June 59, 10p. 2 refs. Technical note AAL-TN-59-17; AD-230 851.
Order from LC mi$1.80, ph$1.80 PB 146 236

The addition of glucose to the supernatant fraction resulted in a 20% increase in $C^{14}O^2$ production from acetate-1-C^{14} by both control and cold-fasted mitochondria. In addition, glucose plus hexokinase was a more potent stimulator of acetate oxidation than glucose plus the supernatant. The mitochondria from the control rats oxidized acetate much more rapidly in the presence of glucose plus hexokinase plus the supernatant, while the cold-fasted mitochondria oxidized acetate no faster than when glucose and hexokinase were present alone. AMP and ATP appeared to be equally effective in promoting acetate oxidation by control mitochondria. ATP caused cold-fasted mitochondria to oxidize acetate at appreciably higher rates than did AMP. Findings indicated that the serious defects in acetate oxidation in the cold-fasted liver slices and homogenates did not appear in the mitochondria.

Tufts U. School of Medicine, Boston, Mass.
RELATIVE MERITS OF SLOW VERSUS RAPID REWARMING AND INTERNAL VERSUS EXTERNAL REWARMING FOLLOWING ACUTE GENERAL AND LOCAL HYPOTHERMIA, 1, by Henry E. D'Amato and Benjamin G. Covino. Rept. on Contract AF 41(657)183. June 58, 4p. Technical note AAL-TN-58-21; AD-230 840.
Order from LC mi$1.80, ph$1.80 PB 146 238

General Hypothermia: Studies were made to ascertain the cardiovascular changes which occur during cooling and rewarming techniques. No gross neurological abnormalities were observed in 15 dogs who had been rendered hypothermic by immersion in crushed ice. All animals appeared healthy, exhibiting normal appetite and activity. No behavioral changes were observed. No cardiovascular collapse occurred in any of the 4 animals cooled to a rectal temperature of 25°C and rapidly rewarmed or cooled to a rectal temperature of 25° to 30°C and slowly rewarmed. Local hypothermia: The right hind paws of 5 rabbits were maintained at a temperature of -2° to -8°C (as measured by a needle thermister probe placed beneath the skin) for 30 min and subsequently rewarmed in warm (45°C) air. All animals developed a severe case of frostbite. Five rabbits were subjected to the same procedure except that the limbs were rewarmed rapidly in hot (45°C) water. Rapid rewarming appeared to be more efficacious than slow rewarming in cases of severe frostbite of 30 min duration.

Vision Research Labs., U. of Michigan, Ann Arbor.
DETECTABILITY OF TARGETS CONSISTING OF MULTIPLE SMALL POINTS OF LIGHT, by A. B. Kristofferson and W. N. Dember. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Sep 58, 25p. 9 refs. Rept. no. 2144-298-T.
Order from LC mi$2.70, ph$4.80 PB 146 000

An element-contribution hypothesis developed previously to account for the detectability of symmetric, uniform, continuous targets is extended to the case of targets consisting of two, three, and five discrete points of light. The data presented on the detection probability of such targets are analyzed with respect to both the modified element-contribution hypothesis and the hypothesis of statistical summation of independent events. Contrast thresholds for these targets are predicted from the data for uniform circular targets of various diameters in conjunction with the data for a single-point target at various intrafoveal positions.

Washington U., Seattle.
THERMAL STRESS AND PHYSIOLOGICAL STRAIN, by L. D. Carlson and K. J. K. Buettner. Rept. on Contract AF 18(600)1467. June 57, 14p. 19 refs. Technical note AAL-TN-57-13; AD-230 831.
Order from LC mi$2.40, ph$3.30 PB 146 242

The evaluation of environmental stress and the resulting physiological strain is presented. Environmental stress is defined as the tendency of the environment to cause a change in the individual. Strain is defined as the change in the homeotherm brought about by the stress (the alteration in physiological function to maintain temperature) and the degree to which this change is effective. A statement of the environmental stress at temperatures below 21°C should include air temperature, wind decrement, and radiation increment. The mechanisms available for maintenance of heat balance with a negative load are increased heat production and added insulation. Departure from the steady state will show an increased heat production, a decreased skin temperature. The environmental stress at temperatures above 21°C in the clothed individual includes air temperature, wind velocity, radiation gain, and water vapor pressure. The mechanisms available for maintenance of heat balance were found to be increased blood circulation to the skin and evaporation.

Willow Run Labs., U. of Michigan, Ann Arbor.
THE MAGNITUDE OF THE PULFRICH STEREOPHENOMENON AS A FUNCTION OF TARGET VELOCITY, by Alfred Lit. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Jan 59, 16p. 10 refs. Rept. no. 2144-362-T.
Order from LC mi$2.40, ph$3.30 PB 145 785

When filters of unequal optical density are placed in front of the two eyes, a target which is actually oscillating in a frontoparallel plane appears nearer than it really is for one direction of stroke and farther than it really is for the return stroke (Pulfrich stereophenomenon). Measurements of the near and far displacements of a black vertical rod have been obtained for a wide range of target velocities under each of several conditions of unequal binocular retinal illuminance. The experimental data show that, for any given difference in binocular retinal illuminance, the near and far displacements progressively increase as target velocity is increased. The data show also that, for any given target velocity, the near and far displacements progressively increase as the difference in binocular retinal illuminance is increased. The obtained results are analyzed in terms of an hypothesized absolute visual latent period whose magnitude is assumed to be an inverse function of level of retinal illuminance. The results are shown to be in good quantitative agreement with predictions based on the geometrical theory of the Pulfrich effect. Discrepancies at low target velocities are noted and discussed. (Author)

Biochemistry

Institute of Psychiatry, Maudsley Hospital, London (Gt. Brit.)
ADVANCED STUDY OF CHEMICAL MECHANISMS IN CEREBRAL FUNCTIONING. Final technical rept. no. 2 for 1 Nov 58-31 Oct 59 on Contract DA 91-591-EUC-882-01-1018-59. [1959] 12p. 1 ref. AD-230 070.
Order from LC mi$2.40, ph$3.30 PB 146 204

Methods have been examined for the partial purification of a cerebral phosphoprotein, attached to particulate matter and undergoing metabolic change when intact cerebral tissues are stimulated electrically. The phosphoprotein was not extracted from tissue residues by solutions of sodium chloride or magnesium sulphate at 2.5-3.0μ; by acidic or alkaline buffers or by treatment with n-butanol. Complete solution was obtained with a sulphonated alkyl detergent, presumably as a result of micelle formation. Other detergents lead to a degradation of the phosphoprotein. From solution, the material can be precipitated with acetone at low temperature and dissolved in dilute alkali. The results are discussed with regard to the importance of the phosphoprotein in the activity metabolism of nervous tissue and aspects for future study are indicated.

Naval Radiological Defense Lab., San Francisco, Calif.
EFFECTS OF X-IRRADIATION ON LIPID METABOLISM. IV. LIPOGENESIS FROM ACETATE-C^{14} BY THE LIVER, by W. L. Warner, S. R. Lerner, and C. Entenman. 23 Oct 57, 25p. 16 refs. Research and Development Technical rept. USNRDL-TR-194; AD-160 461.
Order from LC mi$2.70, ph$4.80 PB 145 829

Rats, mice and guinea pigs were subjected to whole body X-irradiation and the uptake of C^{14} from acetate-C^{14} into liver lipids and exhaled CO_2 was determined. The conversion of acetate-C^{14} to lipid C^{14} in liver slices prepared 24 hours after irradiation was increased as much as 20 fold in rats, 2 fold in guinea pigs and not at all in mice. The changes noted were roughly correlated with the levels of liver glycogen. The data offer a possible explanation for the previously observed increases in blood lipid levels following X-irradiation. (Author)

Schulz, G. V.
TEMPERATURE DEPENDENCE OF SECOND VIRIAL COEFFICIENT IN SERUM ALBUMIN SOLUTIONS, by G. V. Schulz, H. Ende and H. Inagaki. Technical rept. (Final) 1 Nov 58-30 Oct 59, on Thermodynamical Behaviour of Albumin in Solution, Contract DA 91-591-EUC-980-01-1107-59, [1959] 19p. 26 refs. AD-231 392.
Order from LC mi$2.40, ph$3.30 PB 145 951

Scattered intensities from bovine serum albumin in solution were studied at several temperatures in the vicinity of its isoionic point and in the presence of sodium chloride. The extraneous salt concentration dependence of second virial coefficient A_2 was discussed in terms of the theory of Edsall et al. (J. Am. Chem. Soc. 68:2315, 1946) and the protein-protein interaction term β_{22} was estimated from the observed data.

University of Southern California. School of Medicine, Los Angeles.
TESTOSTERONE-INDUCED N-RETENTION IN CASTRATED RATS ON DIETS CONTAINING INCOMPLETE PROTEINS, by M. E. Nimni and E. Geiger. Rept. on Contract AF 18(600)549. Oct 57, 8p. 9 refs. Technical note AAL-TN-57-28; AD-230 836.
Order from LC mi$1.80, ph$1.80 PB 146 240

Testosterone propionate treatment increased the nitrogen retention of castrated adult male rats even when the diet contained zein or gelatin as the only nitrogen sources, compounds which do not support protein synthesis because of their lack of some essential amino acids. A slight shift to positive nitrogen balance has been observed in TP-treated rats which received, as their only nitrogen source, a mixture of 3 non-essential amino acids. The results, therefore, seem to suggest that TP-induced nitrogen retention does not necessarily indicate an increase of tissue protein synthesis.

Medical Specialties and Equipment

Armed Services Technical Information Agency, Arlington, Va.
BIO-ASTRONAUTICS, SUPPLEMENT. Report Bibliography. Feb 60, 49p. 248 refs. AD-233 000.
Order from OTS $1.25 PB 161 653

Previous bibliographies have covered the literature on bio-astronautics through 1958. This supplemental bibliography brings the subject matter up to date through 1959 insofar as report literature, represented by ASTIA holdings, is concerned. (Author) (See also PB 151 853)

Army Prosthetics Research Lab., Washington, D. C.
COMPARISON OF STAIN RESISTANCES OF VINYL MATERIAL DETERMINED BY THE SPECTROPHOTOMETER AND COLOR-DIFFERENCE METER, by James Hill and William Wiedmann. 3 Feb 59, 4p. 2 refs. Technical rept. no. 5904.
Order from LC mi$1.80, ph$1.80 PB 145 705

Stain resistance values were calculated and results compared.

National Bureau of Standards, Washington, D. C.
ANALOG-DIGITAL CONVERSION EQUIPMENT FOR ELECTROCARDIOGRAPHIC DATA, by L. Taback. Apr 60, 46p. Technical note 42.
Order from OTS $1.25 PB 151 401

A corrected orthogonal 3-lead system has been used to record electrocardiograms directly from patients at Veterans Hospitals, using three FM channels of magnetic tape. A pilot facility has been designed and assembled by NBS to permit a medical technician to inspect these on an oscilloscope and select a significant cardiac cycle. This is automatically sampled at millisecond intervals and the numerical values are stored in digital form on magnetic tape acceptable to an electronic computer. Upon writing various programs for the digital computer, the cardiac researcher will have a flexible tool for objective analysis of large quantities of biological data by a variety of possible criteria. (Author)

School of Aviation Medicine, Brooks AFB, Tex.
RESTORATIVE DENTISTRY WORKLOAD OF THE USAF DENTAL SERVICE, by Lucian Szmyd and Clarence M. McCall, Jr. Jan 60, 7p. 5 refs. Rept. 60-27; AD-232 648.
Order from LC mi$1.80, ph$1.80 PB 146 145

This analysis indicates that the system of allocating dental resources on the basis of total number of personnel assigned is complicated by personnel turnover, and by the restorative dental problem of incoming basics and overseas dependents.

Microbiology

Army Chemical [Corps] Fort Detrick, Md.
MONKEY B VIRUS: A REVIEW OF THE LITERATURE, by William T. Soper. Aug 59, 26p. 35 refs. BWL Technical Study 17. AD-229 993.
Order from LC mi$2.70, ph$4.80 PB 145 874

The content of this report deals with the original observations of Dr. Albert Sabin on infection of man with B virus and continues with accounts of other known infections. Diagnostic methods for isolation and identification of the virus in monkeys and man are included. The growth and action of the virus in various host tissues and it's physical and chemical properties are discussed.

Karolinska Institutet, Stockholm (Sweden).
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Order from LC mi$2.70, ph$4.80 PB 146 205

H. pertussis was grown under pilot plant conditions and the cells were broken up and extracted. The two basic fractions were the soluble components obtained by extraction and the sedimentable portion which proved to consist of cellwalls which could be tested in the form of a lyophilic colloid. The extract contained both a neurotoxic and a dermatonecrotic component which could be roughly separated by physicochemical techniques. None of the nucleic acid or protein fractions isolated from the bacterial extracts were immunogenic. On the other hand the sedimentable portion proved to be an excellent immunogen with almost no toxicity. It is unfortunate that the immunogen of H. pertussis to such a large extent is associated with, or identical with cellwall fragments. A fact which makes the originally planned study of the yields as a function of the growth phase difficult or impossible to perform.

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The work was to determine whether it was immunologically practical to combine a large number of bacterial vaccines and toxoids in one preparation for inoculation of man. Small laboratory animals were suggested for these preliminary experiments in which an attempt would be made to combine a minimum of five and a maximum of ten antigens. The scope of work included the study of "non-biological" adjuvants such as aluminum gels and mineral oil to improve the protective capacity of the product. Immunogenic activities were to be compared by determining the titers of antibodies produced in the serum or the degree of protection conferred against a toxic or infectious challenge. The results of the work are given.

Pathology

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The following investigations were carried out: (1) the influence of body-own proteinogenic amines on the renal function, tested by means of the clearance method on dogs: (2) clearance of electrolytes (Na, K, and Cl); (3) the influence of body-own proteinogenic amines on the renal function tested in diuresis experiments on hydrated rats; (4) the influence of body-own proteinogenic amines on the diuresis of rats after previous gift of an aminoxydase-blocker (Iproniacid); (5) determination of proteinogenic amines in blood and urine of patients suffering from renal and hepatic diseases; (6) the influence of body-own proteinogenic amines on change of gas, body-weight, blood-sugar, and body temperature of rats and rabbits, respectively.

Pharmacology and Toxicology

Army Chemical Corps., Fort Detrick, Md.
THE LABORATORY PRODUCTION OF GONYAULAX CATANELLA POISON, by Lloyd H. Graf, Mabel J. Thacher, and Carl R. Brewer. Rept. for Apr 51-Mar 52. 6 Nov 52, 44p. 4 refs. Special rept. no. 174.
Order from LC mi$3.30, ph$7.80 PB 145 875

The investigations described in this report were under taken with the objective of providing a reliable source of G catanella poison in order that chemical characterization might proceed without interruption caused by failure of the natural sources. Attempts were made to increase poison yields by systematic studies on nutrition and incubation conditions affecting G catanella.

Army Chemical Warfare Labs., Army Chemical Center, Md.
EFFECTS OF STRUCTURAL VARIATIONS IN SYSTOX AND ISOSYSTOX ANALOGS ON THEIR REACTIONS WITH CHOLINESTERASE, by Frederick W. Hoffman, James W. King and Harry O. Michel. Rept. for Sep 57-Feb 59. Nov 59, 11p. 9 refs. CWLR-2325, AD-230 382.
Order from LC mi$2.40, ph$3.30 PB 146 251

The effect of variation of the alkoxy group (R') in the series of Systox and Isosystox analogs of the types (RP(S)(OR') $OCH_2CH_2SC_2H_5$(I) and RP(O)(OR')$SCH_2CH_2SC_2H_5$(II), respectively, was investigated for the compounds with R being CH_3 and C_2H_5. The thiono compounds of type I were prepared by the reaction of the appropriate chloridothioates, RP(S)(OR')Cl, with the sodium derivative of 2-ethylthioethanol, and the resulting compounds I isomerized thermally to the thiolo derivatives II. The rates of the inactivation of cholinesterase by I at pH 7.4 and 25° are all small compared to those of the II which show, with increasing chain length of the R' group, increasing velocity constants. (Author)

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METHODS FOR QUANTITATIVE DETERMINATION OF GB ABSORBED FROM INSPIRED AIR OF MAN DURING REST AND EXERCISE, by Fred W. Oberst, William S. Koon and James W. Crook. Oct 52, declassified 30 Mar 59, 29p. 9 refs. Medical Labs. Research rept. no. 143.
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A method was developed for the quantitative determination of GB absorbed from inspired air of man during rest and exercise. A subject inspired orally a known concentration of GB (GB=fluoroisopropoxymethyl phosphine oxide) vapor and exhaled it into a Kel-F bag, the concentration was determined by analysis. The amount of GB retained in the body was calculated. To increase the minute volume of respired air the subject performed work on an ergometer. The amount of GB retained (dosage) for a two minute inhalation period in a man at rest varied between 6 and 13 mmg. During inhalation of a comparable concentration exercise increased the amount retained to 24-82 mmg. (Author)

Radiobiology

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
INFLUENCE OF DIETARY CYSTEINE UPON THE EFFECTS OF CONTINUOUS LOW-LEVEL IRRADIATION, by R. L. Preston and A. Hellman. Rept. on Physiology of Flight. Dec 59, 18p. 15 refs. WADC Technical note 59-190.
Order from OTS $0.50 PB 161 655

Continuous gamma radiation (38.6 and 76.8 roentgens/week given in 8- and 16-hour periods/day, respectively) was administered for 6 weeks to 9 growing rats/radiation level. These were compared to 9 controls. Within these 3 groups, 3 levels of cysteine (0%, 0.4% and 1.6% of total diet) were individually fed in a factorial experiment to determine if this compound in the daily diet would alleviate the effects of continuous irradiation. Adverse effects on a number of physiological variables caused by the irradiation were not alleviated by the administration of this compound. In fact, certain criteria were affected to a greater degree when the animals were fed the high level of cysteine (reduced body growth, feed consumption and efficiency, and thymus and spleen weights). (Author)

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THE METABOLISM OF THE RADIATION PROTECTIVE AGENT 2-AMINO-ETHYLISOTHIURONIUM BROMIDE HYDROBROMIDE IN MICE AND ITS ALTERATION BY RADIATION, by Bernard Shapiro. Dec 59, 13p. 8 refs. AFSAM 59-30; AD-231 617.
Order from LC mi$2.40, ph$3.30 PB 146 188

These experiments were designed to separate the various metabolic forms which appear in the mouse after intraperitoneal injection of AET 2-aminoethylisothiuronium bromide hydrobromide (AET) and to measure the changes in these forms induced by radiation. S-35 labeled AET, paper chromatography, and paper electrophoresis were utilized in making these analyses.

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PROTEIN BINDING OF AET AND ITS ALTERATION BY IONIZING RADIATION, by E. Anne Dickens and Bernard Shapiro. Jan 60, 12p. 7 refs. AFSAM 60-2.
Order from LC mi$2.40, ph$3.30 PB 146 190

Previous reports have described investigations of the behavior of the radiation protective agent, S-(2-aminoethyl) thiuronium bromide hydrobromide (AET) in aqueous buffered solutions (1, 2) and in human serum (3). In aqueous buffered solutions AET underwent transguanylation to form 2-mercaptoethylguanidine (MEG) and its disulfide, guanidoethyl disulfide (GED). In 10^{-3} M solutions of sulfur-35-labeled AET in human serum, 30 to 45 percent of the radioactivity was bound to the serum proteins. The amount of binding did not appear to change appreciably when the serum was allowed to stand at room temperature or when it was exposed to a dose of 240,000 rep from a cobalt-60 gamma ray source. After doses of 1,000,000 rep, however, it was noted that the amount of radioactivity bound to the serum proteins increased. Since radiation protection may be effected by a protein-bound form of the protective agent (4, 5), it seemed that a further investigation of protein binding and its alteration by radiation should be made. A detailed study of the interaction between MEG-GED mixtures and various proteins in solution and of the effect of irradiation upon their interaction is herein reported.

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THE EFFECTS OF RADIATION ON OXYGEN DESIGNED FOR HUMAN CONSUMPTION, by John F Kircher, Justin S. McNulty and others. Rept. on Health Hazards of Materials and Radiation, Contract AF 33(616)5659. Dec 59, 37p. 24 refs. WADC Technical rept. 59-618.
Order from OTS $1.00 PB 161 551

Both liquid and gaseous aviator's breathing oxygen, contained under controlled pressure and temperature in stainless steel vessels, were subjected to gamma irradiation. The rate of ozone formation in liquid oxygen was nearly constant to 5.9 x 10^8 ergs $g.^{-1}$ (C), the maximum dose used in these studies. Ozone formed during irradiation of gaseous oxygen, reached a maximum concentration at about 3 x 10^7 ergs $g.^{-1}$(C) and decreased to an equilibrium concentration at about 10^9 ergs $g.^{-1}$(C). The ozone yield appeared to be independent of pressure and dependent upon temperature and dose rate. There were marked increases in the ozone yield with decreasing temperature and with increasing dose rate. In mixed-field irradiations, induced radioactivity due to argon-41 was found. The equilibrium activity was 10 to 14 x 10^{-5} microcuries per c.c. (Author)

[Defense Atomic Support Agency] Washington, D. C.
MILITARY ASPECTS OF THE BIOLOGICAL EFFECTS OF RADIATION, by Nathaniel I. Berlin.
9 Nov 56, declassified 24 July 57, 58p. 67 refs.
AFSWP-611; AD-212 721.
Order from LC mi$3.60, ph$9.30 PB 146 481

This study has been prepared as a review of some military aspects of radiobiology. Particular attention has been paid to the dosimetric considerations and the quantitation of biological effect. Wherever possible, areas of controversy have been reviewed and evaluated. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
A PROGRAM FOR THE EVALUATION OF THE EFFICIENCY OF RESPIRATORY PROTECTIVE DEVICES AGAINST RADIOACTIVE SUBSTANCES, by F. R. Holden. Interim rept. 26 Sep 49, declassified, 7p. 2 refs. AD-165(H).
Order from LC mi$1.80, ph$1.80 PB 146 855

A program for the evaluation of the effieiency of respiratory protective devices against radioactive substances is outlined. Radon decay products and radioactive dusts of controlled particle size will be used to measure filtration efficiencies of military and industrial protective equipment. The chambers in which the studies will be made are described. (Author)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. Monthly rept.
Apr 60, 48p. 12 refs.
Order from OTS $0.50, $3.00/6 mos. PB 161 371-1

Contents:
Interpretations of radiation levels
Milk
Description of public health service milk monitoring program
Public health service data on radioactivity in milk (November 1959)
Atomic Energy Commission data on radioactivity in milk
State of Minnesota milk data
A selected list of environmental sampling networks for analysis of radioactivity in milk
Milk networks - methods of publication of data
Milk networks - list of sampling stations

School of Aviation Medicine, Brooks AFB, Tex.
SOME EVIDENCE SUGGESTING THE PERCEPTION OF MODERATE-INTENSITY RADIATION AMONG ALBINO RATS, by Loren C. Logie, W. Lynn Brown (Radiobiological Lab., U. of Texas) and others.
Sep 59, 6p. 3 refs. Rept. 60-5.
Order from LC mi$1.80, ph$1.80 PB 146 147

Two experiments designed to test the hypothesis that albino rats perceive x-radiation as a noxious stimulus are reported. Each experiment involved two conditions which were exactly alike except for the location of a protective lead shield. For half of the Ss, the lead shield was located in front of the right-hand compartment of the shuttle-boxes; for the other half, the lead shield was located in front of the left-hand compartment. In each experiment the results suggested that radiation, or its immediate consequence, was perceived by the rats; however, in each experiment the observed effect was very moderate. (Author)

USAF Radiation Lab., U. of Chicago, Ill.
RADIATION AND SUSCEPTIBILITY TO INFECTION: A LITERATURE SURVEY, by Robert D. Boche.
Special rept. on Contract AF 33(038)27353. [1954]
67p. 269 refs. AD-108 849.
Order from LC mi$3.90, ph$10.80 PB 146 480

Radiation exposure of animals with amounts of ionizing radiations in the LD-50 range produces radiation illness and death characterized by invasion of the bloodstream and tissues by bacteria from the intestine. The mechanism by which the bacteria invade the blood stream is unknown. The organisms recovered from irradiated animals are found to be those characteristic of the species. Latent infections are activated by radiation and the rate of spread of infections is increased by irradiation. Human exposures are often characterized by infectious processes after the second week post-irradiation, a fact in agreement with animal experience. The susceptibility of laboratory animals to induced infection is usually increased by moderate or large doses of radiation. Radiation decreases the cellular elements of the blood and in mice the depression of the white blood cell count like that of the resistance has been found to be exponentially related to radiation dose. Increase in phagocytosis by leukocytes of the blood and by the cells of the liver and spleen is observed after radiation. Destruction of lymphocytes by x-radiation does not increase antibody content of the blood or lymph. Antibiotics reduce both the incidence of infection and the mortality in laboratory animals given radiation exposure providing the invading organisms are susceptible to the antibiotic. The localization of the effect of radiation exposure on antibody production to within a few hours of antigen administration is a notable advance in our knowledge of the immune process.

CHEMISTRY

Analytical Chemistry

Army Chemical Warfare Labs., Army Chemical Center, Md.
PRELIMINARY MODEL ROTATING FILTER WHEEL LOPAIR (LONG PATH INFRARED) INSTRUMENT, by Arnold Prostak. 3 Nov 58, 16p. 5 refs. CWL Technical memo. 32-37; AD-207 510.
Order from LC mi$2.40, ph$3.30 PB 146 858

A relatively simple instrument has been built to detect small quantities of contaminants in the air by means of their infrared absorption at a specified wavelength. A rotating filter wheel was used to chop the radiation and provide wavelength selectivity. (Author)

Bell Aircraft Corp., Buffalo, N. Y.
INVESTIGATION OF FUMING NITRIC ACID CONTAMINANTS, by D. Fulmer. Final rept. for 8 Apr 57-30 Sep 58 on Contract DA 18-108-cml-6308. 31 Oct 58, 100p. 5 refs. Rept. no. 8002-981-017; AD-208 452.
Order from LC mi$5.40, ph$15.30 PB 145 906

A whole series of experiments were performed, using containers of various capacities and of various aluminum alloy compositions. Variables included temperature, time, exposure to the atmosphere or fully enclosed with no access to the air. Many series of analyses were performed on the solid contaminants, gaseous products and dissolved materials. Other related studies were undertaken.

Louisiana State U., Baton Rouge.
COLOR REACTIONS FOR INORGANIC ANALYSIS, by Philip W. West. Final rept. on Contract DA 01-009-ORD-460. 1 Mar 59, 51p. 5 refs. OOR rept. 350.15C; AD-213 326.
Order from OTS $1.50 PB 161 544

A variety of color reactions have been studied for inorganic analysis. The studies were directed along two different lines. One phase of the research program was directed toward the development of color reactions that could be applied to nonaqueous systems, especially those associated with solvent extraction separations. The second phase of the program dealt with general studies of colorimetric analysis. Two contributions of special interest have resulted from the program. One is the development of a rapid, simple and reliable scheme for the microanalysis of complex mixtures using only a single drop of solution. The scheme permits the separation and identification of over thirty ions in total time of approximately thirty to forty minutes. The second major contribution has been the development of a highly selective and accurate direct spectrophotometric method for the estimation of chloride. The method is more accurate than any known titrimetric procedure for small amounts of chloride and is free from interferences, even from other halides.

New Mexico Highlands U., Las Vegas.
THE BEHAVIOR OF SOME NIOBIUM(V)-HALIDE COMPLEXES IN AQUEOUS MEDIA, by James H. Kanzelmeyer, B. M. Procter, and Patricia Mack. Final rept. on Contract Nonr-1839(00). 27 May 59, 53p. 6 refs.
Order from LC mi$3.60, ph$9.30 PB 145 745

Evidence has been presented that conflicts with the previously accepted $NbOF_5^{=}$ ions postulated for potassium fluoniobate. This salt, dissolved in water, acts as a moderately strong acid reacting with four hydroxides per niobium to form a soluble niobate, a reaction which appears to be both reversible and rapid. A structure has been proposed that takes into consideration these observations and also accounts for the measured conductance of the solutions. The ionic structure consists of two niobium (V) atoms held together by an oxo linkage. Each niobium is covalently linked to five fluorides and one hydroxyl. Eight of the fluorides are comparatively labile, but one on each niobium is hydrogen-bonded to the hydroxyl on the other niobium. (Author)

Organic Chemistry

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
UREA INCLUSION COMPOUNDS OF ACETYLENE DERIVATIVES, by Jack Radell, Joseph W. Connolly, and Louis D. Yuhas. Feb 60, 13p. 11 refs. WADC Technical rept. 59-672.
Order from OTS $0.50 PB 161 686

Urea inclusion compounds of several acetylene derivatives have been prepared. In the monalkyl and dialkyl acetylenes, the effect of the acetylene group increased the over-all cross-sectional diameter of the molecule. The ability of the acetylenic molecules to form a urea inclusion compound is a function of the number of consecutive $-CH_2-$groups and the over-all cross-sectional diameter of the molecule. The relative stability of the urea inclusion compounds of a series of position isomers of nonyne or decyne depends on the cross-sectional diameter of the molecule. (Author)

Atlantic Research Corp., Alexandria, Va.
THE THERMAL DECOMPOSITION OF 2, 2'-AZOISOBUTANE, by Joseph B. Levy and B. K. W. Copeland. Rept. on Contract AF 49(638)483. Jan 60, 19p. 17 refs. AFOSR-TN-60-161; AD-232 818.
Order from LC mi$2.40, ph$3.30 PB 145 838

The thermal decomposition of gaseous 2, 2'-azoisobutane has been studied over the temperature range 180-220°. The principal reaction products were isobutane and nitrogen. Mirror removal experiments were carried out with antimony mirrors and the lifetime of the t-butyl radical determined. The radical was found to have a substantially longer life than methyl radical. The significance of these results is discussed and a mechanism for the reaction proposed.

Army Chemical [Corps] Fort Detrick, Md.
MONKEY B VIRUS: A REVIEW OF THE LITERATURE, by William T. Soper. Aug 59, 26p. 35 refs. BWL Technical Study 17. AD-229 993.
Order from LC mi$2.70, ph$4.80 PB 145 874

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THE EFFECTS OF RADIATION ON OXYGEN DESIGNED FOR HUMAN CONSUMPTION, by John F Kircher, Justin S. McNulty and others. Rept. on Health Hazards of Materials and Radiation, Contract AF 33(616)5659. Dec 59, 37p. 24 refs. WADC Technical rept. 59-618.
Order from OTS $1.00 PB 161 551

Both liquid and gaseous aviator's breathing oxygen, contained under controlled pressure and temperature in stainless steel vessels, were subjected to gamma irradiation. The rate of ozone formation in liquid oxygen was nearly constant to 5.9×10^8 ergs $g.^{-1}$(C), the maximum dose used in these studies. Ozone formed during irradiation of gaseous oxygen, reached a maximum concentration at about 3×10^7 ergs $g.^{-1}$(C) and decreased to an equilibrium concentration at about 10^9 ergs $g.^{-1}$(C). The ozone yield appeared to be independent of pressure and dependent upon temperature and dose rate. There were marked increases in the ozone yield with decreasing temperature and with increasing dose rate. In mixed-field irradiations, induced radioactivity due to argon-41 was found. The equilibrium activity was 10 to 14×10^{-5} microcuries per c.c. (Author)

[Defense Atomic Support Agency] Washington, D. C.
MILITARY ASPECTS OF THE BIOLOGICAL EFFECTS OF RADIATION, by Nathaniel I. Berlin.
9 Nov 56, declassified 24 July 57, 58p. 67 refs.
AFSWP-611; AD-212 721.
Order from LC mi$3.60, ph$9.30 PB 146 481

This study has been prepared as a review of some military aspects of radiobiology. Particular attention has been paid to the dosimetric considerations and the quantitation of biological effect. Wherever possible, areas of controversy have been reviewed and evaluated. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
A PROGRAM FOR THE EVALUATION OF THE EFFICIENCY OF RESPIRATORY PROTECTIVE DEVICES AGAINST RADIOACTIVE SUBSTANCES, by F. R. Holden. Interim rept. 26 Sep 49, declassified, 7p. 2 refs. AD-165(H).
Order from LC mi$1.80, ph$1.80 PB 146 855

A program for the evaluation of the effieiency of respiratory protective devices against radioactive substances is outlined. Radon decay products and radioactive dusts of controlled particle size will be used to measure filtration efficiencies of military and industrial protective equipment. The chambers in which the studies will be made are described. (Author)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. Monthly rept.
Apr 60, 48p. 12 refs.
Order from OTS $0.50, $3.00/6 mos. PB 161 371-1

Contents:
Interpretations of radiation levels
Milk
Description of public health service milk monitoring program
Public health service data on radioactivity in milk (November 1959)
Atomic Energy Commission data on radioactivity in milk
State of Minnesota milk data
A selected list of environmental sampling networks for analysis of radioactivity in milk
Milk networks - methods of publication of data
Milk networks - list of sampling stations

School of Aviation Medicine, Brooks AFB, Tex.
SOME EVIDENCE SUGGESTING THE PERCEPTION OF MODERATE-INTENSITY RADIATION AMONG ALBINO RATS, by Loren C. Logie, W. Lynn Brown (Radiobiological Lab., U. of Texas) and others.
Sep 59, 6p. 3 refs. Rept. 60-5.
Order from LC mi$1.80, ph$1.80 PB 146 147

Two experiments designed to test the hypothesis that albino rats perceive x-radiation as a noxious stimulus are reported. Each experiment involved two conditions which were exactly alike except for the location of a protective lead shield. For half of the Ss, the lead shield was located in front of the right-hand compartment of the shuttle-boxes; for the other half, the lead shield was located in front of the left-hand compartment. In each experiment the results suggested that radiation, or its immediate consequence, was perceived by the rats; however, in each experiment the observed effect was very moderate. (Author)

USAF Radiation Lab., U. of Chicago, Ill.
RADIATION AND SUSCEPTIBILITY TO INFECTION: A LITERATURE SURVEY, by Robert D. Boche.
Special rept. on Contract AF 33(038)27353. [1954]
67p. 269 refs. AD-108 849.
Order from LC mi$3.90, ph$10.80 PB 146 480

Radiation exposure of animals with amounts of ionizing radiations in the LD-50 range produces radiation illness and death characterized by invasion of the bloodstream and tissues by bacteria from the intestine. The mechanism by which the bacteria invade the blood stream is unknown. The organisms recovered from irradiated animals are found to be those characteristic of the species. Latent infections are activated by radiation and the rate of spread of infections is increased by irradiation. Human exposures are often characterized by infectious processes after the second week post-irradiation, a fact in agreement with animal experience. The susceptibility of laboratory animals to induced infection is usually increased by moderate or large doses of radiation. Radiation decreases the cellular elements of the blood and in mice the depression of the white blood cell count like that of the resistance has been found to be exponentially related to radiation dose. Increase in phagocytosis by leukocytes of the blood and by the cells of the liver and spleen is observed after radiation. Destruction of lymphocytes by x-radiation does not increase antibody content of the blood or lymph. Antibiotics reduce both the incidence of infection and the mortality in laboratory animals given radiation exposure providing the invading organisms are susceptible to the antibiotic. The localization of the effect of radiation exposure on antibody production to within a few hours of antigen administration is a notable advance in our knowledge of the immune process.

CHEMISTRY

Analytical Chemistry

Army Chemical Warfare Labs., Army Chemical Center, Md.
PRELIMINARY MODEL ROTATING FILTER WHEEL LOPAIR (LONG PATH INFRARED) INSTRUMENT, by Arnold Prostak. 3 Nov 58, 16p. 5 refs. CWL Technical memo. 32-37; AD-207 510.
Order from LC mi$2.40, ph$3.30 PB 146 858

A relatively simple instrument has been built to detect small quantities of contaminants in the air by means of their infrared absorption at a specified wavelength. A rotating filter wheel was used to chop the radiation and provide wavelength selectivity. (Author)

Bell Aircraft Corp., Buffalo, N. Y.
INVESTIGATION OF FUMING NITRIC ACID CONTAMINANTS, by D. Fulmer. Final rept. for 8 Apr 57-30 Sep 58 on Contract DA 18-108-cml-6308. 31 Oct 58, 100p. 5 refs. Rept. no. 8002-981-017; AD-208 452.
Order from LC mi$5.40, ph$15.30 PB 145 906

A whole series of experiments were performed, using containers of various capacities and of various aluminum alloy compositions. Variables included temperature, time, exposure to the atmosphere or fully enclosed with no access to the air. Many series of analyses were performed on the solid contaminants, gaseous products and dissolved materials. Other related studies were undertaken.

Louisiana State U., Baton Rouge.
COLOR REACTIONS FOR INORGANIC ANALYSIS, by Philip W. West. Final rept. on Contract DA 01-009-ORD-460. 1 Mar 59, 51p. 5 refs. OOR rept. 350. 15C; AD-213 326.
Order from OTS $1.50 PB 161 544

A variety of color reactions have been studied for inorganic analysis. The studies were directed along two different lines. One phase of the research program was directed toward the development of color reactions that could be applied to nonaqueous systems, especially those associated with solvent extraction separations. The second phase of the program dealt with general studies of colorimetric analysis. Two contributions of special interest have resulted from the program. One is the development of a rapid, simple and reliable scheme for the microanalysis of complex mixtures using only a single drop of solution. The scheme permits the separation and identification of over thirty ions in total time of approximately thirty to forty minutes. The second major contribution has been the development of a highly selective and accurate direct spectrophotometric method for the estimation of chloride. The method is more accurate than any known titrimetric procedure for small amounts of chloride and is free from interferences, even from other halides.

New Mexico Highlands U., Las Vegas.
THE BEHAVIOR OF SOME NIOBIUM(V)-HALIDE COMPLEXES IN AQUEOUS MEDIA, by James H. Kanzelmeyer, B. M. Procter, and Patricia Mack.
Final rept. on Contract Nonr-1839(00). 27 May 59, 53p. 6 refs.
Order from LC mi$3.60, ph$9.30 PB 145 745

Evidence has been presented that conflicts with the previously accepted $NbOF_5^{=}$ ions postulated for potassium fluoniobate. This salt, dissolved in water, acts as a moderately strong acid reacting with four hydroxides per niobium to form a soluble niobate, a reaction which appears to be both reversible and rapid. A structure has been proposed that takes into consideration these observations and also accounts for the measured conductance of the solutions. The ionic structure consists of two niobium (V) atoms held together by an oxo linkage. Each niobium is covalently linked to five fluorides and one hydroxyl. Eight of the fluorides are comparatively labile, but one on each niobium is hydrogen-bonded to the hydroxyl on the other niobium. (Author)

Organic Chemistry

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
UREA INCLUSION COMPOUNDS OF ACETYLENE DERIVATIVES, by Jack Radell, Joseph W. Connolly, and Louis D. Yuhas. Feb 60, 13p. 11 refs. WADC Technical rept. 59-672.
Order from OTS $0.50 PB 161 686

Urea inclusion compounds of several acetylene derivatives have been prepared. In the monalkyl and dialkyl acetylenes, the effect of the acetylene group increased the over-all cross-sectional diameter of the molecule. The ability of the acetylenic molecules to form a urea inclusion compound is a function of the number of consecutive $-CH_2-$groups and the over-all cross-sectional diameter of the molecule. The relative stability of the urea inclusion compounds of a series of position isomers of nonyne or decyne depends on the cross-sectional diameter of the molecule. (Author)

Atlantic Research Corp., Alexandria, Va.
THE THERMAL DECOMPOSITION OF 2, 2'-AZOISOBUTANE, by Joseph B. Levy and B. K. W. Copeland. Rept. on Contract AF 49(638)483. Jan 60, 19p. 17 refs. AFOSR-TN-60-161; AD-232 818.
Order from LC mi$2.40, ph$3.30 PB 145 838

The thermal decomposition of gaseous 2, 2'-azoisobutane has been studied over the temperature range $180-220^{\circ}$. The principal reaction products were isobutane and nitrogen. Mirror removal experiments were carried out with antimony mirrors and the lifetime of the t-butyl radical determined. The radical was found to have a substantially longer life than methyl radical. The significance of these results is discussed and a mechanism for the reaction proposed.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DILUTE SOLUTION PROPERTIES OF POLY(2-ETHYLBUTYL METHACRYLATE) by Frank E. Didot and David W. Levi. Mar 60, 35p. 22 refs. Technical rept. 2676.
Order from LC mi$3.00, ph$6.30 PB 144 827

Florida U. Engineering and Industrial Experiment Station, Gainesville, Fla.
THERMALLY STABLE POLYMERS FROM CONDENSATION POLYMERIZATION OF PERFLUOROALKYL AMIDINES, by Henry C. Brown. Technical rept. on Contract Nonr-580(03). 1 May 59, 54p. 5 refs.
Order from LC mi$3.60, ph$9.30 PB 145 901

This report describes the preparation of new, thermally stable polymers from homopolymerization of perfluoroglutarimidine and perfluoroadipodiamidine and from the copolymerization of perfluoroglutarimidine, perfluorosuccinimidine and perfluoroadipodiamidine with a variety of perfluoroalkyl monoamidines. These polymer products range in physical characteristics from hard solids to elastomeric gums to viscous liquids. All of the polymers are stable in air at 350°C. for extended periods and resist attack by strong oxidizing mineral acids at elevated temperatures. (Author)

Harvard U., Cambridge, Mass.
PREPARATION AND STUDY OF SOME PERFLUOROALKYL COMPOUNDS OF TIN AND LEAD [AND] SYNTHESIS AND CLEAVAGE OF PERFLUOROVINYLTIN COMPOUNDS, by F. G. A. Stone, H. D. Kaesz and others. Rept. on Contract AF 49(638)518. Apr 60, 30p. 35 refs. AFOSR-TN-60-273-274.
Order from LC mi$2.70, ph$4.80 PB 146 765

Leicester U. (Gt. Brit.)
ARYLSILANES AND AROMATIC REACTIVITY, by J. A. Sperry. Annual technical rept. for 1 Jan-31 Dec 59 on Contract DA 91-591-EUC-1024. [1960] 10p. 43 refs.
Order from LC mi$1.80, ph$1.80 PB 145 953

Trimethylsilyl derivatives (mainly new) of benzothiophene, dibenzothiophene, dibenzofuran, N-ethylcarbazole, diphenyl ether diphenylsulphide, diphenylmethane, fluorene, and pyrene have been prepared and studied.

Louisiana Polytechnic Inst. [Ruston.]
THE RLi-INDUCED RING CLOSURE OF TRITYL METHYL ETHER, by J. W. Morton, Jr., W. C. Culp and others. Final rept. for 23 Oct 57-22 Oct 59 on Contract DA 01-009-ORD-585. [1959] 23p. 7 refs. OOR rept. no. 1895. 1-C; AD-231 797.
Order from LC mi$2.70, ph$4.80 PB 145 905

Two mechanisms for the reaction of trityl methyl ether with RLi compounds were investigated in which the reaction yields 9-phenyl-9-fluorenyllithium. In one mechanism, the trityl ether undergoes an ortho metalation, yielding a lithio derivative whose carbanion portion attacks an ortho position of another phenyl group, with the expulsion of methoxide and the formation of a quinoidisomer of 9-phenylfluorene. The latter is then converted into the final lithio derivative by the action of excess RLi. In the second mechanism, the ether, after undergoing ortho metalation, yields a ring closure product, 9-phenyl-9-fluorenyl methylether, by hydride elimination. The fluorenyl ether then yields the final product, either through lateral metalation followed by the elimination of formaldehyde, or through some other mode of reductive cleavage. There is experimental evidence for the ortho metalation which is postulated in both mechanisms. Experimental data agreed well in ruling out the second mechanism as important in the ring closure reaction.

Naval Ordnance Lab., White Oak, Md.
THE TEMPERATURE AND ACTIVATION ENERGY OF ELECTRICAL CONDUCTION IN HIGH POLYMERS, by R. W. Warfield and M. C. Petree. 19 Sep 58, 17p. 19 refs. NAVORD Rept. 6246; AD-212 622.
Order from LC mi$2.40, ph$3.30 PB 145 826

The temperature dependence of the electrical resistivity of a number of high polymers has been determined. By means of an Arrhenius plot, the activation energy for the conduction process in these polymers has been calculated and the results have been interpreted in terms of an ionic diffusion process. The activation energy for the conduction process appears to be a very sensitive index of the extent of polymerization. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
IRRADIATION "FACTOR-DEPENDENCY": SOME VINYL MONOMERS, by Ed. F. Degering, G. J. Caldarella, and M. Mancini. Dec 59, 42p. 5 refs. Radiation Chemistry Lab. Series Research rept. no. 2.
Order from LC mi$3.30, ph$7.80 PB 145 895

Data are given which confirm the observations on the irradiation-induced polymerization of styrene, with respect to the effect of various combinations of parameters. The formulation of Polymerization Rate = $kI^{1/2}$, is not applicable to the dose rates encountered with a 1.5 Mev or higher electron accelerator. The E-value (modified "G_e"-value), or the amount of polymer formation per unit of irradiation energy, increases significantly with a decrease in dose rate down to some optimum value. There is a non-additivity of dose, that is, five exposures at a given dose rate is not equivalent to five times the effect obtained by one exposure at the same dose rate. There is, in certain monomer systems, an "apparent" variation of effects as a function of irradiation parameters, that is, a graph approximating a sloping sinusoidal-type of curve may be obtained for acrylonitrile at least if the per cent yield of polymer is plotted as a function of total dose, provided the points represent also increasing dose rates. Irradiation-induced polymerization-rate has no apparent significance except for a very specifically defined set of irradiation parameters. The results suggest the need

for both extensive and intensive fundamental research in other areas dealing with the applications of ionizing radiation in order to define more accurately the significance of irradiation parameters.

Schmid, Hermann.
THE MECHANISM OF THE DIAZOTIZATION OF AROMATIC AMINES IN NON AQUEOUS SOLVENTS, by Hermann Schmid. Annual technical rept. for 1 Dec 58-30 Nov 59 on Contract DA 91-591-EUC-1010. [1959] 27p. 37 refs.
Order from LC mi$2.70, ph$4.80 PB 145 955

This investigation has been undertaken in the purpose to throw more light on the reaction of the diazotization of amines in organic solvents.

Textile Research Inst., Princeton, N. J.
AN ANALYSIS AND INTERPRETATION OF POLYMER STRESS RELAXATION DATA, by Richard E. Heitman. Technical rept. no. 18 on Contracts Nonr-09000 and Nonr-09001. May 59, 220p. 57 refs. AD-220 739.
Order from LC mi$9.60, ph$33.30 PB 145 903

The relation between the stress relaxation of a polymer sample, pre-stressed below the yield point, and the diffusivity of the reagent which induces the relaxation was established by (1) proposing a theory for the molecular behavior of polymers during stress relaxation in various media (equations which relate force and polymer properties to time were derived); (2) developing experimental and analytical procedures to provide the information necessary to test the theory; and (3) comparing the results obtained from an experimental investigation of the behavior of drawn nylon when it was relaxed in water with data obtained from independent sources. The theory of polymer behavior predicts that the stress relaxation process can, generally, be interpreted to be the result of a series of component relaxations which may, or may not, be related. A new mathematical method is presented by which longitudinal swelling, force constant decay, and chemical reaction can be separated. A continuation of the mathematical development yielded a relationship between the mass of reagent which has entered a relaxing sample at any time and the force level at that time. This method can only be used to determine the diffusivity within a range of values dependent upon the difference of water concentrations in the fiber between the conditioned and relaxed state.

Università degli Studi di Trieste (Italy)
FURTHER STUDIES ON CHEMICAL BEHAVIOUR AND REACTIVITY OF LABILE METAL-ORGANIC COMPOUNDS. Final technical rept. for 1 Jan-31 Dec 59 on Contract DA 91-591-EUC-1015. Jan 60, 57p. 23 refs.
Order from LC mi$3.60, ph$9.30 PB 145 948

Thermal decomposition of $CuCH_3$ in CH_3OH is studied when $Pb(CH_3)_4$ is present. The infrared spectrum of $2AgCD_3 \cdot AgNO_3$ was obtained and studied. The reactivity of copper-methyl towards foreign substances has been studied.

Physical Chemistry

Armour Research Foundation, Chicago, Ill.
AUTOMATIC COUNTING AND SIZING OF AEROSOL PARTICLES, by Sidney Katz and A. Lieberman. Final rept. on Contract DA 18-064-cml-1904. 20 Nov 53, declassified, 166p. 16 refs.
Order from LC mi$7.80, ph$25.80 PB 145 712

This report describes the design and operation of a device for the automatic counting and sizing of aerosol particles in sizes between 1 and 60 μ and in particle concentrations up to 10,000/ml. This report describes the construction of two instruments and discusses fully operating procedures, instrument errors, and instrument performance.

Bonn U. (West Germany).
PHOTOCHEMICAL FORMATION AND THE PHOTOLYSIS OF NITROUS OXIDE IN THE EXTREME ULTRAVIOLET, I. PHOTOCHEMICAL FORMATION OF ORGANIC COMPOUNDS FROM MIXTURES OF SIMPLE GASES, II. INTENSE LIGHT SOURCES FOR THE VACUUM ULTRAVIOLET, III, by H. Schierholz, H. v. Weyssenhoff, and others. Technical rept. no. 1 for July 56-Mar 59 on Contract AF 61(514)1079. [1959] 72p. 12 refs. AFCRC-TN-59-421; AD-217 824.
Order from LC mi$4.50, ph$12.30 PB 145 848

Brush Beryllium Co. [Cleveland, Ohio.]
AN INVESTIGATION OF INTERMETALLIC COMPOUNDS FOR VERY HIGH TEMPERATURE APPLICATIONS, by Robert M. Paine, A. James Stonehouse, and Wallace W. Beaver. Rept. for 13 Mar 56-12 Mar 57 on AEC-ANP Materials Research, Contracts AF 33(616)56-12 and AT(30-1)541. Jan 60, 247p. 603 refs. WADC Technical rept. 59-29, Pt. 1.
Order from OTS $3.50 PB 161 683

Intermetallic compounds from thirty-five binary metallic systems were prepared, fabricated into oxidation-test specimens, and tested for oxidation resistance in dry air at 2300°F. Only high-melting (above 2550°F) compounds were studied. These included aluminides, beryllides, silicides, germanides, and zirconides, as well as numerous miscellaneous compounds. The intermetallic compounds or compositions which are shown to have sufficient oxidation resistance at 2300°F to be potentially useful at this temperature include: $NbAl_3$, $TaAl_3$, $CrBe_2$, $MoBe_{12}$, Nb_2Be_{17}, $NbBe_{12}$, $TaBe_2$, Ta_2Be_{17}, $TaBe_{12}$, $TiBe_2$, $TiBe_{12}$, "WBe_5", $ZrBe_{13}$, Zr_2Be_{17}, Cr_3Si, Ti_5Si_3, "TiSi", $TiSi_2$, and $TaCr_2$. A literature survey of intermetallic compounds is included. (Author)

Calvin Coll., Grand Rapids, Mich.
THE OXIDATION OF THE SILVER ELECTRODE IN ALKALINE SOLUTIONS, by Thedford P. Dirkse. Technical rept. no. 8 on Contract Nonr-1682(01). 1 May 59, 26p. 16 refs.
Order from LC mi$2.70, ph$4.80 PB 145 898

The formation of Ag_2O and AgO was studied by means of constant current and constant potential processes. The efficiency of these oxide formations was determined by measuring the gain in weight of Ag electrodes under various conditions of charge, and the extent of the polarization of these processes was measured by using an interrupted current technique. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
A STUDY OF THE SOLUBILITY AND RATE OF SOLUTION OF FINE AEROSOL PARTICLES, by Clyde Orr, Jr.; F. Kenneth Hurd and others. Final rept. on Contract AF 19(604)1970. 28 Feb 59, 68p. 9 refs. AFCRC-TN-59-281; AD-232 256.
Order from LC mi$3.90, ph$10.80 PB 145 847

The purpose of this research was (1) to determine equilibrium solubilities for PbI_2 and AgI in water at several temperatures, (2) to investigate the rate of dissolution of the same compounds under laboratory conditions, and (3) to determine if the experimental results could have been predicted from previously existing physical data.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
RADIANT ENERGY TRANSFER FROM NONISOTHERMAL MOLECULAR EMITTERS WITH NONOVERLAPPING DISPERSION LINES, by D. Olfe. Technical rept. no. 31 on Contract Nonr-220(03). Apr 59, 16p. 4 refs. AD-218 331.
Order from LC mi$2.40, ph$3.30 PB 145 941

This study on non-overlapping dispersion lines complements earlier work done on overlapping lines and on randomly distributed dispersion lines. Starting with the general relation for the radiant energy flux from a nonisothermal gas, the transparent gas approximation is described for gases of small optical depth. Next the square root approximation is worked out for gases of large optical depth. The result for large optical depths applies provided the temperature gradient in the slab of gas nearest to the observer is not too large. The square root approximation was also used to derive an explicit expression for the radiant energy flux from two adjacent isothermal regions with the hotter gases viewed through the gases which are at lower temperature. (Author)

Harvard U., Cambridge, Mass.
STUDIES IN ELECTRONEGATIVITY, by A. L. Alfred. Doctoral thesis. Technical rept. on Contract Nonr-1866(13). Sep 57, 71p. 63 refs. AD-142 420.
Order from LC mi$4.50, ph$12.30 PB 146 156

A scale of electronegativity based on electrostatic force
The nuclear magnetic resonance absorption of hydrogen in methyl groups. The electronegativity of substituents
Electronegativities of carbon, silicon, germanium, tin and lead

Institute for the Study of Metals, U. of Chicago, Ill.
DIFFUSION IN SOLIDS AND LIQUIDS AND THE PROPERTIES OF SUBSTANCES AT HIGH TEMPERATURES (1) POINT IMPERFECTIONS IN METALS BY CONDUCTIVITY AND DIFFUSION MEASUREMENTS (2) OPTICAL PROPERTIES OF METALS (3) by Norman H. Nachtrieb, Carl T. Tomizuka, and LeRoy G. Schulz. Final rept. on Contract AF 18(600)1489. [1957] 188p. 80 refs. AFOSR-TR-60-23.
Order from LC mi$8.40, ph$28.80 PB 145 836

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMBUSTION IN LAMINAR MIXING REGIONS AND BOUNDARY LAYERS, by Donald Allen Dooley, Doctoral thesis. Rept. on Contract DA 04-495-ORD-18. 1 June 56, 264p. 79 refs. Memo. no. 20-151; AD-153 464.
Order from LC mi$11.10, ph$41.10 PB 145 888

The governing relations for gaseous flow systems with chemical reaction are briefly discussed. One-step unopposed, "global" reactions following first-order, second-order, and third-order kinetics are considered. The analytic techniques developed are applied to the problems of combustion within laminar mixing regions and boundary layers. The application of the similarity techniques to the problem of chemical reaction within a hypersonic boundary layer is briefly discussed in an Appendix.

Linfield Research Inst., McMinnville, Oreg.
RESEARCH ON ELECTROLYTIC MICROMACHINING TECHNIQUES OF REFRACTORY METALS FOR USE IN FIELD EMISSION DEVICES, by H. W. Pitman and D. C. Hamby. Quarterly progress rept. no. 3, 15 Jan-15 Apr 59, on Contract DA 36-039-sc-78191. [1959] 34p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 146 496

Evaluation of methods for determining the thickness of thin anodically formed oxide films on tungsten metal has led to the conclusion that the combined use of the coulometric and reflectance methods will yield the most accurate information on film thickness and forming fields. An approach to the calculation of the properties of anodically formed oxide films from coulometric and optical interference data is presented. (See also PB 142 704)

Lockheed Aircraft Corp., Sunnyvale, Calif.
ABSORPTION COEFFICIENTS OF AIR, by R. E. Meyerott, J. Sokoloff and R. A. Nicholls (U. of Western Ontario). Rept. on Contract AF 19(604)3893. Sep 59, 96p. 59 refs. LMSD-288052.
Order from LC mi$5.40, ph$15.30 PB 145 648

Tables of integrated absorption coefficients have been evaluated for high-temperature air by summation of the contributions from certain discrete and continuous transitions. The tables have been computed for dry air in the temperature range from 1,000°K to 12,000°K, at equal energy increments of 0.25 ev (2,016.5 cm^{-1}), in the wavelength range from 1,167 Å to 19,837 Å, and for density ratios relative to sea level, ρ/ρ_o, at each order of magnitude from 10 to 10^{-6}.

Lockheed Aircraft Corp., Sunnyvale, Calif.
ABSORPTION COEFFICIENTS OF AIR, by R. K. M. Landshoff and D. E. Buttrey. Final summary rept. on Contract AF 19(604)3893. Oct 59, 10p. 4 refs. LMSD-288070; AFCRC-TR-59-296; AD-231 436.
Order from LC mi$1.80, ph$1.80 PB 145 647

Tables of integrated absorption coefficients have been evaluated for high temperature air by studying various transitions involving a series of gaseous molecules and ions including the following: NO, O_2, N_2, N_2^+, N^-, N, and O. Temperature range studies covered 1,000°K to 12,000°K. A supplement continues a summation or research on the study of the absorption coefficients of hot gases for the analysis of nuclear fire balls and other high temperature sources.

Massachusetts U., Amherst.
THE POLARIZABILITY OF POLYPROPYLENE, by Daniel A. Keedy, Joseph Powers, and Richard S. Stein. Technical rept. no. 10 on Contract Nonr-2151(00). 28 May 59, 14p. 4 refs. AD-225 439.
Order from LC mi$2.40, ph$3.30 PB 145 747

Theoretical calculations are shown for the polarizability of a unit chain of isotactic polypropylene and for its refractive index and birefringence. The experimental evidence supports the use of Denbigh's bond polarizabilities (Trans. Faraday Soc. 36:936 1940) for the birefringence calculation of polypropylene. The measured birefringence of 40 to 70% crystalline polypropylene ranged from 20 to 30·10^{-3} birefringence units.

Northwestern U. [Evanston, Ill.]
BRIDGED MECHANISM FOR THE PLATINUM(II) CATALYSIS OF CHLORIDE EXCHANGE IN CHLOROAMMINEPLATINUM(IV) COMPLEXES, by Melvin L. Morris, Fred Basolo, and Ralph G. Pearson. Rept. on Contract AF 49(638)315. 20 Nov 59, 30p. 23 refs. AFOSR-TN-59-1225.
Order from LC mi$2.70, ph$4.80 PB 145 844

A kinetic study was made of the platinum(II) catalyzed chloride ion exchange of various chloroammineplatinum(IV) complexes. The exchange was observed to follow the rate law $R = k[Pt(IV)][Pt(II)][Cl^-]$ and to be essentially the same as the rate of platinum exchange. The rate of chloride exchange with trans-$Pt(NH_3)_4Cl_2^{2+}$ is about 2,000 times faster than with the cis isomer and about 10,000 times faster than with $Pt(NH_3)_5Cl^{3+}$. There is no chloride exchange in the system trans-Pt(tetrameen)$_2Cl_2^{2+}$ - Pt(tetrameen)$_2^{2+}$ - $^*Cl^-$. All of these observations are explained on the basis of a two electron change redox reaction involving a bridged activated complex. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
PHYSICAL PROPERTIES AND CONSTITUTION OF MOLTEN SALTS: ELECTRICAL CONDUCTANCE, TRANSPORT, AND CRYOSCOPY, by Cyril Solomons and George J. Janz. Technical note no. 6 on Contract AF 49(638)50. Dec 57, 94p. 278 refs. AFOSR-TN-58-17; AD-148 056.
Order from LC mi$5.40, ph$15.30 PB 146 521

A review is given of the literature on the theories and experimental techniques of electrical conductance, electrical transport, and cryoscopy of molten salt systems, with particular reference to problems of structure and constitution. (Author)

Rutgers State U., New Brunswick, N. J.
NUCLEAR MAGNETIC RESONANCE STUDY OF XENON, by R. L. Streever, Jr. and H. Y. Carr. Doctoral thesis. Rept. on Contract AF 18(603)6. 26 Jan 60, 29p. 13 refs. AFOSR-TN-60-106.
Order from LC mi$2.70, ph$4.80 PB 145 840

Thin spin lattice relaxation time T_1 of Xe^{129} has been measured as a function of temperature in the liquid and pressure in the gas.

Stanford Research Inst., Menlo Park, Calif.
THEORETICAL STUDY OF HIGH TEMPERATURE COMPOUNDS: BOND DISSOCIATION ENERGIES, by A. Paul Brady. Technical rept. no. 1 on Contract Nonr-2629(00). 1 June 59, 17p. 48 refs. SRI Project SU-2625.
Order from OTS $0.50 PB 161 546

A table of selected bond energies was constructed, using the latest kinetic and thermodynamic data and, in so far as possible, taking into account the influence of the atoms in the neighborhood of the breaking bond. It was found that the concept of a radical electronegativity is consistent and useful, providing the bond to hydrogen is considered a special case. Using the above concepts, it has been possible to estimate the strengths of a large number of bonds for which there are no experimental data. After a brief discussion of the concept of bond dissociation energies, a table of energies (confined, for the present, to the first two rows of the periodic table), together with an outline of its derivation is presented.

Ultrasonics Research Lab., Western Reserve U., Cleveland, Ohio.
ACOUSTO-ELECTROCHEMICAL EFFECTS IN ELECTRODE SYSTEMS, by Ernest Yeager. Technical rept. no. 22 on Contract Nonr-1439(04). 1 May 59, 3/p. 33 refs. AD-219 279.
Order from LC mi$3.00, ph$6.30 PB 145 899

The mechanisms by which sound waves produce dc and ac periodic and directional changes in the potentials of electrodes are considered. The importance of such phenomena in the study of electrode kinetics is also discussed. Schlieren techniques were used to examine the concentration gradients at both the cathode and the anode during the electrodeposition of Cu in order to obtain more specific information concerning the effects of sound waves on mass transport. Results indicated that the effective thickness of boundary layer was reduced to about 2μ with conventional forced convection and 1μ with ultrasonic waves. Estimates were made of the ratio of the surface concentration of $CuSO_4$ to that in the bulk of the solution (c_e/c_o) as a function of the acoustical intensity on the basis of quantitative interpretation of schlieren negatives. Two mechanisms proposed to explain the decreases in H overvoltage on Pt under conditions where concentration polarization involving the electrolyte should be

negligible were discussed. A kinetic treatment is given for the response of a reversible electrode to pressure and temperature variations. Electrode systems involving several consecutive reactions were considered.

EARTH SCIENCES

California U., Berkeley.
THE CAYS OF BRITISH HONDURAS, by Donald E. Vermeer. Rept. on Contract Nonr-222(11). 1959, 134p. 41 refs.
Order from LC mi$6.90, ph$21.30 PB 145 871

Willow Run Labs., U. of Michigan, Ann Arbor.
OBSERVATIONS OF HIGHER-MODE RAYLEIGH WAVES, by James T. Wilson, Walter Chapelle and John C. Johnson. Memo. on Proj. Michigan, Contract DA 36-039-sc-52654. Apr 59, 12p. 6 refs. Rept. no. 2144-409-R; AD-214 304.
Order from LC mi$2.40, ph$3.30 PB 145 973

Observations of Rayleigh waves were made using explosives and large falling weights as sources. Low-frequency vertical and horizontal geophones were used out to a range of 1900 ft. The velocities and frequencies of the various observed seismic waves are discussed, and surface-wave dispersion curves compiled. Weight drops were found to generate higher frequencies than explosive charges. Second-mode Rayleigh waves were observed. (Author)

Yale U., New Haven, Conn.
LATE PLEISTOCENE CHANGES OF SEALEVEL IN SOUTHWESTERN MAINE, by Arthur L. Bloom. Final rept. on Contract Nonr-609(25). 15 May 59, 180p. 76 refs.
Order from LC mi$8.10, ph$27.30 PB 146 175

At some time between 7,000-8,000 yr B.P. and 4,200 yr B.P. the coast of southwestern Maine was emerged at least 2 ft and perhaps 8-9 ft greater than present. Progressive submergence has continued from then to the present time.

Climatology and Meteorology

Air Weather Service, Scott AFB, Ill.
THE LOCAL-AREA SURFACE CHART, ITS PREPARATION AND USE. 29 Jan 60, 82p. 33 refs. Air Weather Service Manual 105-35.
Order from LC mi$4.80, ph$13.80 PB 146 483

This manual includes the suggested plotting procedures, the various techniques recommended to obtain the best analysis and prognosis of the weather in the local area, and the suggested methods for preparing a forecast from the analyzed Local-Area Surface Chart. Some modifications of the chart are presented for occasions where lack of time and personnel deny use of the complete analysis and prognostic procedure. The utilization of facsimile charts in conjunction with the Local-Area Surface Chart is also discussed.

Allied Research Associates, Inc., Boston, Mass.
RADAR PATTERNS AS A FORECAST AID; A CASE STUDY, by Raymond Wexler. Rept. on Contract AF 19(604)3492. 29 May 58, 23p. 6 refs. AFCRC-TN-58-262; AD-152 619.
Order from LC mi$2.70, ph$4.80 PB 146 201

On 2 December 1952, surface weather map indications and a lowering cloud deck threatened imminent snow to the Boston area. However, changing radar echo patterns aloft gave three important clues that precipitation would not be appreciable: (1) The transformation of the upper portion of the echo from a uniform pattern (type 3) to a cellular pattern (type 1) with top at a lower level, indicated advection of dry air aloft and a reduced precipitation rate, (2) A simultaneous cessation of the stalactites at the echo base also indicated a reduced precipitation rate, (3) A remarkably changing wind profile, as determined from the slopes of the trails, indicated advection of warm air tending to stabilize the precipitation forming region near the echo top. Indeed, it turned out that only a trace of snow fell during the succeeding 24-hour period.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
FACTORS INFLUENCING THE USE OF RAWIN SET AN/GMD-2 IN ARTILLERY METEOROLOGICAL SYSTEMS, by William Todd. 22 Aug 58, 20p. 8 refs. USASRDL Technical rept. 1978; AD-205 398.
Order from LC mi$2.40, ph$3.30 PB 139 075

A comparison is made of the operational characteristics of Rawin Sets AN/GMD-1( ) and AN/GMD-2 in determining the winds that exist aloft. The advantages of each system are discussed with respect to use of these sets for obtaining ballistic corrections for artillery. The performance of these systems is compared to a ballistic wind requirement of 1 mph and the inherent limitations of accuracy imposed by the variability of meteorological conditions with space and time as would be experienced in typical army operations. Conclusions indicate that the AN/GMD-1 system provides adequate performance except under conditions of extremely high wind. (Author)

Chicago U., Ill.
AXIAL VELOCITY STREAKS IN THE JET STREAM: AGEOSTROPHIC "INERTIAL" OSCILLATIONS, by Chester W. Newton. Technical rept. no. 2 on National Science Foundation Grant NSF-G6353 and Contract Nonr-2121(10). Apr 59, 28p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 145 795

An air particle alternately speeds up and slows down, as it passes through local isotach maxima. It is shown that on the average, the observed period of such speed variations in the core of the jet stream is about twice the period of an inertial oscillation. Periods are somewhat longer for mean anticyclonically-curved, and shorter for cyclonically-curved flow. The length of a maximum velocity streak, measured between successive points of minimum speed, is greatest when the average wind speed in the jet axis is large, and is greater at low than at high latitudes, other things being equal. This behavior is consistent with the hypothesis that, for an air particle in the jet core, the geostrophic (or gradient) wind velocity varies at one-half the vector change in the actual wind velocity. Outside the jet core, where periods are longer due to smaller wind speeds, the geostrophic (or gradient) wind more nearly accommodates to changes in the actual wind velocity. (Author)

Coastal Studies Inst., Louisiana State U., Baton Rouge.
INFLUENCE OF HURRICANE AUDREY ON THE COASTAL MARSH OF SOUTHWESTERN LOUISIANA, by J. L. Chamberlain (Randolph-Macon Woman's Coll.). Technical rept. no. 10, Pt. B, on Contract N7onr-35608. 1 June 59, 44p. 14 refs. AD-218426.
Order from LC mi$3.30, ph$7.80 PB 146 482

Four distinct phases of the effects of Hurricane Audrey, which struck the coastal area of southwestern Louisiana on June 27, 1957, were studied: (1) general changes in the marsh environment; (2) soil salinity and marsh plant distribution; (3) distribution of beach vegetation; and (4) descriptions of the mud arcs. The three general changes outlined were climatic, gross physical, and vegetational. It was concluded that the variations in soil salinity may have reflected normal seasonal fluctuations rather than storm-induced changes, since post-hurricane sampling was one month after the storm. Horizontal distributions of the plants on the beach were altered by changes in the beach profile, but are evolving toward a stable zonation which will be accomplished when the beach is in balance with the physical forces. The force of the hurricane carried 2 large masses of clay over the beach and deposited them as units (mud arcs) to eventually become permanent features of the shoreline stratigraphy. They were studied in the light of their physical features and vegetation.

Daniel Guggenheim Airship Inst., Akron, Ohio.
RELATION BETWEEN GUSTS AND AVERAGE WINDS FOR HOUSING LOAD DETERMINATION, by P. O. Huss. Rept. on Contract Cwb-6103. June 46, 117p. 3 refs. DGAI rept. no. 140; AD-118 626.
Order from LC mi$6.00, ph$18.30 PB 146 484

Major interest in this study lay in the ratio (f_w) between the peak velocities (V_i) and the "fastest single mile" velocity (V_w) and, also, in the variation with height of the velocities and the above ratio. The ratio appears to vary statistically at a given height and the variation with height follows an inverse exponential relation, $f_w = kh^{-1/n}$. The variation of the velocity with height is, as has been noted by other investigators, a rather erratic factor, but the usual form $V/V_o = (h/h_o)^{1/n}$ is fairly accurate above the 40 foot level. It appears, however, that this exponent varies also with the probability relationship, the average value being in order of 6.5 for the average velocities and 11 for the peaks.

Johannes Gutenberg-Universität, Mainz (West Germany).
INVESTIGATIONS ON THE HEAT BALANCE OF THE TROPOSPHERE, by Günther Korb, Johannes Michalowsky and Fritz Möller. Technical rept. no. 2 on Contract AF 61(514)1005. Nov 57, 87p. 4 refs. AFCRC-TN-58-238; AD-152 471.
Order from LC mi$4.80, ph$13.80 PB 146 228

The investigation on the tropospheric radiation balance, was centered on giving an easy applicability to the methods developed. A method is proposed for simple determination of tropospheric water vapor content from dew point measurements of the usual radiosonde ascents. A clear representation of short-wave absorption with clouded and cloudless skies is described. It appears that the absorption can be represented in dependence on geographic latitude and total water vapor content for any cloud given. This simple method for determination of short-wave absorption together with the method for determination of long-wave emission, given previously, is used for calculation of the tropospheric radiation balance during July and November 1955. The maps of absorption, emission, and tropospheric radiation balance make it evident that regions of high and of low values can be defined. It can be concluded that regions of high and low values of the tropospheric radiation balance are not formed based on simple relations but result from the complicated coherence of many independent factors.

MacDonald Physics Lab., McGill U. (Canada).
ALBERTA HAIL, 1958 AND RELATED STUDIES, PARTS I-III, by R. H. Douglas, R. H. D. Barklie and N. R. Gokhale. Rept. on Contract AF 19(604)2065. July 59, 69p. 9 refs. Stormy Weather Research Group Scientific rept. MW-30; AFCRC-TN-59-448; AD-225 399.
Order from LC mi$3.90, ph$10.80 PB 146 512

Contents:
Alberta field studies
  Hail reports, 1957 and 1958
  Echo top heights and temperatures
  Hail areas and shafts
  Measurements of hail
Growth by accretion
  Growth rates
  Density of particle and of accreted material
  Growth calculations
The freezing of supercooled water drops
  The effect of time on the freezing process
Constant temperature method
Illustration of the random nature of the freezing process
Constant rate of cooling method
Comparison of results obtained by 3 methods
Effect of increasing purity on the values of A and B
The effect of sudden chilling

Massachusetts Inst. of Tech., Cambridge, Mass.
NUMERICAL INTEGRATION OF THE PRIMITIVE EQUATIONS ON THE HEMISPHERE, by Norman A. Phillips. Technical rept. on Numerical Weather Prediction Project, Contract Nonr-1841(18). June 59,

43p. 17 refs. AD-218 148.
Order from LC mi$3.30, ph$7.80 PB 146 475

A 48-hr forecast for the entire Northern Hemisphere of a barotropic hydrostatic atmosphere is made with the primitive equations. Overlapping Mercator and stereographic grids are used together with the finite-difference scheme. Initial data corresponded to a Haurwitz-type pattern of wave number 4, the initial wind field was non-divergent, and the initial geopotential field satisfied the balance equation. The computations seem to be stable and well-behaved, except for 2 small temporary irregularities. The amplitude of the gravity-inertia waves present in the forecast geopotential field is about 1/30 that of the large-scale field. This is shown to be due to the neglect, in the initial data, of the quasi-geostrophically conditioned divergence field. The computational technique does not give any unreal prominence to the meteorological noise. The computational characteristics and stability criterion of the Eliassen-type finite-difference system are investigated for a linearized version of the equations. This finite-difference system possesses 6 computational frequencies. The extra frequencies arise from the advective terms in the equations of motion. (Author)

Michigan U. [Research Inst.] Ann Arbor.
PRESSURE AND DENSITY MEASUREMENTS THROUGH PARTIAL PRESSURES OF ATMOSPHERIC COMPONENTS AT MINIMUM SATELLITE ALTITUDES, by H. S. Sicinski, N. W. Spencer, and R. L. Boggess. Rept. on Contract AF 19(604)545. Mar 56, 13p. 13 refs. Rept. CS-5; 2096-14-S.
Order from LC mi$2.40, ph$3.30 PB 137 511

[Quartermaster Research and Engineering Center, Natick, Mass.]
HANDBOOK OF YUMA ENVIRONMENT, by Albert H. Jackman. Feb 53, 60p. 11 refs. Environmental Protection Branch rept. no. 200.
Order from LC mi$3.60, ph$9.30 PB 146 815

Heat and drought are the major climatic controls over desert testing in the Yuma Test Area. About one-half the days of the year have maximum temperatures of 90°F. or above, and nearly one-third the days have maximum temperature of 100°F. or over. High temperatures and heat stress problems are most frequent from May through September. Winters (December through February) are cool. The low rainfall of the Yuma region is indicated by its mean annual precipitation of 3.38 inches. Moist air, however, sometimes moves over the region from the Gulf of California bringing fairly high humidities which are particularly noticeable during July and August. Other meteorological factors considered in this report include dew points, wind speeds, and cloud cover. The topographic arrangement or form ranges from low, flat bottomlands with practically no slope gradient to rugged mountain terrain with characteristic gradients of 20 to 45 degrees. Most of the area has a sparse vegetation cover of low shrubs, with growths of small thorny trees in the washes and other drainage channels. The smaller shrubs are generally stiff and woody; certain species of cactus present a special protection problem due to their spines. Only in bottomlands where the water table is near the surface is there a dense shrub or tree growth consisting of mesquite, tamarisk (salt cedar), arrowweed, willows, or cottonwoods. Where there is surface water standing most of the year, as in the river overflow areas, there are dense growths of cattails and other semi-aquatic plants.

Washington U., Seattle.
ON VALLEY AND MOUNTAIN WINDS, by Konrad J. K. Buettner and Norman Thyer. Final rept. on Contract AF 19(604)2289. Sep 59, 30p. 15 refs. AFCRC-TR-59-283; AD-231 495.
Order from LC mi$2.70, ph$4.80 PB 146 193

Air currents were investigated in and above the Carbon River Valley in the northwest corner of Mt. Rainier National Park. Observations were made mostly with pibals; wiresonde, tethered balloons, and airplanes. Preference for investigation was given to clear days, and nights with low geostrophic winds. A permanent wind and radiation station was installed in the more distal part of the valley. A daytime valley wind and a nighttime mountain wind flow quite regularly. These winds fill the valley to nearly ridge level. About 300 m above the ridge level compensation currents or anti-valley and anti-mountain winds begin. All four currents are stronger in the more distal valley. Currents in the valley and their respective anti-winds are separated by a highly irregular mixing layer 200-300 m in thickness. Nighttime winds are quite erratic.

Frost Science

ARDE Associates, Newark, N. J.
ANTENNA FOUNDATION DESIGN STUDY, by M. Scheinberg, B. J. Aleck and others. Rept. on Contract AF 30(602)1872. 30 Sep 59, 513p. 45 refs. ARDE rept. no. 3584-1; RADC-TR-59-251.
Order from LC mi$11.10, ph$78.90 PB 146 493

This report contains the results of a study to devise new types of foundations and to evaluate these as well as existing foundations for extremely large, permanent antennas located in Arctic areas. Novel types of foundations, specifically designed for stability in permafrost soils, are presented. Optimum foundation types for several different antennas and for a number of typical Arctic soil conditions are given. Methods for design of these foundations are presented which provide for long time stability under extreme conditions. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
THE NARROW INFINITE WEDGE ON AN ELASTIC FOUNDATION, by D. E. Nevel. Rept. on Bearing Capacity of Floating Ice Sheet. July 58, 22p. 4 refs. Technical rept. 56; AD-208 019.
Order from LC mi$2.70, ph$4.80 PB 146 499

A solution to the problem is presented to serve as a basis for predicting where and under what conditions a circumferential crack will develop in a floating ice sheet. The solution assumes a wedge angle small

enough that tangential bending can be neglected as well as the absence of lateral forces exerted on the wedge by adjacent wedges. The differential equation describing the problem is:

$$\frac{d^4y}{d\chi^4} + \left(\frac{2}{\chi}\right)\left(\frac{d^3y}{d\chi^3}\right) + y = 0$$

and its solution reads: $y = A\,nev_0(\chi) + B\,nev_1(\chi) + C\,nev_2(\chi) + D\,nel_1(\chi)$, where A, B, C, and D are constants of integration and nev_0, nev_1, nev_2, and nel_1 are functions defined by an infinite series. (Author)

Dartmouth Coll., Hanover, N. H.
CRYSTALLOGRAPHIC ORIENTATION IN LAKE AND ARTIFICIAL ICE, by J. B. Lyons and R. E. Stoiber. Scientific rept. no. 2 on Contract AF 19(604)2159. 31 Oct 59, 20p. 9 refs. AFCRC-TN-59-655.
Order from LC mi$2.40, ph$3.30 PB 146 200

Observations on lake ice and ice frozen experimentally at -10°C under varying conditions of thermal flux and in some cases with a stream of air directed toward the surface lead to the conclusions that ice orientation may best be explained in terms of (1) thermal gradients in the growth medium (water), (2) thickness of the supercooled water layer, (3) mechanical effects such as fragmentation of the earliest-formed ice skim, and (4) more rapid crystallization velocity in the basal plane of ice. The crystallographic fabric of the ice formed under several different experimental conditions is presented in a series of illustrations. (Author)

Engineer Corps [Washington, D. C.]
GREENLAND ICE CAP RESEARCH PROGRAM: STUDIES COMPLETED IN 1954. VOL. 2. Feb 57, 245p.
Order from LC mi$11.10, ph$37.80 PB 146 024

Contents:
Glaciological investigations in the Thule Ramp area. SIPRE rept. 28
Approach roads, Greenland 1954 program. ACFEL Technical rept. no. 64
Pipeline study, Greenland, by Army Engineer Research and Development Labs.
Excavations and installations at SIPRE Test Site, Site 2, Greenland. SIPRE rept. 20
Instrumentation of Ice Cap stations. Preliminary rept. SIPRE rept. 23
Structures for snow investigations on the Greenland Ice Cap. SIPRE rept. 27
Sewage disposal at Ice-Cap installations. SIPRE rept. 21 (PB 128 111)
(See also PB 146 022)

Engineer Corps [Washington, D. C.]
GREENLAND ICE CAP RESEARCH PROGRAM. STUDIES CONDUCTED IN 1955-56. VOL. 1. May 58, 182p.
Order from LC mi$8.40, ph$28.80 PB 146 023

Contents:
Report on Greenland operation, 1955-1956, by Army Engineer Research and Development Labs.
Strength studies of high-density snows, SIPRE research rept. 18 (PB 132 802)
Preliminary study of crevasse formation. SIPRE rept. 38
The effect of snow properties on vehicle trafficability in the Arctic. SIPRE special rept. 22
Radiation measurements on the Greenland Ice Cap. SIPRE research rept. 19
Measurements by SIPRE in 1955 on the accumulation markers of Expeditions Polaires Françaises in Central Greenland. SIPRE special rept. 19
Resupply of Ice-Cap expeditions by air drop, SIPRE special rept. 17 (See also PB 146 024)

Engineer Corps [Washington, D. C.]
GREENLAND ICE CAP RESEARCH PROGRAM. STUDIES CONDUCTED IN 1955 - 56, VOL. 2. Oct 58, 178p. 57 refs.
Order from LC mi$8.10, ph$27.30 PB 146 025

Contents:
On the deformation of excavations in the Greenland neve. Apr 57, SIPRE Research rept. 30
Some preliminary observations on the plasticity of Greenland glaciers. July 57, SIPRE Research rept. 33
Shear moraines in the Thule area, Northwest Greenland. Jan 57, SIPRE Research rept. 17
Movement observations on the Greenland Ice Cap. Aug 57, SIPRE Special rept. 24
Ice tunnel, Tuto area, Greenland. Feb 58, SIPRE Technical rept. 44
Precipitation trends in Greenland during the past 30 years. Dec 56, SIPRE Research rept. 22
Occurrence of blowing snow on the Greenland Ice Cap. Apr 57, SIPRE Research rept. 25 (PB 143 317)
White-out in Greenland. Dec 56, SIPRE Research rept. 21 (PB 128 113)
A reconnaissance for a southern Greenland ice-cap access for military purposes. Apr 57, SIPRE Technical rept. 46.
(See also PB 146 023)

Engineer Corps [Washington, D. C.]
GREENLAND ICE CAP RESEARCH PROGRAM. STUDIES CONDUCTED IN 1955-56. VOL. 3. June 59, 193p.
Order from LC mi$8.70, ph$30.30 PB 146 026

Contents:
Approach roads, Greenland 1955 program. ACFEL technical rept. 60; AEWES technical rept. 3-505
Design and construction of an undersnow camp on the Greenland Ice Cap. USA Polar R&D Center rept. 1
Proposed relocation of Camp Tuto and access road. SIPRE technical rept. 52 (PB 138 228)
The cryoconite of the Thule area. SIPRE research rept. 50
Polar glaciology study course. SIPRE special rept. 26
(See also PB 146 025)

Engineer Corps [Washington, D. C.]
GREENLAND ICE CAP RESEARCH PROGRAM. STUDIES COMPLETED IN 1954, VOL. 1 Feb 57, 244p. 5 refs.
Order from LC mi$11.10, ph$37.80 PB 146 022

Contents:
Report on Greenland Operation, 1954, by Army Engineer Research and Development Labs.
Scientific work of Party Crystal, 1954. Preliminary rept. SIPRE rept. 24
Operations and logistics of Ice-Cap Party Crystal, 1954. SIPRE rept. 25

Study of ice fabrics, Thule area, Greenland. SIPRE rept. 26
Trafficability of snow, Greenland Studies, 1954, AEWES TM-3-414, rept. no. 2

Geodesy

[Arctic Inst.], Catholic U. of America, Washington, D. C.
A SYSTEM OF KEYS FOR THE INTERPRETATION OF VEGETATION FROM AERIAL PHOTOGRAPHY OF THE CHESAPEAKE BAY AREA, by Hugh O'Neill, Oswald Schulte, and others. Technical rept. no. 1 on Interpretation of Vegetation on Aerial Photography, Contract N6onr-25504. Aug 50, 256p. 47 refs.
Order from LC mi$11.10, ph$39.60 PB 146 352

Contents:
A system of keys for the identification of vegetation from aerial photography of the Chesapeake Bay area
Characteristics of vegetation of use in interpreting vegetation from aerial photography of
(a) Chesapeake Bay area
(b) Any area. generalizations
Monographic descriptions of the photographic characteristics of some important species of trees and other plants of the Chesapeake Bay area especially prepared for photographic interpreters
List of important Chesapeake indicator plants and what they indicate
Geology and soils of the Chesapeake Bay area
An important assistance in interpreting vegetation from aerial photography

Geographisches Institut der Universität Zürich (Switzerland).
INTERPRETATION OF LAND UTILIZATION FROM AERIAL PHOTOGRAPHS, by Hans Boesch and Dieter Steiner. Final technical rept. for 1 Nov 58-31 Oct 59 on Contract DA 91-591-EUC-975. 1959, 73p. 70 refs. AD-232 725.
Order from LC mi$4.50, ph$12.30 PB 145 950

Systematic study was made of gray tone, texture, and stereoscopic appearance on panchromatic air photographs, taken at different seasons over different regions of Switzerland. The base material consisted of air photographs taken at different seasons, partly at different day-times. Land-use mapping in the field was carried out shortly after the photographs were taken. The usefulness of gray tone, texture, and stereo-effect for the interpretation and the possibilities of distinguishing different types of land-use were evaluated by means of statistical methods. (Author)

Geography

Coastal Studies Inst., Louisiana State U., Baton Rouge.
COASTAL GEOGRAPHY CONFERENCE [NO. 2] HELD APRIL 6-9, 1959, AT THE COASTAL STUDIES INSTITUTE, LOUISIANA STATE UNIVERSITY, by Richard J. Russell. Rept. on Contract Nonr-2300(07). 1959, 457p. 381 refs. AD-218 547.
Order from LC mi$11.10, ph$68.10 PB 146 524

Contents:
Coastal classification maps
An analysis of coastal climates, with particular reference to humid midlatitudes
Origin and development of the Texas shoreline
Padre Island and the Laguna Madre Flats, coastal South Texas
The geomorphology of the Guiana coast
Coastal sand ridges and marshes and their environment near Grand Polo and Ouidah, Dahomey
Geomorphological reconnaissance of the northwest coast of Cape York Peninsula (Northern Australia)
Littoral and submarine morphology of the Rhone Delta
The development of the coastline of the Wash, England
Dutch post-war coastal studies
The Danish moraine archipelago as a research field for coastal morphology and dynamics
Archaeology and physiography in coastal studies
Methods of correlating cultural remains with stages of coastal development
Mississippi deltaic plain flight
Alluvial morphology field trip
Coastal marsh and chenier field trip
Southwestern Louisiana field trip - Land and man in the chenier, Louisiana

Louisiana State U. [Baton Rouge.]
THE PHYSICAL GEOGRAPHY OF THE LOWER COASTAL PLAIN OF THE GUIANA COAST, by John H. Vann. Technical rept. no. 1 on Contract Nonr-1575(02). 14 Apr 59, 103p. 56 refs.
Order from LC mi$5.70, ph$16.80 PB 146 168

The purpose of this study is the investigation of the lower coastal plain landforms and the processes that have fashioned these forms. Furthermore, it is hoped that the description of the landforms may aid in the terrain analysis of tropical coastal lowlands.

Oceanography

Air Force Cambridge Research Center, Bedford, Mass.
SCIENTIFIC STUDIES AT FLETCHER'S ICE ISLAND, T-3, 1952-1955. VOLUME II, by Vivian Bushnell. Dec 59, 126p. 38 refs. Geophysical Research Papers no. 63, AFCRC-TR-59-232(2); AD-216 814.
Order from OTS $2.75 PB 161 691

Results of field investigations are presented and include a summary of surface meteorological observations, a study of upper air temperatures, and an analysis of solar radiation data. Appendixes include tables of surface meteorological observations, mean monthly upper-air temperatures at selected levels, solar radiation data, and plots of position lines with resulting geographical locations. (Author) (See also PB 161 289)

Scripps Institution of Oceanography, U. of California, San Diego.
FINAL REPORT. Rept. for 1 Apr 56-16 Sep 58 on Contract Nonr-233(42). 6 Apr 59, 14p. 4 refs. SIO Ref. 58-77; AD-225 715.
Order from LC mi$2.40, ph$3.30 PB 145 706

Outlines work done on buoys and batteries, sensing systems and moorings.

Weather Forecasting Research Center, U. of Chicago, Ill.
EVAPORATION FROM THE OCEANS, by W. C. Swinbank. Scientific rept. no. 12 on Contract AF 19(604)2179 and National Science Foundation Grant NSF-G6385. Dec 59, 18p. 10 refs. AFCRC-TN-60-211.
Order from LC mi$2.40, ph$3.30 PB 146 194

The present report by Dr. W. C. Swinbank was prepared to provide an up-to-date formula for computations of the exchange of latent heat between the oceans and the atmosphere. The results of these computations, with special reference to the energy supply of mobile motion systems on the North Atlantic, will be described in separate reports.

Woods Hole Oceanographic Institution, Mass.
OCEANOGRAPHIC DATA FROM THE CARIBBEAN SEA "CRAWFORD" CRUISE 17, FEBRUARY-MARCH 1958 FOR THE INTERNATIONAL GEOPHYSICAL YEAR OF 1957-58, by W. G. Metcalf. Rept. on Contract Nonr-2196(00). Apr 59, 89p. 6 refs. Reference no. 59-9.
Order from LC mi$4.80, ph$13.80 PB 146 245

In the present report, the oceanographic data are presented in a form similar to that used earlier. Four north-south cross sections of the Caribbean Sea were made. Station positions from CRAWFORD Cruise 17 are shown in Figure 1. Also included are the Caribbean stations from the 1954 ATLANTIS cruise. Temperature, salinity and oxygen profiles for each section are presented on a base showing the observation points and the bottom contours in Figures 2 through 19 The tabular data are presented in the same form as those from earlier cruises. The position given is the mean for each station. The GMT is the time at which the messenger was sent for the first (shallow) cast. The Depth is the sonic depth corrected for the speed of sound in sea water according to Matthews' (1939) tables and is rounded off to the nearest five meters. In some instances the bottom bottle tripped on the ocean floor, and the depth has been calculated from paired protected and unprotected reversing thermometers. The BT# is the slide number of the bathythermogram obtained for the station. In most cases, the bathythermograph lowering was made shortly before the ship stopped or shortly after getting underway in connection with each station. Salinities were determined on the Woods Hole Mark II salinometer. Dissolved oxygen determinations were carried out by the Winkler method. Hourly bathythermograph loweringa were made while underway, sea conditions permitting. The tracings of the bathythermographs presented were prepared in the manner described by Fuglister. Below each tracing is given the following information: First line: Slide number G.C.T., Day, Month, Year, Wind Direction (in tens of degrees, True) and Wind Force (Beaufort Scale). Second line: Latitude and Longitude. Third line: Surface (bucket) temperature.

Physics of the Atmosphere

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE DYNAMICS OF ISOTROPIC TURBULENCE IN TWO DIMENSIONS, by W. H. Reid. Technical rept. no. 23 on Contract Nonr-562(07). Apr 59, 25p. 11 refs. 562(07)/23.
Order from LC mi$2.70, ph$4.80 PB 145 796

The dynamical equations which describe the behavior of isotropic turbulence in two dimensions are derived under the assumption that all fourth-order cumulants of the velocity field vanish. Due to the absence of vortex line stretching, the transfer mechanism which developes in this case differs markedly from the usual three-dimensional one. For example, an initial energy distribution in the form of a single line spectrum is found to remain unchanged. More generally, however, there is found to be an almost equal transfer of energy from the medium sized eddies to both smaller and larger eddy sizes. The large magnitude of this 'back-transfer' suggests the need for caution when applying the usual cascade arguments to turbulence in two dimensions. These results would seem to be relevant to the problem of the large-scale motions in atmospheric turbulence which are known to exhibit certain two-dimensional characteristics. (Author) (See also PB 145 799)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
CONCERNING THE PHENOMENON OF SPREAD F IN THE IONOSPHERE, by J. Renau. Technical rept. no. 51 on Studies on Propagation in the Ionosphere, Contract DA 36-039-sc-74903. 30 Oct 58, 19p. 11 refs. Research rept. EE-393.
Order from LC mi$2.40, ph$3.30 PB 146 166

To shed some light on the phenomenon of Spread-F, a thin scattering screen is postulated above the E region. Experimental ionograms are presented that substantiate the theory, although there are a large number of occurrences of spread-F whose characteristics apparently cannot be explained by the mechanism suggested.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
STUDIES ON PROPAGATION IN THE IONOSPHERE, by H. G. Booker, D. Farley and others. Quarterly progress rept. no. 1 on Contract DA 36-039-sc-78258. 15 Feb 59, 20p. 4 refs. Research rept. EE-416.
Order from LC mi$2.40, ph$3.30 PB 146 157

Work is continuing on the possibility of transfer of irregularities of electric field from lower heights up to the F region. Equations have been derived for the radar echo strength backscattered from nonisotropic irregularities of ionization.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
STUDIES ON PROPAGATION IN THE IONOSPHERE, by D. Farley and J. Renau. Quarterly progress rept. no. 2 on Contract DA 36-039-sc-78258. 15 May 59, 52p. 10 refs. Research rept. EE 425.
Order from LC mi$3.60, ph$9.30 PB 146 065

The theoretical examination of the possibility of transferring irregularities of electric field from lower heights up to the F-region of the ionosphere has been continued. (See also PB 146 157)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
STUDIES ON PROPAGATION IN THE IONOSPHERE, by H. G. Booker, B. Nichols and others. Progress rept. no. 3 on Contract DA 36-039-sc-74903. 30 June 58, 33p. 3 refs. Research rept. EE 379; AD-204 119.
Order from LC mi$3.00, ph$6.30 PB 138 117

A critical review has been begun of the various unsolved questions connected with ionospheric turbulence. Equipment that had been prepared for measuring the height of phase scintillations using Sputnik III was put into operation. The results were disapointing, apparently due to low radiated power from Sputnik III. An investigation has been begun of the idea due to Dagg that phase scintillation spread-F could be due to ionospheric turbulence below the F-region. The idea is that turbulence in the E-region might cause irregularities of space charge and hence irregularities of electric field. The IGY auroral radar, operating continuously at 41.0 Mc/s, has been used for a series of new measurements of the decay of long-duration meteor echoes. Figures and tables showing some of the results are presented herewith. (See also PB 135 964)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
A THEORY OF ELECTROSTATIC FIELDS IN A HORIZONTALLY STRATIFIED IONOSPHERE SUBJECT TO A CONSTANT, VERTICAL MAGNETIC FIELD, by D. T. Farley. Technical rept. no. 52 on Studies on Propagation in the Ionosphere, Contract DA 36-039-sc-74903. 31 Dec 58, 33p. 9 refs. Research rept. EE-397.
Order from LC mi$3.00, ph$6.30 PB 146 165

A theory is developed to describe quantitatively the idea that, in an ionized gas subject to an imposed magnetic field, such as the ionosphere, the lines of magnetic flux are approximately equipotential lines. The analysis indicates that in the ionosphere the results are strongly affected by the variation of conductivity with height, as well as the anisotropy.

Deutscher Wetterdienst, Offenbach (West Germany).
CELL STRUCTURE OF THE ATMOSPHERE: FIGURES, by Heinrich Faust and Walter Attmannspacher. Final rept., Part 2 on Contract DA 91-508-EUC-387. Oct 59, 161p. AD-231 503.
Order from LC mi$7.80, ph$25.80 PB 146 220

See also PB 146 219

Deutscher Wetterdienst, Offenbach (West Germany).
CELL STRUCTURE OF THE ATMOSPHERE: TEXT, by Heinrich Faust and Walter Attmannspacher. Final rept., Part 1 on Contract DA 91-508-EUC-387. Oct 59, 102p. 17 refs. AD-231 502.
Order from LC mi$5.70, ph$16.80 PB 146 219

Contents:
The null layer of the upper troposphere
Extremes of the horizontal wind and the vertical velocity
Null layer analysis
The layer of scalar wind minimum
The correlation between the wind profiles and the weather situations
Investigations on dissolving pressure systems
Mean temperature distribution over the northern hemisphere
On the existence of an upperstratospheric layer of maximum wind
On the general circulation of the extratropical latitudes
Investigations on air density
Meteorological terminology

New York U. Coll. of Engineering, N. Y.
DYNAMICS OF THE MESOSPHERE, by Julius London, Bernhard Haurwitz, and Katsuyuki Ooyama. Final rept. on Contract AF 19(604)1738. Dec 59 [44]p. 18 refs. AFCRC-TR-60-206.
Order from LC mi$3.30, ph$7.80 PB 146 192

The final report is divided into five sections covering the main phases of the project research. These deal with: 1. The radiation budget of the upper atmosphere 2. The distribution of atmospheric ozone. 3. Motions in the upper atmosphere. 4. Studies of atmospheric tides. 5. Solar-weather relationships.

Vienna U. (Austria).
EXPERIMENTAL INVESTIGATION OF THE CARBONDIOXIDE CONTENT OF THE AIR AND AN ANALYSIS OF ITS GASEOUS AND COLLOIDAL PHASES, by Georg Stetter. Final technical rept. for 1 Jan-31 Dec 59 on Contract DA 91-591-EUC-1012. Dec 59, 76p. 13 refs.
Order from LC mi$4.50, ph$12.30 PB 145 947

Contents:
Chemical methods
High frequency titration of CO_2
The determination of CO_2 by URAS
Measurement of humidity based on the scattering of high energy neutrons
Determination of CO_2 by an optical method

ENGINEERING

Army Chemical Warfare Labs., Army Chemical Center, Md.
VALVE, ANTIBACKDRAFT, E2R2 (FINAL ENGINEERING TEST NO. 117) by Donald F. McFarland, Jr. Oct 59, 46p. CWLR-2314; AD-229 340.
Order from LC mi$3.30, ph$7.80 PB 145 755

This report covers in detail the final engineering test of an antibackdraft valve developed to maintain a constant static pressure in small portable shelters under collective protection. Results of the test program indicated that the valve was essentially satisfactory in filling the design characteristics. (Author)

Northwestern Technological Inst., Evanston, Ill.
A NEW METHOD OF WASTE DISPOSAL FOR ISOLATED SITES IN THE ARCTIC. I. CHEMICAL ADDITIVES AND MECHANICAL HOMOGENIZERS, by John A. Logan. Rept. for 30 Sep-31 Dec 58 on Contract AF 41(657)207. [1958] 19p. Technical note AAL-TN-59-5; AD-230 843.
Order from OTS $0.50 PB 161 540

Chemical additives, homogenizers, oil burners, toilets, oil burners and garbage disposal units are discussed. A preliminary layout for a camp of 50-100 men is attached to the report.

Aeronautical Engineering

[Aero Space] Medical Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
MAN'S ABILITY TO APPLY CERTAIN TORQUES WHILE WEIGHTLESS, by Ernst Dzendolet and John F. Rievley. Apr 59, 33p. 8 refs. WADC Technical rept. 59-94; AD-220 363.
Order from LC mi$3.00, ph$6.30 PB 146 575

The torque that a maintenance man can exert within a space vehicle while weightless, and hence tractionless, is analyzed. Anthropological literature was reviewed to determined the torques a man can apply under normal conditions. Using elementary physical principles the consequences of applying these torques while tractionless were calculated. Certain of the predictions were verified experimentally. It is tentatively concluded that standard anthropometric data can legitimately be extrapolated to the weightless conditions. Suggestions are advanced regarding (a) the optimum body position for a simple tightening task without using a handhold, (b) the use and location of handholds, (c) maximum torque limitations, (d) the use of impulses, and (e) the design of hand tools. (Author)

Armour Research Foundation, Chicago, Ill.
MEASUREMENT OF AIR NAVIGATION ACCURACY ALONG CERTAIN VOR AIRWAYS, by G. W. Bond. Final rept. on Contract FAA/BRD-28. June 59, 131p.
Order from OTS $2.75 PB 161 652

During the winter of 1958-59 a large number of measurements were made, by means of a long-range radar, of the accuracy of air navigation along certain VOR airways within 130 miles of Kansas City. The measurements encompassed a variety of aircraft types and flight conditions, and were made generally without the pilots knowledge. The type, identity, assigned altitude, origin, destination, and reported times over certain VOR station were obtained for each aircraft from air traffic control records. Related weather and winds aloft data were obtained from the weather teletype. The positions of the VOR radials defining the airways in the area were also measured, by means of a specially instrumented aircraft.

Arnold Engineering Development Center [Tullahoma, Tenn.]
AERODYNAMIC LOADS ACTING ON THE CANTILEVERED NOSE SECTION OF THE COLEMAN AJ 10-33 ROCKET SLED AT TRANSONIC AND SUPERSONIC SPEEDS AS DETERMINED BY WIND TUNNEL TESTS, by Benford H. Johnson. Rept. on ARO, Inc. Contract AF 40(600)800. Jan 60, 32p. 2 refs. AEDC-TN-59-167. AD-231 447.
Order from LC mi$3.00, ph$6.30 PB 145 749

Wind tunnel tests were conducted on a 0.0298-scale model of the Coleman AJ 10-33 rocket sled to determine the aerodynamic loads acting on the cantilevered nose section of the model and to determine the rates of change of these loads with deflection of the nose section in pitch and yaw. The tests were performed with the model in the presence of a ground plane at Mach numbers from 0.6 through 2.5. Longitudinal and lateral loads were obtained in the deflection ranges of ± 3.0-deg angle of attack and ± 1.5-deg angle of yaw. Axial-force data were obtained from pressure distribution measurements on the nose section.

Bell Aircraft Corp. [Buffalo, N. Y.]
A STUDY OF VELOCITY-FREQUENCY-DAMPING RELATIONSHIPS FOR WING AND PANEL BINARY SYSTEMS IN HIGH SUPERSONIC FLOW, by Melvin B. Zisfein and Frank J. Frueh. Rept. on Contract AF 49(638)365. Oct 59, 64p. 11 refs. Rept. no. 9015-19-001; AFOSR-TN-59-969; AD-228 774.
Order from LC mi$3.90, ph$10.80 PB 145 978

Initial results are presented of a program to obtain and study analytical relations between flutter and dynamic response. Piston theory aerodynamics was used to study two kinds of binary systems, pitch-plunge wings and 2-degree-of-freedom simply supported panels. A major portion of the effort was focused on the effects of viscous and structural damping on the flutter and dynamic response characteristics and the relations between them.

deFlorez Co., Inc., Englewood Cliffs, N. J.
METHODS OF PRESENTING MOVING OBJECTS IN POINT LIGHT SOURCE VISUAL DISPLAYS. Rept. on Contract Nonr-1628(00). June 59, 68p. 2 refs. Technical rept. NAVTRADEVCEN 1628-5.
Order from LC mi$3.90, ph$10.80 PB 145 932

This report describes the results of an investigation to discover and analyze methods and systems whereby moving objects may be presented in point source projected visual displays. It includes an analysis of the nature of movement in the real world as a frame of reference for movement to be produced in the world of visual displays. A number of methods and systems have been devised which will project moving objects in point source visual displays. However, each system is quite limited in capability and can meet only

a particular and rather narrow range of requirements. None of these systems will produce a completely non-programmed moving object which will be completely realistic as well. In general, it is practicable to provide only one moving object.

Directorate of Flight and All-Weather Testing, Wright-Patterson AFB, Ohio.
OPERATION ANALYSIS TECHNIQUES FOR ESTIMATING THE EFFECT OF DELETING AIRCRAFT ICE PROTECTION SYSTEMS, by James K. Thompson. Sep 59, 14p. 15 refs. WADC Technical note 59-163; AD-216 082.
Order from LC mi$2.40, ph$3.30 PB 146 914

A method is defined for estimating the significance and frequency of encountering various total accumulations of ice on unprotected components during proposed operations. The technique has been evolved over a period of years and reduces available statistics and pertinent theory to practical graphs for use by personnel without previous experience in icing theory. Examples of application to three types of aircraft operations are provided to illustrate use of the technique and the effects of varying aircraft speeds and operational altitudes. (Author)

Goodyear Aircraft Corp., Akron, Ohio.
ROUGH TERRAIN LANDING GEAR EVALUATION PROGRAM, by George Schuck. Rept. on Contract DA 44-177-TC-436. 15 Mar 59, 275p. 10 refs. GER 9244; AD-206 902.
Order from LC mi$11.10, ph$42.60 PB 145 804

This report covers the testing of an L-19A "Bird dog" liaison airplane equipped with Goodyear Terra tires, air wheels and the Standard 700 x 5 tire. The tests were conducted over sand, mud, and simulated rough terrain. The results indicate that the use of large size low pressure tires improves performance over both the sand and mud. The large low pressure tires show indication of greater energy absorption than the standard tires; however, the area of optimum pressure for the large tires appeared to be below the inflation pressure range tested. (Author)

Hiller Aircraft Corp., Palo Alto, Calif.
DYNAMIC STABILITY ANALYSIS OF DUCTED FAN TYPE FLYING PLATFORMS, by R. N. Greenman and M. G. Gaffney. Rept. on Contract Nonr-1357(00), Phase IV. 29 May 59, 164p. 7 refs. Rept. no. ARD-233.
Order from LC mi$7.80, ph$25.80 PB 146 029

An analysis is presented of the longitudinal dynamic stability characteristics in hovering and in level low-speed flight ($\lambda \leq .12$), of the Hiller 7-foot diameter ducted fan flying platform. In addition, several configuration variations were investigated, including duct section and chord, number of propeller blades, propeller blade setting, and clearance between tips of propellers and inside of duct. The equations of motion are developed using standard methods. Time histories, obtained with an analog computer, and the resulting stability parameters are presented graphically. The present gyrobar stabilizer system provides sufficient damping in hovering flight but will not overcome the divergent motion in forward flight. For this reason, the dynamic characteristics deteriorate with increasing speed. This is primarily due to the static (angle-of-attack) instability which occurs at higher speeds. (Author)

Hiller Aircraft Corp., Palo Alto, Calif.
WIND TUNNEL TEST OF SEVERAL DUCTED PROPELLERS IN NON-AXIAL FLOW, by W. J. Gill. Rept. on Contract Nonr-1357(00), Phase IV. 20 Apr 59, 397p. 10 refs. Rept. no. ARD-224.
Order from LC mi$11.10, ph$60.60 PB 146 176

Wind tunnel and static tests were conducted on various ducted propellers of 2.0 foot diameter. Measurements were made of the total aerodynamic forces and moments, the forces and moments acting on the duct itself, and the power supplied to the propellers. The model was tested at advance ratios (tunnel airspeed/propeller tip speed) of 0, 0.05, 0.10 and 0.15 with the duct axis tilted through a range of angles between 0 and 90 degrees. Detailed velocity surveys were conducted in the slipstream, and vanes mounted in the slipstream were tested. In addition, centerbodies of the type used in flying platforms were investigated. Four ducts were tested in combination with three different sets of contra-rotating, adjustable pitch propellers. The data are presented in the form of coefficients based on propeller tip speed, duct area and propeller radius, except for the duct alone (ring wing) data, for which the coefficients are based on tunnel airspeed. Slipstream flow survey data are presented in tabular form.

Kaman Aircraft Corp., Bloomfield, Conn.
KRC-4 ROTOCHUTE DEVELOPMENT, by C. B. Packard. Final rept. on Contract Nonr-901(00). 1 Aug 58, 160p. 10 refs. Rept. no. R-239.
Order from LC mi$7.50, ph$24.30 PB 146 103

The following are summarized: development of a Rotochute design that is ready for service evaluation; development of a tactical prototype vehicle with multiple, interchangeable containers; demonstration of dynamically stable descent at a rate of 53 feet per second for 100-pound payload, and 58 feet per second for 200-pound payload; establishment of a minimum release altitude of 300 feet to develop terminal descent; demonstration of successful deployment of the KRC-4 Rotochute from the P2V-7 aircraft at speeds up to maximum attainable (250 knots); and deployment and operation of the companion Rotochute (KRC-4A) at 1070 feet per second (Mach .99) in a near vertical attitude at 4174 feet altitude.

Institute of Flight Structures, Columbia U., New York.
STRESS FUNCTIONS WITH AXIAL SYMMETRY IN HETEROGENEOUS BODIES, by M. B. Friedman and J. L. Sackman. Technical rept. no. 7 on Contract Nonr-266(34). Apr 59, 13p. 2 refs. CU-1-59-ONR 266(34)-CE; AD-225 390.
Order from LC mi$2.40, ph$3.30 PB 145 800

The use of stress functions are extended to the analysis of visco-elastic phenomena involving variable material properties. The results are also applicable to elasticity problems with non-constant properties. The case of axial symmetry is considered in both cylindrical and spherical coordinates.

Naval Weapons Lab., Dahlgren, Va.
QUALIFICATION OF POWER CARTRIDGES, TALCO P/N-1000-121 FOR F8U-1 AIRCRAFT CANOPY REMOVER, by J. P. Matarrese. 4 Feb 60, 44p. 7 refs. NWL rept. no. 1685.
Order from LC mi$3.30, ph$7.80 PB 145 777

The power cartridge for use in the F8U-1 canopy remover was evaluated in accordance with applicable sections of MIL-D-21625 and Chance Vought Aircraft Incorporated Specification CVA 1202C. Final release of the cartridge to service for use within the operational temperature range of -65°F to +160°F is recommended. The functions of the evaluated cartridges in the canopy removal system and the test procedures, instrumentation and methods of data analysis employed in the evaluation are described. (Author)

Purdue Research Foundation, Lafayette, Ind.
A SURVEY OF GERMAN HOLLOW TURBINE BLADE DEVELOPMENT. PART I: INITIAL INVESTIGATIONS AND DEVELOPMENTS, by E. N. Petrick. Rept. on Contract W33-038-ac-17625. Oct 49, declassified 26 Mar 51. 222p. 39 refs. ATI-79 552; 102-AC-49/14-23.
Order from LC mi$9.90, ph$34.80 PB 146 852

This report is the first in a series of three dealing with German developments in the field of turbine blade cooling, with particular emphasis on the use of air-cooled hollow turbine blades. The current report contains (a) a discussion of the various methods of turbine cooling considered by the Germans, (b) information on the initial investigations and developments, and (c) methods of improving internal blade cooling.

SKF Industries, Inc., [Philadelphia, Pa.]
ENDURANCE TESTS OF ROLLING CONTACT BEARINGS OF CONVENTIONAL AND HIGH TEMPERATURE STEELS UNDER CONDITIONS SIMULATING AIRCRAFT GAS TURBINE APPLICATIONS, by H. O. Walp, R. P. Remorenko, and J. V. Porter. Rept. for Feb 53-Feb 58 on Contract AF 33(600)22860. July 59, 87p. WADC Technical rept. 58-392; AD-212 904.
Order from OTS $2.25 PB 161 672

Endurance tests of rolling contact bearings of conventional and high temperature steels were conducted at two temperature levels and at normal and high speeds. Test results indicate that the fatigue life of the high temperature steels is materially increased by vacuum melting. High speed ball bearings, alike in all respects except for ball diameter variations, were tested at high speed to study dimensional effect on endurance life. Results of the endurance tests indicate no correlation of individual bearing life with observed dimensional variations for the same bearings. To provide a means of determining the fatigue properties of materials without using complete bearings, simple specimen testing machines were designed and operated. (Author)

Systems Technology, Inc., Inglewood, Calif.
THE DETERMINATION OF LATERAL HANDLING QUALITY REQUIREMENTS FROM AIRFRAME-HUMAN PILOT SYSTEM STUDIES, by Irving L. Ashkenas and Duane T. McRuer. Rept. on Contract AF 33(616)5661. June 59, 90p. 57 refs. WADC Technical rept. 59-135; AD-212 152.
Order from OTS $2.25 PB 161 538

Pilot describing functions and airframe transfer functions are combined within a servo analysis framework to develop a partial theory of lateral handling qualities. Tentative criteria for certain roll/aileron transfer function quantities are derived and compared with existing pilot opinion data to establish limited regions of validity. The report contains a summary of pilot dynamic capabilities in closed loop tasks, airframe lateral transfer function characteristics and parameters, and current dynamic lateral handling qualities requirements and data. (Author)

Chemical Engineering

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
DESIGN STUDY OF HIGH PRESSURE OXYGEN VESSELS, by Donald A. Keating. Rept. for Sep 58-May 59 on Equipment for Life Support in Flight Operations. Feb 60, 28p. 9 refs. WADC Technical rept. 59-767.
Order from OTS $0.75 PB 161 666

The feasibility of storing gaseous breathing oxygen under extreme high pressures for life support in flight operations is investigated. The method of solution is theoretical in nature utilizing both analytic and graphic techniques. In general, high pressure oxygen storage vessels utilizing an internal pressure at approximately 7500 psia were found to be theoretically superior on a weight-volume basis to standard liquid oxygen converters for missions of moderate duration. The optimum internal pressure is based on the minimum mathematical product of vessel weight and volume, and is dependent upon the strength characteristics of the vessel material. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
AIRCRAFT-TRACKING COLORED-SMOKE MARKER, by Woodrow W. Reaves and Kenneth G. Carlon. Rept. for May 55-Oct 57 on Dissemination Research on CW Agents. Jan 60, 24p. CWLR 2338; AD-231 129.
Order from LC mi$2.70, ph$4.80 PB 146 061

Investigation for the Navy of a smoke tracking device to aid in visual tracking of guided missiles and rockets during test flights resulted in the development of a marker designated the E24 aircraft-tracking red-smoke marker. This marker is essentially a pair of smoke canisters mounted in a pod suspended from the

wing racks of an aircraft. The pyrotechnic composition of the marker consists of the following: red dye, 57.0 parts by weight; potassium chlorate, 25.0 parts by weight; and thiourea, 18.0 parts by weight. This formulation was tested in an aircraft traveling at a speed of 570 knots at an altitude of 30,000 feet or higher, and produced a clearly visible smoke trail for approximately 3 minutes.

Army Chemical Warfare Labs., Army Chemical Center, Md.
DEVELOPMENT TESTING OF PORTABLE DECONTAMINATING APPARATUSES: E17R1, 1-1/2-QUART (NONEXPENDABLE) AND E18, 1-QUART (EXPENDABLE) by John H. Buddemeyer and M. F. Gilchrist. Aug 59, 33p. 11 refs. CWLR-2302.
Order from LC mi$3.00, ph$6.30 PB 146 058

The object was to develop a small improved decontaminating apparatus which would meet prescribed military/technical characteristics. This report concerns the development testing of the nonexpendable Decontaminating Apparatus, and the attempted development of the expendable Decontaminating Apparatus. The unit, designed for mounting on vehicular-type equipment, was to serve for decontaminating the essential components of these systems to a degree where continuous operation was assured. Conclusions: The E17R1 unit meets the prescribed military/technical characteristics for an improved small decontaminating apparatus, and is a satisfactory development prototype for final engineering testing. A prepressurized apparatus such as the E18 is not feasible when used with DS2 solution if operation is required over a wide temperature range.

Army Chemical Warfare Labs., Army Chemical Center, Md.
GAS-AEROSOL FILTER MATERIAL PILOT PLANT, by Morris Thompson and Bernard J. Bruns. Sep 59 217p. CWLR-2297.
Order from LC mi$9.60, ph$33.30 PB 146 171

This report covers the relocation of the filter material pilot plant from Pittsburgh, Pennsylvania, to the Army Chemical Center, Maryland, the modifications to this plant and the changes to the dry process for making Gas-aerosol filter material for the M17 field protective mask. The pilot plant was relocated, modified, and operated to make changes to and to gather data on the dry process.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
THERMAL PARAMETERS ASSOCIATED WITH IGNITION OF THE MAGNESIUM-BARIUM NITRATE SYSTEM, by Martin Gilford and Saul Gordon. Mar 60, 27p. 11 refs. Technical notes no. 43.
Order from LC mi$2.70, ph$4.80 PB 144 830

The effects of the thermal blanketing technique and of high-humidity storage on the ignition behavior of the magnesium-barium nitrate system have been investigated.

Indiana U., Bloomington.
A DIGITAL PULSE INTEGRATOR FOR FLASH INTENSITY MEASUREMENTS, by Henry H. Kramer and Edward J. Bair. Rept. on Contract AF 18(603)93. 29 Aug 58, 13p. 3 refs. AFOSR-TN-58-777; AD-201 925.
Order from LC mi$2.40, ph$3.30 PB 138 173

A digital pulse integrator is described for measuring the voltage-time area of electrical impulses such as the photocurrent resulting from the photoelectric observation of a xenon flash source. As the basis of its operation, the positive pulse to be integrated charges a capacitor. A decade scaler then counts the number of smaller negative pulses from a crystal oscillator that are required to discharge the capacitor to its original voltage.

Willow Run Labs., U. of Michigan, Ann Arbor.
THE PHASE DIAGRAM FOR THE BINARY SYSTEM CADMIUM-TELLURIUM, by Donald R. Mason and Bernard M. Kulwicki. Rept. on Project Michigan, Contract DA 36-039-sc-78801. Apr 60, 33p. 13 refs. 2900-139-R.
Order from LC mi$3.00, ph$6.30 PB 146 870

The phase diagram for the cadmium-tellurium system has been redetermined by measuring the thermal behavior of representative compositions in the system by the method of differential thermal analysis. The experimental details and the resulting data are described and discussed. Thermodynamic analysis shows that the system CdTe-Te appears to form an ideal solution. The latent heat of fusion of CdTe is estimated to be 10,700 cal/gm mol. The system Cd-CdTe is an elementary solution and has a relatively large excess partial molar entropy of solution and a large partial molar enthalpy of solution. These partial molar qualities are independent functions of composition, but not of temperature. The eutectic compositions have been determined as 10^{-6} atom-fraction Te and about 0.99 atom-fraction Te. The validity of this work vis-a-vis that of other investigators is discussed. (Author)

Civil Engineering

Bureau of Yards and Docks, Washington, D. C.
CONSTRUCTION BATTALION ADMINISTRATION. 1 Aug 53, 32p. 28 refs. Technical pub. NAVDOCKS TP-Ad-7.
Order from LC mi$3.00, ph$6.30 PB 139 135

Described herein are the authority and responsibilities of the Bureau of Yards and Docks for technical and management control matters related to the Naval Construction Forces, followed by a short history of the Seabees. The types of Naval Construction organizations are described and the military aspects and command relationships are outlined. Information also is presented on types of assignments, personnel administration, correspondence, records and reports, military justice, supply and disbursing, and training. This publication does not give detailed instructions for handling administrative matters.

Illinois U., Urbana.
REVIEW OF THE LITERATURE PERTAINING TO THE BEHAVIOR AND DESIGN OF DEEP STRUCTURAL MEMBERS, by W. J. Austin and W. Egger. Technical note on Contract AF 29(601)468. June 58, 52p. 80 refs. AFSWC-TN-59-8; AD-211 213.
Order from LC mi$3.60, ph$9.30 PB 145 731

A comprehensive literature survey into the field of deep beams. Reinforced-concrete deep beam theory. Data can be used as a guide in organizing future testing. Moment-shear interaction in medium-thick beams (1:6 ratio), from which information on web reinforcement was obtained. Response of small-scale beams of conventional length depth ratios to impact loading. Behavior of deep steel members.

Mathematics Research Center, U. of Wisconsin, Madison.
A SURVEY OF THE LITERATURE ON THE THEORY OF THIN-WALLED BARS, by J. Nowinski. Rept. on Contract DA 11-022-ORD-2059. Oct 58, 39p. 133 refs. MRC Technical summary rept. no. 57; AD-207 995.
Order from LC mi$3.00, ph$6.30 PB 145 872

Stanford U., Calif.
INVESTIGATION OF SHEAR WALLS. PART 9: CONTINUED EXPERIMENTAL AND MATHEMATICAL STUDIES OF REINFORCED CONCRETE WALLED BENTS UNDER STATIC SHEAR LOADING, by Jack R. Benjamin, and Harry A. Williams. Technical rept. no. 7 on Contract DA 49-129-eng-193. 1 Sep 55. 126p. 8 refs. AFSWP 888.
Order from LC mi$6.30, ph$19.80 PB 137 986

A study to determine an efficient way of strengthening walls with openings resulted in recommendations for the addition of diagonal corner bars well anchored in the edge members of the wall. In panel reinforcing localized reinforcing patterns were no better than uniform horizontal and vertical steel. A limited study was made to determine the resistance of walls to combinations of shear load in the plane of the wall and forces perpendicular to a face. (See also PB 137 465)

Stanford U., Calif.
INVESTIGATION OF SHEAR WALLS. PART 10: LIMITED STUDY OF BRICK AND CONCRETE BLOCK SHEAR WALLS WITH STEEL FRAME, by Jack R. Benjamin, Harry A. Williams and others. Technical rept. no. 8 on Contract DA 49-129-eng-193. Sep 56, 54p. 7 refs. AFSWP 889.
Order from LC mi$3.60, ph$9.30 PB 137 987

This report gives results of a limited investigation of brick and concrete block shear walls, with and without openings, and enclosed in a steel frame. Rough methods of predicting the load-deflection characteristics of such walls are given. (See also PB 137 986)

Electrical and Electronic Engineering

Airborne Instruments Lab. [Melville] N. Y.
APPLICATION OF SEMICONDUCTOR DIODES TO MICROWAVE LOW-NOISE AMPLIFIERS AND HARMONIC GENERATORS, by J. C. Greene, E. Kraemer, and others. Quarterly progress rept. no. 3, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-78161. 15 Apr 59, 23p. 5 refs. Rept. no. 5872-1-3.
Order from LC mi$2.70, ph$4.80 PB 145 807

Preliminary experimental results are presented on the operation of a microwave third-harmonic generator. In the experimental model, the input signal frequency is about 1000 Mc, and the impedances presented to the fundamental, second, and third harmonic currents are independently variable. The inability to obtain the large predicted values of gain-bandwidth products at higher operating frequencies is tentatively attributed to diode lead inductance. (See also PB 142 622)

Airborne Instruments Lab., Melville, N. Y.
APPLICATION OF SEMICONDUCTOR DIODES TO MICROWAVE LOW-NOISE AMPLIFIERS AND HARMONIC GENERATORS, by J. C. Green, E. Kraemer, and others. Final progress rept. 30 June 58-30 June 59, on Contract DA 36-039-sc-78161. 15 July 59, 70p. 22 refs. Rept. no. 5872-1; AD-225 845.
Order from LC mi$3.90, ph$10.80 PB 145 806

A theory for the maximum achievable voltage gain-fractional bandwidth product of one-port and two-port difference frequency reactance amplifiers has been worked out. Low-frequency and microwave experiments indicate good agreement between theoretical and measured values. The noise figure of a reactance amplifier designed in this manner is nearly optimum. (See also PB 145 807)

Battelle Memorial Inst., Columbus, Ohio.
LABORATORY TEST PROCEDURES FOR PREDICTING THE TROPICAL-SERVICE LIFE OF ELECTRONIC COMPONENTS AND MATERIALS, J. L. Easterday, A. E. Mace, and W. E. Chapin. Final summary rept. for 1 Sep 54-31 Mar 59 on Contract DA 36-039-sc-64518. 31 Mar 59, 122p. 20 refs. AD-226 309.
Order from OTS $2.75 PB 161 692

This report contains the summarized base-line data obtained from over 3 years' exposure to tropical environments for a wide variety of electronic components. Several laboratory investigations were conducted; the results of this work have been analyzed and correlated to the base-line data obtained from the tropical exposures. Acceleration factors relating laboratory investigations to the tropical exposures have been formulated and are presented.

Bell Telephone Labs., New York.
SUBMINIATURE FIXED CAPACITORS, by D. A. McLean, H. G. Wehe, and J. K. Werner. Final rept. for 1 July 55-30 June 57 on Contract DA 36-039-sc-64695. June 57, 68p. 4 refs. Rept. no. 26286-G; AD-156 911.
Order from LC mi$3.90, ph$10.80 PB 145 979

Final models of both grade 1 and 2 capacitors were completed and delivered along with drawings and specifications. The original purpose for grade 1 capacitors for 1-mc use was achieved except that the tan δ requirement was applied at 200 kc instead of 1 mc. The original requirements of tan δ = 0.0015 max were achieved or closely approached. A practicable design was established for subminiature, supported-film, fixed capacitors with mica-like properties for use in LV transistor circuits. Using polystyrene lacquer supported by metallized strips of paper, a capacitance of >25,000 µµf was placed in a volume of 0.03-cu in. with no dimension greater than 5/8 inch. The complete original purpose for grade 2 capacitors was not achieved. Tan δ requirements were readily met, but the capacitance was low if the IR was satisfactory, and vice versa. An alternate film was used, a stripped lacquer film of cellulose acetate, with new objectives of 0.15 µf minimum, tan δ of 0.02 max at 1 kc, in 0.03 cu inch. With this film, the new objectives were completely achieved. The capacitance was 0.23 µf, tan δ was less than 0.02 at 1 kc (and less than 0.03 at 100 kc.). The initial IR's at 50-v dc were greater than 1000 ohm-farads, the median IR being 20,000 ohm-farads at room temperature. Capacitors showed satisfactory life-test performance at 100-v dc (twice rated voltage) at temperatures between -55°C and 65°C for periods exceeding 440 hr.

Bright Star Industries, Clifton, N. J.
FLAT CELL MAGNESIUM DRY CELL BATTERIES, by F. A. Keller. Semi-annual progress rept. no. 1, 30 Sep 58-31 Mar 59, on Contract DA 36-039-sc-78231. [1959] 12p.
Order from LC mi$2.40, ph$3.30 PB 145 803

The dimensions and design for the flat Magnesium "N" cell and its components have been established. All tools are satisfactory except the stellite die and punch for the mix cake.

Centre de Physique Eléctronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE T.C.M. 16, by G. Wendt. Rept. on Proj. NR-048-140. 31 May 59, 21p. W.R. 406; AD-218 425.
Order from LC mi$2.70, ph$4.80 PB 146 261

In the first part of the present report we will describe the technological improvements made on the TCM 16 gun. We were able through them to get stable characteristic curves which showed the required current linearity. In the second part we studied the formation of the electron beam in such a gun. With an electrolytic tank fields have been plotted and rays traced. Moreover a tube having a metallic target with a slit allowed us to see how the spherical aberration did depend upon the nature of the focusing lens, either electrostatic or magnetic. In the third part we describe the tests made with that gun shooting on a memory target of our usual type. (See also PB 145 585)

Chatham Electronics, Livingston, N. J.
DEVELOPMENT AND EVALUATION OF ELECTRON TUBE GLASSES RESISTANT TO RADIATION DAMAGE, by G. R. Weinberg. Final rept. for 1 May 58-30 Apr 59 on Contract DA 36-039-sc-75065. [1959] 26p. AD-220 199.
Order from LC mi$2.70, ph$4.80 PB 146 041

Enclosures made of various glass without leads and with matching leads sealed-in were exposed to an integrated thermal neutron flux of 10^{16}NVT. Except for glass type 7052, no damage besides discoloration could be noticed. The 7052 glass with sealed-in molybdenum leads cracked when exposed to an integrated thermal neutron flux of 10^{16}NVT. Type 7720 glass with sealed-in tungsten leads cracked when exposed to an integrated thermal flux of 10^{17}NVT.

Clevite Transistor Products, Waltham, Mass.
RESEARCH AND DEVELOPMENT OF GERMANIUM PNP JUNCTION SWITCHING TRANSISTORS, by Paul L. Meretsky. Quarterly progress rept. no. 3, 10 Dec 58-9 Mar 59, on Germanium High Current NPN or PNP Junction Switching Transistor, Contract DA 36-039-sc-75060. [1959] 26p; AD-218 663.
Order from LC mi$2.70, ph$4.80 PB 145 876

Approximately fifty germanium PNP transistors meeting all electrical specifications of SCL-5522 were on hand. Measurements indicate that reliable hermetic enclosures have resulted. (See also PB 142 760)

Clevite Transistor Products, Waltham, Mass.
RESEARCH AND DEVELOPMENT OF GERMANIUM PNP JUNCTION SWITCHING TRANSISTORS, by Paul L. Meretsky. Quarterly progress rept. no. 4, 10 Mar-9 May 59, on Germanium High Current NPN or PNP Junction Switching Transistor, Contract DA 36-039-sc-75060. [1959] 30p.
Order from LC mi$2.70, ph$4.80 PB 146 167

The work continued along the lines of solving the burnout problem. At present it appears that the lowest possible resistivity combined with the widest possible alloyed base width leads to fewer burnouts in the switching test. (See also PB 142 760)

David Sarnoff Research Center, Princeton, N. J.
HIGH-TEMPERATURE SEMICONDUCTOR DEVICES, by A. Amith, L. Ekstrom and others. Scientific rept. for 15 Feb 57-30 Sep 59 on Contract AF 33(616)5029. 31 Oct 59, 131p. 63 refs. AFCRC-TN-60-134.
Order from OTS $2.75 PB 161 541

Purification, crystal growth, and evaluation of the compounds, GaAs and InP. Determination of Impurities in GaAs, Diffusion in GaAs and InP, and Minority Carrier Lifetime in GaAs. Fabrication of diodes, rectifiers, and transistors of both GaAs and InP. Large single crystals of GaAs and InP have been prepared by four different growth techniques with low dislocation densities and with no lineage. Purification techniques have been devised by which arsenic, phosphorus, and gallium are prepared with a purity of about 99.9999%. Single crystal growth of arsenic from the melt, the distillation of arsenic from lead-arsenic alloys, the vacuum annealing of gallium with a cold "finger", single crystal growth of gallium, and chemical and physical treatments of phosphorus. The diffusion of indium and phosphorous in InP was studied using radioactive tracers of these elements. Photoconductance and the photoelectromagnetic effect have been measured over the temperature range 80°K-300°K with a view toward learning the lifetime of minority carriers. The basic technology important to the fabrication of most known devices has been demonstrated in GaAs and InP. This includes point contacts, metal semiconductor contacts, and alloy and diffusion junctions. Devices such as the microwave diode, parametric amplifier, large and small signal rectifiers, tunnel diode, and unipolar transistor have been successfully made.

Diamond Ordnance Fuze Labs., Washington, D. C.
EFFECTS OF PULSED NUCLEAR RADIATION ON NONOPERATING TUBES AND TRANSISTORS, by Herbert G. Chandler. 20 Nov 59, 20p. 4 refs. Technical rept. TR-795; AD-230 237.
Order from LC mi$2.40, ph$3.30 PB 146 077

During Operation Hardtack electron tubes of both ceramic and glass construction and transistors were exposed to nuclear radiation while they were not functioning. These components were subjected to neutron bombardment as great as 4×10^{14} Pu^{239} nvt. No deleterious effects on the electron tubes were observed under these conditions. However, measured transistor parameters suffered large percentage changes from radiation greater than 3×10^{13} Pu^{239} nvt. These effects were much greater in audio than in RF types. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PHASE SYNCHRONIZATION OF SUPERREGENERATIVE OSCILLATIONS, by H. G. Fritz. 28 Dec 59, 20p. 3 refs. Technical rept. TR-780; AD-231 044.
Order from LC mi$2.40, ph$3.30 PB 146 079

Pulsed continuous-wave and absolutely periodic oscillator spectra are discussed with emphasis on line position. Experimental pulsed continuous-wave spectra are shown. The superregenerative phase-synchronized spectrum is derived. It is shown that the spectral lines for a superregenerative oscillator controlled by an external signal occur about the signal frequency regardless of the oscillator frequency and regardless of changes in this frequency during the quench pulse. This effect is attributed to synchronization of the oscillator starting phase with the external signal. Experimental spectra are used to illustrate this principle. The difference between phase synchronization and locking is stressed. Photographs of spectra for a locking CW oscillator are shown. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
STATUS OF ELECTRONIC MICROMINIATURIZATION: FEBRUARY 1960, by Norman J. Doctor. 4 Mar 60, 29p. 31 refs. TR-823.
Order from OTS $0.75 PB 161 674

Major programs in electronic microminiaturization currently being pursued by educational, Governmental, and industrial laboratories are described. The techniques reviewed include: (1) welding of miniature commercial parts, (2) soldering of miniature commercial parts to miniature etched-wiring boards, (3) riser-wire connecting of wafer microelements, (4) printing of multicomponent circuits on single ceramic substrates and (5) forming of both integrated and functional solid circuits. An extensive bibliography is included. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
THEORY OF THE GERMANIUM DIODE MICROWAVE SWITCH, by Robert V. Garver, John A. Rosado, and Edward F. Turner. 15 July 59, 14p. 13 refs. Technical rept. TR-747; AD-228 975.
Order from LC mi$2.40, ph$3.30 PB 146 060

The application of a generally neglected theory of microwave detection to the poorly understood problem of p-n semiconductor junction behavior at microwave frequencies is discussed. Experimental results are presented which appear to be the first direct experimental verification of the theory. The theory predicts that germanium microwave diodes should exercise direct switching action upon microwaves while silicon microwave diodes should not, as had been observed in the past but with no explanation. (Author)

Dielectrics Lab., Johns Hopkins U., Baltimore, Md.
A PRACTICAL INTERPRETATION OF DIELECTRIC MEASUREMENTS UP TO 100-MC, by J. J. Chapman and L. J. Frisco. Rept. on Contract DA 36-039-sc-73156. 31 Dec 58, 211p. 23 refs.
Order from OTS $3.50 PB 161 545

The rapid development of the electronics industry in recent years has brought about a demand for increased activity in the development of insulating materials and design techniques which can be applied to high-frequency problems. With the ever increasing demands of industry and the military for greater power output ratings from smaller units, the insulating material has become the critical part of many assemblies. The authors have made extensive investigations of the behavior of solid insulating materials over the frequency range of 60-cps to 100-mc. The primary objective of these studies was to determine the effects of frequency, temperature and moisture absorption on the electrical properties of representative insulating materials. Particular emphasis was placed on the measurement of electric strength at frequencies up to 100-mc. The purpose of this present report is to summarize all of the data in a convenient form and to discuss the results from a practical, rather than an academic viewpoint.

Eastman Kodak Co., Rochester, N. Y.
BASIC RESEARCH INVESTIGATIONS FOR AMMONIA VAPOR ACTIVATED BATTERIES, by J. M. Freund, V. M. Bryant, and J. B. Schliff. Quarterly progress

rept. no. 7, 15 Mar-14 June 59, on Contract DA 36-039-sc-74902. [1959] 21p. AD-226 662.
Order from LC mi$2.70, ph$4.80 PB 145 878

Data are given for the conductance of ammonia solutions of NH_4SCN at concentrations ranging between 6 mol% and 40 mol% NH_4SCN, at temperatures between -70°C. and +30°C. Preliminary data are presented for NH_4NO_3 and NaSCN solutions and on the effect of water or CO_2 additives to NH_4SCN solutions. Some information is also given on the vapor pressure of moderately concentrated NH_4SCN solutions, 8.3 and 13.2 mol%. These pressures are about 80% and 60%, respectively, of the pressure of pure ammonia at the same temperature. (Author) (See also PB 143 896)

Educational Research Corp. [Cambridge, Mass.]
A COMPARISON OF TWO METHODS OF TEACHING MORSE CODE, by Philip J. Rulon and W. Douglas Brooks. Rept. on Contract N61339-294. 11 Jan 60, 29p. 11 refs. Technical rept. NAVTRADEVCEN-294-2.
Order from LC mi$2.70, ph$4.80 PB 145 833

The results of this study indicate that with regard to speed, there is no difference between the groups at any time during the course of training. One method requires about the same length of time to increase the students' speeds to certain levels, whether this speed is 4, 10, 16 or 22 words per minute. At the end of 22 weeks of instruction, students taught by one method are just as fast and as accurate as students taught by the other. The only differences found were that during the early weeks of code training, the Robins method produced more accurate students than did the standard Navy method.

Eitel-McCullough, Inc., San Bruno, Calif.
EVALUATION OF UHF PLANAR TRIODE TUBE TYPE 2C39A IN THE POSITIVE GRID REGION. Final technical rept. for 15 Nov 57-15 Oct 58 on Contract DA 36-039-sc-74815. [1958] 35p. AD-225 985.
Order from LC mi$3.00, ph$6.30 PB 145 935

This work was undertaken to establish tube capabilities in the positive grid region and to provide data as a basis for setting test limits suitable for inclusion in a procurement specification. Long-pulse (4500 μs) tests in the positive-grid region were made on nine monthly, 10-tube samples of 2C39A tubes over a six-month period. Results were analyzed statistically and means and standard deviations are reported for each of the tests. No correlation was found between the long-pulse tests and the conventional tests of the MIL-E-1/546 TSS. (Author) (See also PB 142 994)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
INVESTIGATION OF MICROWAVE DUPLEXER SWITCHING MECHANISMS, by A. Aharoni, R. Poeschel and others. Quarterly progress rept. no. 7, 1 Nov 58-28 Feb 59, on Contract DA 36-039-sc-73150. 31 Mar 59, 45p. 13 refs. AD-225 731.
Order from LC mi$3.30, ph$7.80 PB 145 936

Under Task A experiments were performed: (1) to improve upon the precision in the determination of the collision cross section, for momentum transfer, of water vapor molecules for slow electrons of a room temperature (300°K) electron gas; (2) to analyze the free electron loss processes as influenced by immersion in the volume of the gas container solid substances (quartz wool) in Helium and Argon discharges; (3) to investigate the gas dynamics in pulsed electrical discharges in rate gases of short duration moderate intensities. Under Task B research of semiconductor behavior in high level eight millimeter waves was continued. Previously observed spurious phenomena associated with the high level eight millimeter pulsed signals have been analyzed in detail and found to be due to a sizable second harmonic component of the (8mm) magnetron output. The elimination and/or use, as the case may be, of this harmonic component in the microwave pulsed signal will permit the development of a method by which changes in mobility and carrier concentration in both microwave fields can be determined. (Author) (See also PB 142 996)

Electron Tube and Microwave Lab., Calif. Inst. of Tech., Pasadena.
POWER FLOW AND GAP COUPLING TO SLOW WAVE PLASMA MODES, by Gary D. Boyd. Technical rept. no. 12 on Contract Nonr-220(13). June 59, 37p. 10 refs. AD-220 086.
Order from LC mi$3.00, ph$6.30 PB 146 516

The interaction impedance for the slow wave plasma modes of Trivelpiece and Gould is obtained for a coaxial system of plasma column, surrounding dielectric and conducting surface. The theory presented includes a finite axial magnetic field. Calculations are presented for the special case of no static magnetic field for the so-called surface wave interaction impedance versus βa. Coupling to the slow wave plasma modes by a known electric field across a gap in the conducting surface at the dielectric surface is analyzed for the coaxial plasma system including a static axial magnetic field. This results in an impedance as seen by the cavity gap. Calculations are presented for the special case of no static magnetic field. (Author) (See also PB 151 638)

Electronic Communications, Inc., Timonium, Md.
AUTOMATIC CONTROL OF RADIO FREQUENCY PHASE SHIFT, by S. N. Broady and R. G. Roush. Final rept. on Contract AF 19(604)2407. 31 Oct 59, 41p. 3 refs. AFCRC-TR-59-363.
Order from LC mi$3.30, ph$7.80 PB 145 757

The purpose of this report is to investigate and develop feed-back techniques to provide precision electronic control of phase shifter devices suitable for operation in the 200 to 1500 Mc/sec frequency band. Three phase control systems are discussed: The first, developed under another contract, provided the basis for the work described herein. The second, a refinement of this original system, was found to be unrealizable in this frequency range. The third and successful system can be realized conveniently at both UHF and microwave frequencies.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
SPARE PARTS KITS AT MINIMUM COST, by Guy Black and Frank Proschan. Rept. on Contract DA 36-039-sc-75012. 13 Oct 58, rev. 4 Dec 59, 33p. 14 refs. Technical Memo. no. EDL-M154; AD-208 305.
Order from LC mi$3.00, ph$6.30 PB 146 876

The root of the problem is that spare parts consumption is a random process. Statistical records on electronic component failure indicate that often the rate of failure is quite constant during a large part of equipment life, meaning that an exponentially declining probability density function must be used to describe the probability that a component will survive a given number of hours.

Electronics Research Lab., U. of California, Berkeley.
SCATTERING BY A NONRESONANT SLOT IN A RECTANGULAR GUIDE, by N. Kusnezov. 10 Dec 58, 42p. 14 refs. IER Series no. 60, Issue no. 219. Rept. no. 76.
Order from LC mi$3.30, ph$7.80 PB 145 850

The approximate solution is explored for a thin slot in a rectangular wave guide as obtained by Stevenson (Jnl. of Applied Physics 19:24-38 (1948)), and later improved in this laboratory by Held (ERL rept. 27, PB 117 529). Although both theories treat the same problem, they arrive, in the case of a resonant slot, at answers which differ in form considerably.

Electronics Research Lab., U. of California, Berkeley.
SCHEME FOR IMPROVING BEAM-TUBE PERFORMANCE BY DEPRESSING COLLECTOR POTENTIAL, by J. W. Hansen. Scientific rept. no. 7 on Contract AF 19(604)2270. 15 Dec 59, 48p. 18 refs. IER Series no. 60, issue no. 260; AFCRC-TN-59-977.
Order from LC mi$3.30, ph$7.80 PB 145 767

The present state of the art of depressed-collector design is reviewed and the characteristics of various designs are discussed. A design is proposed with desirable characteristics of most present designs but without the common disadvantage of adding to the size and weight of the tube. The performance of the collector is evaluated experimentally and is found to be promising. The device is readily adaptable to a rugged, simple collector for a commercial tube. The possibility of modification of the design to include velocity sorting is discussed. (Author)

General Electric Co., Owensboro, Ky.
INVESTIGATION OF THE EFFECTS OF OPERATING CONDITIONS ON SUBMINIATURE ELECTRON TUBES, by M. W. Edwards. Final rept. for 1 July 56-1 July 58 on Contract DA 36-039-sc-73072. [1958] 807p. AD-217 415.
Order from LC mi$11.10, ph$122.70 PB 145 925

Bulb temperature proved to be most important variable interacting with plate voltage to result in electrolysis of glass. Filament voltage ranks next to bulb temperature in importance and has more effect on slumping characteristics and less effect on electrolysis. Plate voltage has an important effect on electrolysis. Plate wattage as applied in this project had an important effect on the 6021 only, and was discarded as unimportant on all other types. Heater-cathode voltage as applied was discarded as unimportant on all types. The 5840 and 6021 display great tolerance to shock, whereas the 1AD4 and 6088 show good tolerance. The T3-Cathode type subminiatures are superior to Filamentary Cathode types. Folded Heaters are indicated to be somewhat superior to coil heaters. Electrolysis of the glass envelope opposite opening in the plate will cause early life slump. Statistical analysis has developed a figure of merit which is a valuable tool.

General Electric Co., Schenectady, N. Y.
DEVELOPMENT OF RUGGEDIZED HIGH TEMPERATURE CERAMIC UHF TUBES OF PLANAR GEOMETRY, by R. E. Manfredi and K. R. MacNaughton. Final rept. for 1 July 57-31 Oct 58 on Contract DA 36-039-sc-74859. [1958] 124p.
Order from LC mi$6.30, ph$19.80 PB 145 879

This report summarizes a program for development and/or evaluation of three ruggedized high temperature ceramic UHF tubes of planar geometry. The program included (a) design and construction of a six-stage, 500-MC amplifier for circuit evaluation of Type Z-2389 Triode as a preamplifier, (b) evaluation of Type Z-1910 Triode as a frequency doubler from 500 MC to 1000 MC and as an intermediate amplifier at 1000 MC, (c) development of Type Z-5192 Tetrode and its evaluation as a power amplifier, and (d) simultaneous demonstration of the above three tube types in a single test gear. (Author)

General Electric Co., Schenectady, N. Y.
PACKAGED VOLTAGE TUNABLE MAGNETRON, by R. G. Lock and M. Bessarab. Final rept. for 1 Mar 57-30 June 58 on Contract DA 36-039-sc-73125. [1958] 127p. 27 refs. AD-214 732.
Order from LC mi$6.30, ph$19.80 PB 145 934

A study was made of microwave circuits for voltage tunable magnetrons. Experimental results are presented for broad and narrow bandwidths at S-band. Design construction and packaging of a prototype voltage tunable magnetron oscillator was accomplished in the initial phase utilizing a Z-5112 VTM. Refined units using a Z-5299 VTM were supplied as the final units. Test data, sketches and photographs are contained in the report. (Author)

General Electric Co., Syracuse, N. Y.
70-AMPERE HIGH POWER SILICON CONTROLLED RECTIFIER, RESEARCH AND DEVELOPMENT PROGRAM, by G. N. Hall and R. P. Lyon. Quarterly progress rept. no. 1, 19 Jan-19 Apr 59, on Contract DA 36-039-sc-78278. [1959] 98p. 6 refs.
Order from LC mi$5.40, ph$15.30 PB 145 816

Junction feasibility studies have been completed and the alloy-diffused process has been chosen for fabrication. Test equipment includes: life test, forward

drop and thermal resistance, constant current, turn-off time, and PIV, VBO, gate test. Schematics and photographs of these equipments are presented.

General Electric Co., Syracuse, N. Y.
70-AMPERE HIGH POWER SILICON CONTROLLED RECTIFIER, RESEARCH AND DEVELOPMENT PROGRAM, by C. N. Hall and R. P. Lyon. Quarterly progress rept. no. 2, 19 Apr-18 July 59, on Contract DA 36-039-sc-78278. [1959] 40p. 12 refs.
AD-227 721.
Order from LC mi$3.00, ph$6.30 PB 145 815

This report includes: Two-terminal asymmetrical and symmetrical silicon negative resistance switches, by R. W. Aldrich and N. Holonyak, Jr. Phase-controlling kilowatts with silicon semiconductors, by F. W. Gutzwiller. The larger area silicon PNP pellet (.500" dia.) and emitter (.410" dia.) are being employed in the fabrication of the ZJ-70B silicon controlled rectifier. Evaluation of this junction is not complete, but fabrication feasibility and improved characteristics were demonstrated. A preliminary investigation on turn-off time was performed. This investigation was designed to probe the dependency of recovery times on structure geometry. The operating life test of five 100 volt cells has reached 500 hours with no failures. Thermal fatigue tests are in progress. Preliminary data is available. (Author) (See also PB 145 816)

General Mills, Inc., Minneapolis, Minn.
PARABALLOON ANTENNA MATERIALS STUDY, by J. H. Nash, F. J. Bollag and others. Rept. on Contract AF 30(602)1940. 1 Dec 59, 93p. 1 ref. General Mills Rept. no. 1915; RADC-TR-59-233.
Order from LC mi$5.40, ph$15.30 PB 145 835

There is currently considerable interest in the development of large, portable radar antennas. One approach which has shown some promise is the paraballoon antenna. This study deals with the development of a material suitable for application to the fabrication of paraballoon antennas.

General Radio Co., Cambridge, Mass.
FREQUENCY CONTROL SYSTEMS, by R. W. Frank and R. W. Stuart. Quarterly progress rept. no. 4, 1 Feb-1 Aug 53, on An Investigation of Circuits for the Purpose of Crystal Elimination, Contract DA 36-039-sc-15542. Aug 53, 71p. 2 refs.
Order from LC mi$4.50, ph$12.30 PB 137 908

The aim of this research is to develop a system which will permit the elimination of many quartz crystals which are currently used to control communication channel frequencies. The initial objective was to investigate two possible systems: one using multiples of phase-locked oscillators, and the second using one phase-locked oscillator driving a present continuously operating divider circuit. The second system was chosen on the basis of the work of the first three report periods. It is our purpose now, therefore, to evaluate the chosen system; and to engage in design refinements which will reduce the ideas reported here, and before, to practice for possible end-item manufacture. (Author) (See also PB 139 395, PB 142 534)

General Radio Co., Cambridge, Mass.
FREQUENCY CONTROL SYSTEMS, by R. W. Stuart. Quarterly progress rept. no. 7, 1 Feb-1 Sep 54, on [Investigation of Circuits for the Purpose of Crystal Elimination] Contract DA 36-039-sc-15542. Sep 54, 28p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 137 907

The program scheduled in the Fifth Quarterly progress report for the redesign of the scale-of-"N" counter has been completed. The three decades of the counter have been redesigned with principal emphasis on reliability, economy of power supply requirements and component totals, and the inclusion of ten-position rotary switching on all decades. The control circuits for the scale-of-"N" counter have undergone major revisions resulting in considerable reduction in complexity.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
HIGH FREQUENCY CRYSTAL-CONTROLLED OSCILLATOR CIRCUITS, by William A. Edson. Progress rept. no. 9 on Contract W36-039-sc-36841. 10 Aug 50, 28p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 137 869

The use of mutual inductance to compensate the crystal shunting capacitance has been reduced to practice in several oscillator circuits, and complete design procedures have been evolved, thus bringing this particular problem to a satisfactory completion. A convenient and accurate procedure for designing single layer solenoid transformers to meet specified inductance and coupling values, which has resulted from this work, is also applicable to a wide variety of problems involving radio frequency transformers. Existing theory with respect to Class C operation of triodes and pentodes has been adapted to the present problem.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
HIGH FREQUENCY CRYSTAL-CONTROLLED OSCILLATOR CIRCUITS, by William A. Edson. Progress rept. no. 10 on Contract W36-039-sc-36841. 10 Nov 50, 26p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 137 868

The use of inductance in series with crystals has been studied on a general basis. This work is an extension of the quarter-wave line concept as applied to the impedance-inverting oscillators, and indicates that under favorable circumstances impedance higher than that given by the quarter-wave line may be obtained. This advantage is realized, however, at the expense of frequency stability. The work on Class C operation has been continued, and a convenient design procedure for use with the grounded-grid oscillator has been evolved. Quantitative relationships are presented; their use in oscillator design is illustrated and experimentally confirmed. Additional work has been done on electron-coupled circuits for frequency multiplication. (See also PB 137 869)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY PROGRAM FOR INVESTIGATION TO AID IN REDUCTION AND PREVENTION OF UHF INTERFERENCE, by Floyd P. Holder, Henry W. Mauldin, Jr. and others. Technical rept. no. 3, phase 3, on Contract AF 30(602)673. 1 Oct 55, 174p. 50 refs. [RADC TR-56-89; AD-97 735]
Order from LC mi$8.10, ph$27.30 PB 137 653

This report presents the results of investigating the interference-reduction possibilities of modes of modulation and detection other than double-sideband amplitude modulation, polyphase modulation, and synchronous and polyphase detection as filtering techniques for the alleviation of common- and adjacent-channel interference. Reducing the carrier components of the amplitude-modulated signal reduces the interference generated within non-linear circuits. (See also PB 135 248)

Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF NARROW-BAND BANDPASS FILTERS WITH CENTER FREQUENCIES IN THE RANGE OF 10-60 MC, by Leo Storch. Interim final rept. on High Frequency Crystal Filters, Contract DA 36-039-sc-73070. Mar 58, 108p. 20 refs. Rept. no. 73070-1-F; AD-202 077.
Order from LC mi$5.70, ph$16.80 PB 146 561

The design theory for Type NB bandpass crystal filters is presented. The pertinent design equations for three-, five-, and seven-crystal filter sections of this type are given. The "Appendix B technique" is discussed in detail. The test results for five different Type NB filters are summarized. A self-contained design theory for bandpass ladder crystal filters is presented. Test results for a four-crystal ladder filter are given. The present status of the filter crystal art in the frequency range of interest is discussed. Suggestions for further work in the area of high-frequency, relatively narrow-band, bandpass filters are appended. (Author) (See also PB 146 564)

Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF NARROW-BAND BANDPASS FILTERS WITH CENTER FREQUENCIES IN THE RANGE OF 10-60 MC, by Leo Storch. Quarterly progress rept. no. 2, 1 Jan-31 Mar 57, on High Frequency Crystal Filters, Contract DA 36-039-sc-73070. [1957] 37p. 9 refs. Rept. no. 73070-2-Q.
Order from LC mi$3.00, ph$6.30 PB 146 564

A powerful crystal filter design procedure, which has been designated as the "Type NB technique", is outlined. Prototype designs based on this method for the following filters are described. (1) Center frequency: 11.5 mc; 6 db bandwidth: 40 kc; optimized bandpass characteristics for a total of 7 crystals. (2) Same center frequency and bandwidth as in #1, but characteristics optimized for a total of 5 crystals. (3) Center frequency: 20 mc; 3 db bandwidth: 150 kc; a total of 7 crystals. (4) Center frequency: 24 mc; 6 db bandwidth: 400 kc; a total of 8 crystals. Recent developments in linearized-phase crystal filter design are described. A prototype design of a Gaussian response filter with a 3 db bandwidth of 800 kc with respect to a center frequency of 10 mc and employing LC resonators is discussed.

Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF NARROW-BAND BANDPASS FILTERS WITH CENTER FREQUENCIES IN THE RANGE OF 10 - 60 mc, by Leo Storch. Quarterly progress rept. no. 4, 1 May-15 Sep 58, on High Frequency Crystal Filters, Contract DA 36-039-sc-73070. [1958] 26p. 2 refs. Rept. no. 73070-4-Q.
Order from LC mi$2.70, ph$4.80 PB 146 676

The design, construction and test results for two different high-frequency quartz crystal filters are discussed. The first of these filters possesses a center frequency of 11.5 mc, a 6 db bandwidth of 55 kc, and a sharp selectivity characteristic. The second filter is a branching filter with the center frequencies of the two constituent filters lying in the vicinity of 37 mc and the 6 db bandwidths of the individual filters equal to 3 kc. (Author)

International Resistance Co., Philadelphia, Pa.
HIGH TEMPERATURE, GENERAL PURPOSE, FIXED RESISTORS, by William F. Ebling, Jr., and Henry D. Pugh. Rept. on Improved Electronic Components, Contract AF 33(616)3633. Feb 60, 57p.
WADD Technical rept. 60-131.
Order from OTS $1.50 PB 161 688

Fifty, 1500, 0.25M, and 2M-ohm resistors have been fabricated using "Carbon Alloy" resistance films deposited on high alumina substrates protected by a reducing atmosphere. Special hard soldering and leak testing procedures are discussed. Performance data is included for resistance-temperature characteristics between 25° and 500°C, load life testing for 1000 hours at 1-watt load, temperature cycling between -77° and 500°C, vibration testing from 10-3000 cycles per second at 15G, and terminal strength appraisal of 5 pounds up to and including 500°C. In 0.25M-ohm and 2M-ohm resistors and blank units, a paralleling conductivity was observed as low as 50K-ohm after 100 hours operation at 500°C. No substantiated explanation of the paralleling conductivity is presented. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
TRANSISTOR LIFE EXPERIENCE: 1954-1958, by D. J. Eckl, P. A. Fergus, and R. L. Burke. Rept. on Contract AF 19(604)5200. 26 Mar 59, 40p. 7 refs.
Technical rept. no. 199; AD-214 565.
Order from OTS $1.00 PB 161 675

Original small-scale life tests, started in 1954 on the surface-barrier transistor, produced 4 million operating transistor hours with 5 transistor failures. In 1955 further data were obtained from two prototype systems: TM-1, an 8-digit multiplier, and EMAR, an experimental memory-address register. The TX-0 computer started operation in April 1956 and in April 1958 it had been in operation for 6000 hours. At this time 660 transistors were retested. All are still operating in TX-0 because of anticipation of and allowance for some parameter degradation. The most serious change has been a decrease in current gain. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
SPIN ECHO RESONANCE, by Daniel E, Kaplan and Michael E. Browne. Annual status rept. no. 1 on Contract Nonr-2541(00). 1 Apr 59, 11p. LMSD-48497.
Order from LC mi$2.40, ph$3.30 PB 145 735

Development of a millimicrosecond resolution time, electron pulse spectrometer has been undertaken with the dual objectives of investigating the feasibility of information storage in electron paramagnetic systems by spin echo techniques and of providing a research tool that would be useful for studying fast relaxation phenomena in such systems.

Mallory, P. R., and Co., Inc., Indianapolis, Ind.
SWITCH, ROTARY, 3-POLE, 8-POSITION HERMETICALLY SEALED, by Lowell G. Brodrick, Donald E. Givan and others. Rept. for 27 Jan 55-20 July 59 on Improved Electronic Components, Contract AF 33(600)29252. Jan 60, 122p. 135 refs. WADC Technical rept. 59-623.
Order from OTS $2.75 PB 161 659

This report covers the research leading to the development of two entirely different types of three pole, eight position, hermetically sealed, rotary switches. Included in this report are factual data pertaining to the design and development program, the technical requirements followed, and a detailed test report for the final developmental models. The switches submitted to the Air Force for approval were designed to make and break resistive loads at 300 volts DC, 50 millamperes, with superimposed radio frequencies up to 30 megacycles at 0.1 volt rms. The switch housing employed a one-piece metal case with three rows of eight each glass-insulated, eyelet-type terminals soldered around the periphery of the case. Switching was obtained by appropriate double leaved contacts engaging rotor shoe tabs as the rotors were rotated. The switches were approximately 1.6 inches in diameter and 1.5 inches long (exclusive of terminal and shaft extensions). This represented a volume of 3.1 cubic inches and a weight of 3.1 ounces. (Author)

Maxson, W. L., Corp., New York.
REDESIGN OF AMPLIFIER-POWER SUPPLY AM-598 (XM-1)/U, by R. Gittleman and S. Stempler. Final engineering rept. for 26 Mar 56-18 July 58 on Contract DA 36-039-sc-71222. Corrected to 31 Aug 59, 86p. Rept. no. 3074-1; AD-226 383.
Order from LC mi$4.80, ph$13.80 PB 145 956

The program is described that led to the redesign of amplifier-power supply AM-598/U. The equipment, designated amplifier-power supply AM-598(XM-1)/U, is a completely transistorized device, utilizing printed circuitry and a plug-in design to enhance reliability, servicing, and maintenance. The equipment converts the varying prime voltage of the vehicle to the regulated voltages to operate radio receiver transmitter type RT-176. An audio amplifier to operate loudspeakers in conjunction with the radio receiver is included. (Author)

Michigan U. Research Inst., Ann Arbor.
INVESTIGATION OF MICROWAVE PROPERTIES OF FERROELECTRIC MATERIALS, by C. B. Sharpe and C. G. Brockus. Final rept. for 1 Feb 58-31 Jan 59 on Contract DA 36-039-sc-75003. Mar 59, 67p. 13 refs. 2732-4-F.
Order from LC mi$3.90, ph$10.80 PB 145 893

A method is developed for measuring the complex dielectric-constant $\varepsilon'-j\varepsilon''$ of ferroelectric materials in the frequency range 1.8-4.0 kmc. Data are given on the variation of ε' and ε'' with frequency, temperature, and bias field for a number of ferroelectric ceramics. (Author) (See also PB 138 790)

Microwave Associates, Inc., Burlington, Mass.
HIGH REPETITION RATE BROADBAND DUPLEXER, by L. Gould and E. Horn. Quarterly progress rept. no. 3, 15 Feb-15 May 59, on Contract DA 36-039-sc-78165. 4 Apr 58, 44p. AD-226 815.
Order from LC mi$3.30, ph$7.80 PB 146 494

Measurements of arc loss and recovery time as a function of gas pressure were obtained for argon, neon, krypton and xenon using an encapsulated window containing medium density quartz wool. In addition, measurements of recovery time as a function of gas processing indicate that impurities may be present which increase the arc loss. Measurements of arc loss and recovery time as a function of peak incident power were obtained for argon at various gas pressures. A study of echo signal attenuation as a function of time indicates that the rate of attenuation is a function of the nature of the gas and the gas pressure. The TR filter design investigation shows that a bandpass of 2400 to 2800 Mc with a VSWR less than 1.3 can be obtained for a single tube incorporating an encapsulated input window. (Author)

Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF DUPLEXING TECHNIQUES AT HIGH DUTY CYCLE CONDITIONS, by Lawrence Gould. Quarterly progress rept. no. 1, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-78233. [1958] 32p. AD-217 834.
Order from LC mi$3.00, ph$6.30 PB 145 958

A study program for a theoretical and experimental study and investigation of techniques leading to the development of microwave duplexers for operation at high duty cycle conditions has been initiated. Gas discharge switching devices are discussed and the recovery time and arc loss values are presented for a number of gases. Preliminary results on ferrite circulators are discussed. Insertion loss values of less than 0.4 db were obtained. Some results on crystal protector TR tube at high repetition rate are presented. Recovery times less than 0.1 μs can be achieved for both gas switching elements and crystal protector TR tubes. (Author)

Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF DUPLEXING TECHNIQUES AT HIGH DUTY CYCLE CONDITIONS, by Lawrence Gould. Quarterly progress rept. no. 2, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-78233. [1959] 26p. AD-226 012.
Order from LC mi$2.70, ph$4.80 PB 145 959

An analysis of the power handling limitations of ferrite circulators at low values of peak power and high repetition rates is discussed. The results indicate that the thermal conductivity, insertion loss, and height of the ferrite material are important parameters. Techniques for enhancing the power handling capability of crystal protector TR tubes is discussed. In particular, a balanced ATR switch shows promise for this application. Preliminary studies on limiting with ferrites showed values of threshold power of the order of 100 peak power. (Author) (See also PB 145 958)

Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF DUPLEXING TECHNIQUES AT HIGH DUTY CYCLE CONDITIONS, by Lawrence Gould. Quarterly progress rept. no. 3, 1 Apr-30 June 59, on Contract DA 36-039-sc-78233. [1959] 17p. AD-228 147.
Order from LC mi$2.40, ph$3.30 PB 146 495

The feasibility of Tee circulators as high duty cycle duplexers in considered. Experimental models indicate that for bandwidths of the order of 3 to 4% isolations higher than 20 db and insertion losses less than 0.3 db can be achieved. The circulators were evaluated as high as 70 w average power at extremely high repetition rates with no deterioration in performance. Measurements on the characteristics of crystal protector TR tubes were continued. Results on recovery time and leakage power are reported. Of significance is the discontinuity in recovery time and leakage power at the peak power corresponding to input window breakdown. (Author) (See also PB 145 959)

Microwave Associates, Inc., Burlington, Mass.
RESEARCH AND DEVELOPMENT PROGRAM ON A MINIATURE X-BAND PULSED MAGNETRON (MA208) by A. C. Bougas. Final progress rept. for 1 Oct 57-31 Dec 58 on Contract DA 36-039-sc-74919. [1959] 56p. AD-220 530.
Order from LC mi$3.60, ph$9.30 PB 146 015

A description is presented of the final electrical and mechanical design characteristics for the MA208 magnetron. A photograph, outline drawing, and cross-section view of the final magnetron are included. A summary of the major technical and operational problems encountered is given. The methods of approach used to solve the problems are related. The general problem areas are divided and described according to the major sub-assemblies involved.

Microwave Engineering Labs., Inc., Palo Alto, Calif.
INVESTIGATION OF MICROWAVE NON-LINEAR EFFECTS UTILIZING FERROMAGNETIC MATERIALS, by Roy W. Roberts. Quarterly progress rept. no. 8, 1 Feb-30 Apr 59, on Contract DA 36-039-sc-73278. [1959] 22p. 5 refs. AD-220 227.
Order from LC mi$2.70, ph$4.80 PB 146 492

Thin slabs of ferrite magnetized in the plane of the slab have been tried for harmonic generation. In general, the slab geometry has not given as large outputs as other configurations which have been investigated more extensively. (See also PB 142 766)

Microwave Engineering Labs., Inc., Palo Alto, Calif.
INVESTIGATION OF MICROWAVE NON-LINEAR EFFECTS UTILIZING FERROMAGNETIC MATERIALS, by Roy W. Roberts. Quarterly progress rept. no. 9, 1 May-31 July 59, on Contract DA 36-039-sc-73278. [1959] 32p. 2 refs. AD-229 053.
Order from LC mi$3.00, ph$6.30 PB 146 491

Efficient doubling was obtained with a single crystal yttrium iron garnet sphere. A sphere grinder and resonance linewidth test fixture were built for checking the quality of the single crystal garnets grown under this program. (See also PB 146 492)

Microwave Associates, Inc., Burlington, Mass.
VARIABLE CAPACITANCE MICROWAVE DIODE. Quarterly progress rept. no. 2, 1 Feb-30 Apr 59 on Contract DA 36-039-sc-78236. [1959] 52p. 4 refs. AD-225 433.
Order from LC mi$3.60, ph$9.30 PB 145 960

A technique is discussed for measuring varactor cutoff frequency at X-band. The cutoff-frequency values are conservative and may be treated as lower limits, because cartridge and holder losses are included. The main features of the techniques are: use of high frequency, exploitation of the variable capacitance property as an essential part of the measurement, and use of low-loss tuning elements to improve accuracy and simplify calculations. It is argued that this technique is the most reliable thus far described. Test results are given on a fairly large number of sample model varactors. The cutoff frequency, measured at X-band, varies from 50 to 80 kMc for units with zero-bias capacitance less than 2 uuf, down to 30 kMc for units with zero-bias capacitance of 5 uuf. (Author)

Microwave Lab., Stanford U., Calif.
AN IMPROVED PULSE TRANSFORMER FOR HIGH-VOLTAGE APPLICATIONS, by T. F. Turner. Technical rept. on Contract Nonr-225(48). May 59, 16p. 2 refs. M. L. no. 609.
Order from LC mi$2.40, ph$3.30 PB 146 225

Economy often dictates the use of a very low impedance network and step-up ratios of as much as 20 or 30. Transformers for such service are expensive to construct, and they deteriorate the pulse shape. In addition, the additional energy dissipated during the long rise and decay times required to obtain high step-up ratio and a reasonably flat top portion of the pulse requires a large investment in line storage capacitors and, of course, increases the operating cost. The transformer design described below substantially reduces the leakage inductance and at the same time reduces the total size and amount of core material required for a given high-voltage transformer.

Microwave Lab., Stanford U., Calif.
MICROWAVE TUBE RESEARCH, by E. L. Ginzton and M. Chodorow. Quarterly status rept. no. 33, 1 Apr-30 June 58, on Contract N6onr-251(23). July 58, 34p. 3 refs. M. L. rept. no. 535; AD-211 183.
Order from LC mi$3.00, ph$6.30 PB 146 696

Contents:
Structures for high-power traveling wave tubes
Distributed-interaction klystrons
Field-emission harmonic generation
Space-charge effects in velocity-modulated beams
Fast-wave tubes
Large-signal klystron theory
High-power klystron studies

Microwave Lab., Stanford U., Calif.
PARAMETRIC REFRIGERATION: A MECHANISM FOR REMOVAL OF NOISE FROM THE SLOW WAVE OF AN ELECTRON BEAM, by P. A. Sturrock. Scientific rept. no. 16 on Contract AF 19(604)1930. Oct 59, 22p. 15 refs. M. L. Rept. no. 656; AFCRC-TN-59-974. AD-231 894.
Order from LC mi$2.70, ph$4.80 PB 145 766

Reasons for believing it to be impossible to remove the noise power from the slow wave of an electron beam are reviewed and found not to be cogent. A method for effecting this removal is proposed. Noise is first removed, by conventional techniques, from a band of fast waves; an appropriate parametric coupling, by means of an applied pump wave, between this band of fast waves and a band of slow waves then leads to a spatially periodic exchange of excitations between these waves so that one may transfer the noise which will be present on the slow waves to the fast waves. There are no obvious modes of instability in this process. By an appropriate choice of frequencies, the slow wave may be cooled to a temperature below the initial temperature of the fast wave: this device therefore constitutes a "parameter refrigerator". (Author)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HIGH POWER MICROWAVE SWITCH, by S. J. Tetenbaum. Quarterly progress rept. no. 3, 16 Dec 58-15 Mar 59, on Contract DA 36-039-sc-78044. 13 Apr 59, 38p.
Order from LC mi$3.00, ph$6.30 PB 145 809

High power measurements were performed on a helium-filled encapsulated window switch. Two forsterite tubes have been successfully constructed. The pyroceram cement sealing technique works excellently. A number of techniques were investigated for employing synthetic mica, a readily machinable material, in tube construction. Satisfactory final designs for the electromagnet and switching power supply have been achieved, and both are being constructed. (See also PB 142 762)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
INVESTIGATION OF THE USE OF ELECTRON CYCLOTRON RESONANCE TO OBTAIN MICROWAVE PHASE SHIFT, by H. Bandel, A. Penico and F. Olson. Scientific rept. no. 1 on Contract AF 19(604)2231. 2 Apr 58, 46p. 3 refs. Technical rept. MPL-11; AFCRC-TN-58-158; AD-152 391.
Order from LC mi$3.30, ph$7.80 PB 137 912

The feasibility of applying the dispersive properties of gas discharges near cyclotron resonance as the basis for developing electronically controllable microwave phase shifters has been investigated. Preliminary results indicate that it is possible to achieve a high figure of merit (phase shift per unit loss) over an appreciable range of phase shift by either magnetic field control or by electron density control.

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
MIXING IN FERRITES AT MICROWAVE FREQUENCIES, by P. H. Vartanian and E. N. Skomal. Rept. on Contract DA 36-039-sc-73188. 7 May 57, 11p. 3 refs. Technical rept. MPL-5; AD-129 869.
Order from LC mi$2.40, ph$3.30 PB 145 880

Microwave mixing in ferrites is experimentally observed by subjecting a magnetized ferrite to two X band signals of differing frequency. Both sum and difference components are generated. A conversion efficiency for the sum frequency of -13 db was observed with a local oscillator power of 13 kw. The sum frequency output is observed to be linear with both signal and local oscillator inputs even when the two signals are of equal level. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
SYNTHESIS OF INFINITE ZERO-POLE NETWORK STRUCTURES, by S. Deutsch. Rept. on Contract Nonr-839(05). 19 May 59, 35p. 11 refs. Research rept. R-739-59; PIB-667.
Order from LC mi$3.00, ph$6.30 PB 145 993

A desired amplitude or phase response that contains a "sharp corner" or slope discontinuity can be represented by an infinite number of zeros and/or poles in the s-plane. An approximation to the desired response can be achieved by rounding off the sharp corner and synthesizing the corresponding network structure. A different approach is suggested in this paper: (1) An exact analytic expression is given for the desired response; (2) the corresponding network is synthesized with the aid of infinite ladder structures. Synthesis of a ladder is carried out to a reasonable number of elements. An increased number of elements. An increased number of elements yields a better approximation to the desired response.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
MICROWAVE CRYSTAL DETERIORATION STUDIES, by P. P. Lombardini and R. J. Doviak. Quarterly progress rept. no. 3, 1 Feb-30 Apr 59, on Contract DA 36-039-sc-78055. 31 May 59, 39p. 8 refs. Moore School rept. no. 59-18; AD-225 424.
Order from LC mi$3.00, ph$6.30 PB 145 808

Recent investigations have shown that the whisker contact pressure must be standardized before any comparable measurements of temporary deterioration are made. The effect exists in both types of silicon. Tests performed on germanium p-n junction diodes at room temperature and at -180°C have shown no temporary deterioration effects.

MSA Research Corp., Callery, Pa.
STUDY OF ENERGY CONVERSION DEVICES, by R. E. Shearer. Quarterly progress rept. no. 1, 1 July-30 Sep 59, on Contract DA 36-039-sc-78955. 31 Oct 59, 31p. 11 refs. MSAR 59-119; AD-230 503.
Order from OTS $1.00 PB 161 690

Preliminary investigations were made into the development of energy conversion device converting thermal energy into electrical energy by means of thermal decomposition of ionic hydrides followed by electrochemical recombination of the decomposition products on a cyclic and continuous basis. A closed cycle system was constructed on information obtained in earlier batch-type cells. It was based on lithium hydride in the molten eutectic of the chloride and fluoride of lithium. Only 270 mv was obtained with one atmosphere of hydrogen pressure prior to regenerative operation and a peak of only 30 mv was obtained regeneratively. These values are susceptible to improvement by improved cell design and higher temperature operation of the regenerator, which was held to the range of 1300 to 1400 F because of limitations imposed by materials of construction. Construction of an improved regenerative system was undertaken on the basis of information developed with the first system. Differential thermal analysis on temperature changes of the eutectic of the ternary salt system LiI-LiCl-LiF shows a eutectic temperature in the range of 395 to 420°C compared with 485°C for the binary eutectic of LiCl-LiF. In one test on a batch-type cell with a potassium anode and the eutectic of KCl-LiCl as solvent, an open circuit voltage of 0.33 was obtained with the cell at 710°C. The information developed above gives background for improved regenerative operation with lower melting solvents, different anode material or higher temperature operation. (Author)

National Bureau of Standards, Boulder, Colo.
OPERATING INSTRUCTIONS FOR ARN-2 AUXILIARY LOG-LINEAR NOISE RECORDER, by R. T. Disney and C. A. Samson. Jan 60, 34p. 3 refs. Technical note no. 45.
Order from OTS $0.50 PB 151 404

National Co., Inc., Malden, Mass.
DEVELOPMENT OF FSK-4 RECEIVER SYSTEMS. Final rept. for 25 Mar 58-15 Jan 60 on Contract AF 19(604)3070. 15 Jan 60, 188p. AFCRC-TR-60-102.
Order from LC mi$8.40, ph$28.80 PB 145 759

This final report describes a long-range, FSK radio teletype system. The principles of system operation are given, along with the theoretical aspects involved in the implementation of the design for optimum performance. Further development possibilities for future investigation are outlined. The appendixes contain extensive reference data on the equipment and complete alignment procedures for the individual units. (Author)

Naval Ordnance Test Station, China Lake, Calif.
CHARACTERISTICS OF AN ULTRAVIOLET-SENSITIVE PHOTOMULTIPLIER, by R. G. McCarty and J. Weimholt. 31 Dec 59, 13p. 2 refs. NOTS TP 2383. AD-232 533.
Order from LC mi$2.40, ph$3.30 PB 145 907

The characteristics of several types of ultraviolet-spectrum-sensitive photomultiplier tubes have been measured. One tube, is considered exemplary. Its characteristics are indicative of performance to be expected, or at least desired, in forthcoming ultraviolet-sensitive photomultiplier tubes. Characteristics, including gain, sensitivity, and stability are reported. Apparatus, including power source, used in evaluating this optical, light-detector device, are itemized.

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY ABSTRACTS. March 60, 120p. 533 refs.
Order from OTS $2.50 PB 161 301

This, the third bibliography in a series, includes current periodicals and research reports received in the Library of the U. S. Naval Research Laboratory and the following index and abstract journals: Applied mechanics reviews; Applied science and technology; ASM review of metal literature; Battelle Technical review; Bell telephone laboratories. Technical information libraries. Index to current technical literaure; Chemical abstracts; Engineering index; Institute of radio Engineers. Proceedings; Metallurgical abstracts Monthly index of Russian accessions (Library of Congress) Nuclear science abstracts; Readers guide to periodical literature; Science abstracts (Section A. Physics abstracts; Section B. Electrical engineering abstracts) Semiconductor electronics; Technical abstract bulletin (ASTIA) U. S. Government research reports (OTS). (See also PB 151 810)

Office of Scientific Research and Development. Div. 7.
RANGE FINDERS AND TRACKING. Summary technical rept. vol. 2, Contract OEMsr-1131. 1947, declassified 23 Apr 58, 208p. 623 refs.
Order from LC mi$9.30, ph$31.80 PB 139 788

Office of Scientific Research and Development, Div. 14.
MILITARY AIRBORNE RADAR SYSTEMS [MARS]. Summary technical rept. vol. 2, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 338p. 329 refs.
Order from LC mi$11.10, ph$51.60 PB 139 786

Office of Scientific Research and Development. Div. 14.
RADAR: SUMMARY REPORT AND HARP PROJECT. Summary technical rept. vol. 1, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 176p. 40 refs.
Order from LC mi$8.10, ph$27.30 PB 139 791

Pan-Electronics Corp., Griffin, Ga.
INDUSTRIAL PREPAREDNESS STUDY, QUARTZ CRYSTAL UNITS CR-(XM-3)U, by John R. Blasingame. Final rept. on Step 1, Contract DA 36-039-sc-72689. Dec 58, 62p. AD-213 930.

Order from LC mi$3.90, ph$10.80 PB 145 882

A process is described for the manufacture of quartz crystals operating on the fundamental mode at frequencies of 4.3, 6.2, 9.0, 15.5 and 20.0 megacycles. Problems of especial importance were: (1) Cutting quartz bars to close tolerances. (2) X-ray measurements and equipment. (3) Lapping quartz blanks. (4) Radio lapping. (5) Contour of blanks below 10 MC. (6) Materials and methods for base plating. (7) Sealing can to base. (8) Short-term aging.

Penta Labs., Inc., Santa Barbara, Calif.
EVALUATION OF TRANSMITTING BEAM PENTODE TYPE PL-177A, by R. L. Norton. Final rept. for 1 Dec 57-31 Dec 58 on Contract DA 36-039-sc-74978. [1959] 53p. AD-219 217.
Order from LCmi$3.60, ph$9.30 PB 146 014

Fifty-two type PL-177A 75-watt transmitting pentodes were tested to determine the normal range of electrical characteristics for this type. Ten tubes from this group were tested to determine mechanical characteristics. Twenty-one tubes from the group were subjected to 1000-hour life test at VHF. The results of the the tests are presented in tabular, graphical and histogram form. A proposed MIL-E-1 type specification for the PL-177A is given. (Author)

Philco Corp., Philadelphia, Pa.
RESEARCH AND EXPERIMENTAL WORK ON MICROWAVE TRANSISTORS, by W. C. Follmer, M. M. Fortini and others. Quarterly progress rept. no. 5, 15 Jan-15 Apr 59, on Contract DA 36-039-sc-74988. [1959] 27p. 51 refs. Philco no. H-2153-5; AD-225 036.
Order from LC mi$2.70, ph$4.80 PB 145 877

Transistor action in depletion-layer devices was achieved when the bias on the injecting probe is more positive than the floating potential is negative. The fabrication work was concerned principally with the development of techniques for forming contacts to high-resistivity p-type silicon. Best results were obtained with a pressure-bonding technique that uses titanium-aluminum foil as the tab material. Fabrication and testing of germanium depletion-layer devices has continued.

Physical Research Lab., Space Technology Labs., Inc., Los Angeles, Calif.
A RESONANT CAVITY WITH A UNIFORM FIELD SECTION, by Erich S. Weibel. Rept. on Contract AF 04(647)127. 19 Mar 58, 19p. GM-TR-0127-00017.
Order from LC mi$2.40, ph$3.30 PB 146 851

Pickard and Burns, Inc., Needham, Mass.
ANTENNA SYSTEM FOR AIRBORNE X-BAND BEACON, DEVELOPMENTAL MODEL, by Thomas C. Cahill. Final technical rept. for 14 Apr 58-30 June 59 on Contract DA 36-039-sc-75018. 30 June 59, 47p. 1 ref. P&B Pub. no. 541; AD-225 118.
Order from LC mi$3.30, ph$7.80 PB 145 957

Report covers design and development of an antenna system for an airborne X-band beacon to be used on the RP-71 drone or equivalent aircraft. A study of radiation patterns of antennas mounted on various parts of the drone showed that a single antenna was inadequate. Tests with two identical, equally powered, antennas proved satisfactory. Transmission line problems were solved by the use of Phelps-Dodge Foamflex cable with modified connectors for the upper antenna and RG9B/U cable for the lower. The system is made up of two discone radiators, two Teflon radomes, a power divider, and upper and lower transmission lines. The system, its relative position in the drone, and the three major planes of the aircraft are illustrated. A series of radiation patterns, recorded through the planes (yaw, roll, and four angles of pitch) at frequencies of 8500, 9100, and 9600 megacycles, show that the system omnidirectionally covers the frequency range required within the limits of the specifications. Other graphs show that the system and its components meet the limit for VSWR characteristics. (Author)

Psychological Lab., Johns Hopkins U. [Baltimore, Md.]
SIGNAL MARK SIZE AND VISIBILITY OF RADAR SIGNALS ON A PLAN POSITION INDICATOR, by N. R. Bartlett and S. B. Williams. Rept. on Systems Research, Contract N5ori-166(01). 20 Sep 47, 18p. 3 refs. Rept. no. 166-1-30.
Order from LC mi$2.40, ph$3.30 PB 137 809

Preliminary research on the detectability of signal images on a 7BP7 radar screen indicates the extreme importance of the image size. Image size was varied (1) by regarding the radar screen from different distances, (2) by changing the length of the image by widening the azimuth gate, (3) by changing the thickness of the image by switching to different presentation range scales and (4) by moving the signal from the center to the periphery of the screen. Image size variations by such methods can change the strength of the minimum visible signal by at least eight or ten decibels. The data are preliminary, for equipment limitations did not permit variations from a signal pulse length of two microseconds nor reductions in azimuth gate below 12 degrees. Further research on the problem of image size with refined equipment is now in progress. (Author)

Radio Corp. of America, Lancaster, Pa.
ELECTRON TUBE MATERIALS, GASES, AND GETTERS, by J. C. Turnbull and G. P. Kirkpatrick. Quarterly progress rept. no. 2, 15 Jan-15 Apr 59, on Contract DA 36-039-sc-78226. 15 May 59, 163p. 134 refs. AD-220 824.
Order from LC mi$7.80, ph$25.80 PB 145 805

Surveys on the state of the art on outgassing techniques and on getter techniques and materials used in making electron tubes are included. Measurements are given of the thermal outgassing of nickel, cold rolled low carbon steel and nickel plated steel, on heating these materials to 1000°C. Results are summarized as follows: (a) For all materials, carbon monoxide is the predominant gas evolved with smaller quantities of carbon dioxide, nitrogen and hydrogen;

(b) Nickel shows lower gas levels than steel, while nickel plated steel resembles nickel more than steel in high temperature outgassing performance; (c) Vacuum melted nickel shows the same gas levels as air melted nickel, for the particular lots tested; and, (d) Comparing thicker (0.020") versus thinner (0.005") strip from the same vacuum melted nickel ingot, the thicker material shows, per unit area of sample, the same or lower gas levels. (Author) (See also PB 145 237)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
ALGEBRAIC DECODING FOR A BINARY ERASURE CHANNEL, by M. A. Epstein. Doctoral thesis. Rept. on Contract DA 36-039-sc-64637. 14 Mar 58, 15p. 10 refs. Technical rept. 340; AD-208 649.
Order from LC mi$2.40, ph$3.30 PB 145 780

This paper presents an optimum decoding procedure for parity check codes that have been transmitted through a binary erasure channel. The erased digits are decoded by means of modulo 2 equations generated by the received message and the original parity check equations. Most previous decoding procedures required a number of computations that grew exponentially with code length. At best, the required number of computations grew as a polynomial of code length. The decoding procedure for convolution parity check codes presented here will decode with an average number of computations per digit that is bounded by a finite number, which is independent of code length, for any rate less than capacity. (Author)

ResearchLab. of Electronics, Mass. Inst. of Tech., Cambridge.
ANALYSIS OF CIRCUITS WITH MULTIPLE-HOLE MAGNETIC CORES, by Lubomyr S. Onyshkevych. Master's thesis. Rept. on Contract DA 36-039-sc-64637. 9 July 57, 67p. 47 refs. Technical rept. 329; AD-214 554.
Order from LC mi$3.90, ph$10.80 PB 145 779

Multiple-hole magnetic cores, also called transfluxors, which have been developed recently, promise to be very useful in computer, control, and other logical circuitry. They are ferrite cores, with square hysteresis loops, of various complicated geometries. In this report, a workable analysis procedure for circuits that contain transfluxors is developed; it is based on the square-waveshape approximation. This analysis forms a basis for a design procedure. Sample circuits were designed and tested, and the results were found to be within 10 per cent of the predicted values. The main problems in circuit design were flux division and loading effects. Diode elimination presented another problem, which is treated at some length in this report. Diodeless operation of a transfluxor circuit was found to be possible, but slow, unreliable, and critical. In the field of logical design, a symbolic notation was developed, and an approach to design was made, using "gate boxes." A description of the physical properties of transfluxors is given; it includes some new, unpublished, special effects encountered with multiple-hole cores. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORY OF THE ANALYSIS OF NONLINEAR SYSTEMS, by Martin B. Brilliant. Doctoral thesis. Rept. on Contract DA 36-039-sc-78101. 3 Mar 58, 60p. 15 refs. Technical rept. 345; AD-216 209.
Order from LC mi$3.60, ph$9.30 PB 146 001

A theory of the analysis of nonlinear systems is developed. The central problem is the mathematical representation of the dependence of the value of the output of such systems on the present and past of the input. It is shown that these systems can be considered as generalized functions, and that many mathematical methods used for the representation of functions, of a real variable, particularly tables of values, polynomials, and expansions in series of orthogonal functions, can be used in generalized form for nonlinear systems.

Rome Air Development Center, Griffiss AFB, N. Y.
DESIGN OF A QUASI-DOPPLER UHF DIRECTION FINDER (RADIO DIRECTION FINDER AN/GRD-11), by Richard C. Benoit, Jr., Francis Coughlin, Jr. and Stanley Kraszewaski. Nov 59, 31p. RADC-TR-59-106.
Order from LC mi$3.00, ph$6.30 PB 145 851

This report describes the design of Radio Direction Finder AN/GRD-11, a medium-aperture, quasi-Doppler direction finder operating in the frequency range of 225 to 399.9 mc. Contemporary techniques are compared to the quasi-Doppler technique, with respect to accuracy, reliability, susceptibility to site errors, and over-all system performance. The equipment developed is described and compared to existing direction finders. It is shown that the AN/GRD-11 provides a stable, fast-response bearing which is more reliable and more accurate than that obtained with contemporary, narrow-aperture, uhf D-F equipments.

Rome Air Development Center, Griffiss AFB, N. Y.
EVALUATION OF THE "M" TYPE CARCINOTRON FOR COMMUNICATIONS, by Ralph W. Mifflin and Joseph W. Ferguson. Feb 60, 16p. 1 ref. RADC-TN-60-30.
Order from LC mi$2.40, ph$3.30 PB 146 430

An "M" type carcinotron, backward wave power oscillator type CM 252, was delivered to RADC for evaluation for communication purposes. This tube is evaluated and problems in frequency stabilization are described. The use of this tube for quantized frequency modulation systems is indicated. Tests performed and their results are discussed. (Author)

Skiatron Electronics and Television Corp., New York.
VIDEO CONVERTER GROUP OA-1021(XW-1)/GPA-29. Final development rept. for Feb-Sep 56 on Contract AF 30(602)1460. [1956] 21p. RADC-TR-57-119; AD-131 170.
Order from LC mi$2.70, ph$4.80 PB 146 155

The adequate generation of locally generated, as well

as radar derived information is an important consideration in air traffic control and aircraft warning systems. The information presented in this report will cover the development of a device (to be used with the GPA-29 radar transmission system) which can be used to generate and insert into the radar video, information of various types. This information can take the form of map overlays, identifying numbers, symbols, or other information, and can be inserted with a simple marker or grease pencil. (Author)

Sonotone Corp., Elmsford, N. Y.
STUDY OF SEALED NICKEL-CADMIUM BATTERIES, by Irwin M. Schulman and Paul Ritterman. Quarterly rept. no. 2, 1 Mar-31 Mar 59, on Research investigations to develop and evaluate a nickel cadmium battery having a hermetically sealed construction, and to study its reaction mechanisms. Contract DA 36-039-sc-78249. [1959] 53p. 8 refs. AD-225 160.
Order from LC mi$3.60, ph$9.30 PB 145 802

Forty-eight cells with varying concentrations and amounts of electrolyte were started on a life cycling program. The capacity data is reported. A new experiment was designed to test the effects of cobalt addition to the positive plates, lithia addition to the electrolyte, and varying negative/positive capacity ratios. There are general indications that the rate of recombination of oxygen with the negative plate is a function of the mole fraction rather than the partial pressure of oxygen when using a mixture of nitrogen and oxygen.

South Carolina U., Columbia.
APPLICATIONS OF A DIELECTRIC SHEET HALF-REFLECTING MIRROR AT MILLIMETER WAVELENGTHS, by R. G. Fellers. Rept. on Contract AF 18(603)43. 2 Jan 60, 21p. 3 refs. AFOSR-TN-60-14.
Order from LC mi$2.70, ph$4.80 PB 145 789

A free-space transmission system has been investigated as a possible low-loss replacement for waveguide over within system distances. In the use of such a scheme, it is necessary to devise the free-space equivalent of a number of waveguide components including the magic-tee, the wavemeter, the standing wave indicator and the duplexer. A dielectric sheet of appropriate thickness can be made to act as a half-silvered mirror and hence to serve the purpose of a magic-tee or three decibel directional coupler. Using this unit, a duplexer can be constructed and a Michelson interferometer can be built which will perform the functions of a wavemeter and a standing wave indicator.

Stanford Research Inst., Menlo Park, Calif.
BEACON ANTENNAS FOR DRONE AIRCRAFT USED AT WHITE SANDS MISSILE RANGE, by John B. Chown and Harold S. Rothman. Final rept., Task III, on Contract DA 36-039-sc-71205. Feb 59, 41p. 5 refs. AD-225 013.
Order from LC mi$3.30, ph$4.80 PB 145 942

An investigation was made of the general nature of problems associated with low-angle tracking of beacon-equipped aircraft and drones at WSMR. The investigation was made in two main parts. First, low-angle tracking was studied to determine the important limitations of the presently available tracking equipment and to ascertain where significant improvement in system performance can be made. Second, the airborne antenna was considered, to determine the proper location of the antennas on the aircraft to obtain the desired radiation patterns. Sufficient data are provided to select satisfactory antenna locations without the necessity of making extensive radiation pattern studies. (Author)

Stanford Research Inst., Menlo Park, Calif.
AN EXAMINATION OF BACKSCATTER PROPAGATION BETWEEN BOZEMAN, MONTANA AND PALO ALTO, CALIFORNIA, by Russell T. Wolfram. Scientific rept. 1 on Contract AF 19(604)5571. Jan 60, 23p. 4 refs. AFCRC-TN-60-120; AD-232 605.
Order from LC mi$2.70, ph$4.80 PB 146 013

Non-great-circle, ground backscatter, radio propagation paths between Bozeman, Montana, and Palo Alto, California, were studied by means of a radio scanning and direction-finding system operating at 33 Mc. The system utilized a 1.5-kw, FM transmitter at Bozeman and receiving and recording equipment at Palo Alto. Rotating directional antennas were used at both stations to determine the bearings of paths over which signals were propagated. During the observing period great-circle propagation along the 1200 km path was negligible, but strong signals were received over two 5000-km, two-hop paths, one to the east and one to the northwest of the stations, almost every day, averaging seven to eight hours per day. (Author)

Stanford Research Inst., Menlo Park, Calif.
RESEARCH INVESTIGATIONS OF BEACON-TRACKING ANTENNAS FOR AEROBEE-HI AT WHITE SANDS MISSILE RANGE, by Harold S. Rothman. Final rept., Task IV, on Contract DA 36-039-sc-71205. June 59, 43p. 10 refs. AD-220 021.
Order from LC mi$3.30, ph$7.80 PB 145 937

A two-part investigation was made of the general nature of problems encountered in tracking the Aerobee-Hi missile at White Sands Missile Range. First, a system analysis was made of the response and interrogation function to determine the limitations of the present tracking equipment and to ascertain where significant improvement in system performance can be made. Second, a study was made to determine what antennas that were suitable for missile installation would provide the desired radiation patterns. The region of reliable tracking can then be determined from the allowable airborne equipment complexity and the radar receiving system parameters. (Author)

Stanford Research Inst., Menlo Park, Calif.
A SUMMARY OF LITERATURE PERTAINING TO RADIO STUDIES OF METEORS AND METEOR TRAILS, by W. R. Vincent and Frances H. Smith. Final rept. on Contract AF 19(604)1517. Jan 60, 383p. 1447 refs. SRI Project 1422; AFCRC-TR-59-367; AD-231 809.

Order from LC mi$11.10, ph$59.10 PB 145 975

A comprehensive survey of the literature pertinent to radio studies of meteors is presented. An abstract is given of each article, paper, report, or book that was available in English. A separate list without abstracts is given of material published in the Soviet Union and in Eastern European countries. (Author)

Sylvania Research Labs., Bayside, N. Y.
WIDEBAND OSCILLATOR TUBES, by J. A. Noland. Final rept. on Contract DA 36-039-sc-73147. 30 Apr 59, 31p. 2 refs. TR 59-1795.1, formerly YD 57-3, AD-225 215.
Order from LC mi$3.00, ph$6.30 PB 145 940

The design and constructional details of K-band backward wave oscillators are presented. These tubes are of all metal and ceramic construction and may be operated in a permanent magnet focusing field. One sample tube was built for each of the desired tuning ranges, 15 to 24, 27 to 41 and 24 to 38 kMc. Experimental data obtained on these tubes is presented. (Author) (See also PB 140 598)

Technische Hochschule, Darmstadt (West Germany).
RESEARCH ON PULSED IMAGE CONVERTER TUBES, by Otto Scherzer. Technical rept. on Contract AF 61(514)439. 30 Mar 55, 28p. 1 ref. EOARDC-TR-54; AD-95 486.
Order from LC mi$2.70, ph$4.80 PB 146 284

To find the best way of building an image converter which can be used as an electron-optical shutter for estremely short exposure times, the advantages of electric and magnetic electron lenses are analysed and compared. While magnetic lenses yield better images, electric lenses can be operated with pulses of not rectangular shape. For reasons of intensity and of space-charge effects, the voltage must be the higher, the shorter the exposure time is. Yet the production of high-voltage pulses of extremely short duration and of exactly rectangular shape is extremely difficult and expensive. Therefore it looks much more promising to start the investigation with electric lenses.

Union Thermoelectric Corp., Forest Park, Ill.
ABRASIVE GRADING AND THE LAPPING OF QUARTZ OSCILLATOR PLATES, by Wallace E. Richmond and Ralph P. Chalker. Special rept. on Contract DA 36-039-sc-71061. 15 Apr 58, 47p.
Order from LC mi$3.30, ph$7.80 PB 145 885

The uniformity of commercially available abrasives of the grades most used in the quartz crystal industry falls short of that needed in order to insure uniform rates of stock removal, or surfaces of uniform and predictable finish. Microphotographs are used to illustrate. (Author)

Upper Air Lab., U. of Colorado, Boulder.
A MINIATURE TRANSISTORIZED RADIOMETER FOR MEASUREMENT OF VISIBLE AND INFRARED RADIATION FROM HIGH ALTITUDE VEHICLES, by Frank E. Stuart. Scientific rept. no. 1 on Contract AF 19(604)1899. Sep 58, 37p. 8 refs. AFCRC-TN-58-610; AD-209 220.
Order from LC mi$3.00, ph$6.30 PB 137 836

Two models of this radiometer have been developed: one for measuring integrated radiation from the ultraviolet to the near infrared, with a long-wavelength cut off of approximately 4.5 microns; the other for measuring integrated infrared radiation from approximately 4 microns to 30 microns, which includes the spectral region containing most of the thermal radiation from the earth. Three radiometers have been built and operated a combined total of several hundred hours. Tests on these instruments show them to be fairly rugged and foolproof. Various modifications of the optics and filter system will permit this instrument to be adapted to a variety of tasks in which the intensity being measured is not too low. (Author)

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer. Quarterly rept. no. 8, 1 Apr-30 June 59, on Contract DA 36-039-sc-73266. [1959] 29p. 6 refs. Engineering rept. no. 218-8Q; AD-226 026.
Order from LC mi$2.70, ph$4.80 PB 146 016

The problem of forming molecular beams for use in ammonia masers is examined. It is shown theoretically and experimentally that through the use of a new type of parabolic focuser with a point source effuser, the molecular flow may be reduced by a factor of 8, for the same power output, or the power output may be increased by a factor of 2 for the same molecular flow. A theory of beam formation in a multitube effuser is described. This shows that the most intense molecular beam is formed by an effuser of small overall diameter. Design considerations are discussed for parabolic, upper-state focusers, and for coaxial, lower-state focusers. The operation of a system is described using a lower-state focuser and an ionization detector in which lower-state molecules produced by maser oscillation may be detected. (See also PB 145 234)

Willow Run Labs., U. of Michigan, Ann Arbor.
THE EFFECT OF SYMMETRICAL LIMITING ON A SIGNAL CONSISTING ON N DISCRETE FREQUENCIES, by Kit-Yin Tieng. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 20p. 16 refs. Rept. no. 2144-416-R.
Order from LC mi$2.40, ph$3.30 PB 145 786

An expression is derived for the output of a symmetrical limiter, when the input signal consists of N discrete frequencies. The output is expressed as a double summation, each with an infinite number of terms. The amplitude of each frequency component can be found, although calculations may become involved. The two cases, where N = 2 and N = 3, are considered and expressions for the output are given which are readily adaptable to calculations.

Willow Run Labs., U. of Michigan, Ann Arbor.
SOME RESULTS ON NOISE THROUGH CIRCUITS, by William M. Brown. Memo. on Proj. Michigan,

Contract DA 36-039-sc-78801. May 59, 22p. 7 refs. Memo. no. 2900-17-R; AD-216 941.
Order from LC mi$2.70, ph$4.80 PB 145 997

The general zero-crossing problem is analyzed for nonstationary noise. The zero-crossing rate is calculated in detail for the nonstationary noise consisting of the sum of stationary Gaussian noise and the following determinate signals: video pulse train, sine wave, and triangular wave. Also, the following two properties of the envelope of noise are established: (1) the mean square output of an envelope detector is twice the mean square input (independent of the statistics of the input), and (2) the derivative of the envelope of stationary Gaussian noise has a Gaussian first probability distribution. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
TRANSPORT OF NOISE AT MICROWAVE FREQUENCIES THROUGH A SPACE-CHARGE-LIMITED DIODE, by W. E. Vivian. Technical rept. no. 34 on Proj. Michigan, Contract DA 36-039-sc-7880 78801. Feb 60, 21p. 15 refs. Rept. no. 2900-112-T.
Order from LC mi$2.70, ph$4.80 PB 145 991

Several analyses of the transport of cathode shop noise through a space-charge-limited diode at microwave frequencies have been published to date. Each of these analyses has suffered from inconsistencies arising from assumptions of monovelocity perturbation flow, direct or reflected. A new method of analysis of diode flow eliminating this problem has been de veloped. Numerical results based on this method are presented here. Attention is restricted to the now classical problem of one-dimensional longitudinal confined flow. The magnitude and variation with distance of the so-called beam noise invariants is shown for a range of diode operating conditions. These calculated results, based for economy on an approximate static flow model, essentially substantiate the qualitative expectations suggested by prior analyses, and fit what few experimental data are available. The method of analysis employed in the calculation of the numerical results comprises a linear multistream formulation, based on representation or approximation of the perturbation particle density for the noise flow as a composite of singular impulse streams, N in number, along characteristic trajectories in the velocity-distance phase space. The resulting set of N ordinary linear differential equations which are coupled and of the first order, is solved by simultaneous numerical extrapolation. (Author)

Ordnance, Missiles, and Satellite Vehicles

Aberdeen Proving Ground, Md.
DESERT DURABILITY TEST, 1958, OF CODE A CONTINUOUS FIRE DETECTION DEVICE IN M48A2 TANK, by Philip J. Moravec and Edward L. Uhl, Jr. Rept. no. 1 on Ordnance Proj. no. IT-5093. 16 Oct 59, 20p. 6 refs. AD-227 151.
Order from LC mi$2.40, ph$3.30 PB 146 699

The Code A fire detection device was installed in an M48A2 Tank, to determine durability of the device, during 3082 miles of vehicle operation under desert environmental conditions. Durability and reliability of the fire detection device was generally satisfactory. It is recommended the fire detection device be considered sufficiently durable for use in military vehicles. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
ASKANIA CINE-THEODOLITE DATA REDUCTION MANUAL, by Eugene S. Smith. Rept. on Contract AF 08(606)1156. Jan 60, 146p. 26 refs. RCA Data Processing Technical rept. no. 56. AFMTC-TR-60-1.
Order from LC mi$7.20, ph$22.80 PB 146 762

The primary objective of this manual is to show how basic Askania Cine-theodolite data are obtained and utilized at AFMTC in determing the space coordinates of an object in flight. This manual is intended to be educational in view of the need for a reliable manual of Standard Operating Procedures to aid in training new employees in the procedures and techniques of theodolite data reduction. It is also intended to be a source of information for those agencies and individuals who utilize the reduced data by making the reduction procedures available to them.

Aircraft Armaments, Inc., Cockeysville, Md.
DEVELOPMENT OF AIRCRAFT CANOPY REMOVERS T14 AND T15, by Nicholas J. LaCosta. Rept. on Contract DA 36-034-507-ORD-50. Jan 57, 111p. 5 refs. Frankford Arsenal rept. no. R-1367; AD-129 784.
Order from LC mi$6.00, ph$18.30 PB 146 518

A report is made on the development of the T14 and T15 gas-fired aircraft canopy removers, and their performance is evaluated according to Frankford Arsenal specifications. The major improvements incorporated in the new removers were an aluminum firing pin and its shear pin, a modified locking arrangement, and silicone-rubber seals. The performance of both removers was consistent and exceeded the minimum characteristics put down by the Frankford Arsenal specification. Both removers are suitable for standardization. Studies and tests incidental in the investigation indicated that a 2-tube remover is possible which is capable of a performance equal to or greater than either of the 2 removers tested.

Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.
AN EVALUATION OF OBSERVER ERRORS IN SPOTTING ROUND FIRE CONTROL, by Robert T. Gschwind. Mar 60, 22p. Technical Memo. 4-60.
Order from LC mi$2.70, ph$4.80 PB 146 159

A field investigation was conducted at Aberdeen Proving Ground, Maryland to measure human errors associated with spotting round fire control. Ten mortar observers from Ft. George G. Meade were used to direct fire of a 60mm mortar at each of five 8' x 8' vertical targets randomly positioned within the range of the weapon. They were allowed 5 rounds to adjust fire and were instructed to call on target when they thought a round fell within 25 yds. of the

target. Nearly all the subjects thought they had determined the range after 5 rounds, however the distribution of range error when calling on target had an average deviation from the target of 7% of the range of the target. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
DEVELOPMENT AND RESEARCH OF AN AUTOMATIC BALLISTIC WIND DISPLACEMENT COMPUTER, by Robert J. Franklin. 10 Oct 58, 91p. 13 refs. USASRDL Technical rept. 1990; AD-212 479.
Order from LC mi$5.40, ph$15.30 PB 145 752

The automatic ballistic wind displacement computer predicts the wind displacement of the landing point of ballistic rockets in miles from the theoretical "no wind" impact point. These predeterminations are made with an automatic continuous computer using single theodolite techniques and yield a digital display of rectangular coordinate components of ballistic wind displacement for pilot balloon runs of up to 6 min. duration. With the balloon release mechanism the theodolite tracker can readily perform all necessary operations to effect a computation. Some of the possible variations in operation, output data and accuracy are indicated. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE DYNAMIC TESTER, by Robert H. Brunelle. June 59, 13p. Technical note no. 1261.
Order from LC mi$2.40, ph$3.30 PB 145 728

The Dynamic Tester is used in testing other devices, such as a fire control system, under realistically simulated dynamic conditions. Predetermined data, simulating a target in motion, are entered into the Tester on magnetic tape; and the test system's response is compared automatically against desired results based on the input data.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
REVIEW OF PROBLEMS IN USING FLAT-ROLLED MATERIALS IN AIR- AND SPACE-WEAPON SYSTEMS, by F. W. Boulger. 14 Apr 60, 23p. 12 refs. DMIC memo. 52.
Order from OTS $0.50 PB 161 202

It has been estimated that, within 5 years, materials will be expected to operate at 1200 F for reasonably long times and at or above 2000 F for a few minutes. Within 10 years, operational temperatures are expected to reach 2500 F for a few minutes and 4000 F for a life of a few seconds. Therefore, this review deals mainly with problems in producing and using sheet materials intended for service at high temperatures.

Diamond Ordnance Fuze Labs., Washington, D. C.
HONEST JOHN HOB SELECTOR, by W. Hunter Boyd. 15 Dec 59, 19p. Technical rept. TR-794; AD-231 403.
Order from LC mi$2.40, ph$3.30 PB 146 078

The Honest John missile employs a device known as the HOB selector, the purpose of which is to allow the fuze to be manually preset to function at different settings for desired results. The present model of this device has undergone preservice testing in which its setting mechanism proved to be unreliable. To overcome the defects observed during these tests, DOFL has redesigned this HOB and constructed prototypes for production. The details to the redesign are described. The features of this design incorporated in prototype models of HOB's for the LaCrosse and Littlejohn missiles are briefly discussed. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
MAGNITUDE OF IN-FLIGHT VIBRATION OF THE T2078E1 FUZE ON THE M31 ROCKET, by W. Gaylord. 11 Jan 60, 21p. TR-801; AD-232 435.
Order from LC mi$2.70, ph$4.80 PB 146 226

Four instrumented fuze housings were flight tested at Yuma Test Station, Arizona. The flights were conducted to obtain data relevant to the shock and vibration input environment of the T2078E1 fuze on the M31 rocket. The analyzed data show that the Honest John fuze housing experiences low-frequency input vibration of 30 to 500 cps and acceleration levels below 40 g for short periods during launch and burnout. The vibration which occurred during the remainder of flight did not have sufficient magnitude to be distinguished from noise. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
RADIATION DAMAGE OF DC-TO-DC POWER CONVERTERS, by Paul A. Trimmer and Louis DeLuca. 29 Jan 60, 13p. 4 refs. Technical rept. TR-792; AD-232 333.
Order from LC mi$2.40, ph$3.30 PB 146 080

Semiconductor devices normally used in the dc converter of the T3022E1 fuze system were exposed to neutron radiation up to 0.7×10^{13}nvt from the Godiva bare critical assembly. Measurements of their characteristics were made before and after irradiation. The current gain (β) of the transistors was reduced by the neutron radiation to the extent that they would not function properly in the circuit. This was corrected by adding a biasing resistor to the base circuit of one of the transistors. The results of this study indicate that this unit will then operate reliably after being exposed to neutron radiation up to 0.7×10^{13}nvt. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF STATIC TEST CHARGE ASSEMBLY FOR SIMULATED DAVY CROCKETT ROUND, by Garry Weingarten and Joseph Kristal. Mar 60, 8p. 1 ref. Technical notes no. 39.
Order from LC mi$1.80, ph$1.80 PB 145 241

An assembly was developed containing 50/50 stabilized red phosphorus and finely divided (200/325 mesh) atomized magnesium which functioned without case fragmentation and provided good spotting characteristics at a distance of approximately 3000 yards.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PREVENTION OF EXUDATION FROM AMMUNITION ITEMS, by Robert W. Heinemann and Stanley J. Lowell. Feb 60, 13p. 5 refs. Technical rept. 2675.
Order from LC mi$2.40, ph$3.30 PB 144 633

The problem of preventing exudation has been intensively investigated in the last few years. The investigation has proved that exudation can be prevented by either incorporating a calcium silicate absorbent (Spec X-PA-PD-1659) into the explosive filler or placing the same absorbent on top of the explosive filler. Results of tests conducted with T34E2 warheads show that incorporating the absorbent into the explosive filler is the better of the two techniques studied. Further, an amount of absorbent equal to 1.25% of the TNT content is needed to prevent exudation from TNT-containing explosives.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
TEST METHODS FOR POSITIVE IDENTIFICATION OF FLEXIBLE BARRIER MATERIALS, by Roswell H. Evans. Jan 60, 11p. Technical Notes no. 38.
Order from LC mi$2.40, ph$3.30 PB 145 824

Tests have been developed for the evaluation and positive identification of representative currently used non-asphaltic, flexible barrier materials. (Author)

[General Electric Co., Schenectady, N. Y.]
ALTITUDE-TIME TESTS OF MODEL 85 TENNEY ALTITUDE CHAMBER LOCATED IN DEVELOPMENT LABORATORY, by R. W. Ottaway and Glen E. McIntosh. 12 Aug 52, 5p. Heat Transfer memo. no. 44.
Order from LC mi$1.80, ph$1.80 PB 145 980

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TRANSIENT TEMPERATURE OF NOSE DOOR SEAL HA-3B, by Helen G. Bass and William W. Fischer. 6 Oct 52, declassified, 3p. Hermes Heat Transfer memo. no. 53.
Order from LC mi$1.80, ph$1.80 PB 145 917

The object was to estimate the during flight temperature of the rubber seal of the nose doors for the HA-3B missile. No attempt is made herein to determine the overall satisfactoriness of the design investigated.

[General Electric Co., Schenectady, N. Y.]
AN OUTLINE OF THE NUMERICAL METHOD USING A DESK CALCULATOR FOR THE DETERMINATION OF NOZZLE WALL TEMPERATURES, by Allen E. Galson and W. W. Fischer. 9 Sep 52, 6p. 4 refs. Proj. Hermes Heat Transfer memo. no. 46.
Order from LC mi$1.80, ph$1.80 PB 145 982

National Bureau of Standards, Washington, D. C.
EXPERIMENTAL PLATING OF GUN BORES TO RETARD EROSION, by Vernon A. Lamb and John P. Young. May 60, 99p. 35 refs. Technical note no. 46.
Order from OTS $2.50 PB 151 405

Methods for plating the bores of gun barrels are described, including details of fixture design, solution composition, and operating conditions. Extensive firing tests were performed, which show that chromium plate increases the life of barrels about 2- to 5-fold, depending on the type and caliber of barrel. Optimum thickness of plate ranges from 0.0015 inch in the smallest calibers to 0.015 inch in cannon. Certain modifications of the barrels enhance the improvement provided by the chromium plate. Chromium plating has been adopted as standard production practice for caliber 0.30, 0.50, and 20 mm barrels, and for several calibers of cannon.

Naval Ordnance Lab., White Oak, Md.
THE HARMONIC GENERATION TECHNIQUE FOR THE DETERMINATION OF THERMAL CHARACTERISTICS OF WIRE BRIDGES USED IN ELECTRO-EXPLOSIVE DEVICES, by Louis A. Rosenthal. 9 Sep 59, 26p. NAVORD rept. 6691. AD-231 918.
Order from LC mi$2.70, ph$4.80 PB 146 252

The thermal equations for a wire bridge or equivalent electro-explosive device are presented. When a sinusoidal current passes through such a thermally sensitive resistance, it is capable of generating a third harmonic voltage which is a measure of the resistance's ability to follow the instantaneous cycling power fluctuations. By measuring the variation of this third harmonic with frequency it is possible to determine the thermal time constant with good accuracy. The heat equations are also verified. Confirming experimental data are presented. (Author)

Naval Ordnance Test Station, China Lake, Calif.
NOTS SUPERSONIC TRACKS, by Frank H. Haymaker. 1 July 58, 41p. NOTS rept. no. 1938; AD-200 540.
Order from LC mi$3.30, ph$7.80 PB 146 057

This booklet is written expressly to acquaint potential users with the testing services and facilities available at the NOTS supersonic tracks. The facts presented here should materially shorten the time between the developing agency's realization that a testing problem is forthcoming and the acquisition and assessment of the test data.

Naval Research Lab., Washington, D. C.
RADIOMETRIC BEHAVIOR OF HIGH EXPLOSIVES AT REDUCED PRESSURE, by M. Cavanagh and A. Rockman. Final rept. 15 Feb 60, 9p. 2 refs. NRL rept. 5432.
Order from LC mi$1.80, ph$1.80 PB 143 941

Radiometric measurements of exploding pentolite at sea-level atmospheric pressure and at simulated altitudes of 50,000 and 100,000 feet were made at the U. S. Naval Ordnance Laboratory using a ballistic thermopile and a high-speed streak camera. At 50,000 feet, an unexpected maximum of total thermal radiation was encountered. This is higher by a factor of 10 than the total thermal radiation measured at sea level and higher by a factor of 2 than the yield measured at 100,000 feet. While this phenomenon is real, it is unexplained. (Author)

North Carolina State Coll., Raleigh.
A PRELIMINARY REPORT ON THE DYNAMICS OF SATELLITE MOTION, by Raimond A. Struble. Rept. on Contract DA 36-034-ORD-2733. Jan 60, 20p. 9 refs. OOR rept. 2125.4-M; AD-231 185.
Order from LC mi$2.40, ph$3.30 PB 145 711

Office of Scientific Research and Development. Div. 6.
TORPEDO STUDIES. Summary technical rept. vol. 21, Contract OEMsr-1131. 1946, declassified 17 July 58, 167p. 93 refs.
Order from LC mi$7.80, ph$25.80 PB 139 774

Office of Scientific Research and Development. Div. 7.
AIRBORNE FIRE CONTROL. Summary technical rept. vol. 3, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 256p. 296 refs.
Order from LC mi$11.10, ph$39.60 PB 139 787

Office of Scientific Research and Development. Div. 7.
GUNFIRE CONTROL. Summary technical rept. vol. 1, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 196p. 163 refs.
Order from LC mi$8.40, ph$28.80 PB 139 789

Picatinny Arsenal, Dover, N. J.
PROPERTIES OF EXPLOSIVES OF MILITARY INTEREST, by W. R. Tomlinson, Jr. rev. by Oliver E. Sheffield. Apr 58, 363p. 331 refs. Technical rept. no. 1740, rev. 1.
Order from LC mi$11.10, ph$54.60 PB 145 974

The 81 explosive compounds or mixtures and their properties - including composition variations for a given type - were selected for inclusion in this manual because of their current or future interest or due to past or present application in military items. The tabulated data reflect the results of tests which measure sensitivity to friction, impact, heat, initiation; performance characteristics or effectiveness in weapons; and physical and chemical properties of the explosive. A method of preparation, synthesis or manufacture is included for each type of explosive.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
APPLICATION OF FRACTURE MECHANICS TO RECOILLESS RIFLE PROBLEMS, by C. M. Carman. Sep 59, 31p. 15 refs. Rept. R-1521; AD-231 923.
Order from LC mi$3.00, ph$6.30 PB 146 003

The principles of fracture mechanics are briefly reviewed. Included in this review are the equations for circumferentially notched bars in tension, centrally notched sheet specimens in tension, plastic strain zone correction, conditions for plain strain fracture, and maximum flaw size with its practical limitations. Fracture toughness values for 433OV (Mod + Si) steel, Vasco-Jet 1000 steel, and 300-M steel have been determined, using circumferentially notched specimens. These values have been corrected for plastic strain zone, analyzed for plain strain conditions, and used to determine maximum flaw size. (Author)

Rock Island Arsenal Lab., Ill.
STABILITY OF HARD ELECTRODEPOSITED CHROMIUM, by J. W. McGarvey. 20 Nov 59, 23p. 6 refs. Rept. no. 59-2989; AD-231 485.
Order from LC mi$2.70, ph$4.80 PB 145 894

Several samples of hard electrodeposited chromium were studied utilizing X-ray diffraction, light microscopy, and electron microscopy to determine if any structural modifications could be detected in aged specimens. All of the deposits examined were found to be in the normal body-centered cubic form and exhibited no detectable modifications after aging at normal atmospheric temperatures. Heat treatment at 450 F did not affect the body-centered cubic form of the deposits although it did widen the cracks which were present.

Utah U., Salt Lake City.
SPECTRAL ANALYSIS OF THE IMPACT OF ULTRA VELOCITY COPPER SPHERES INTO COPPER TARGETS, by J. S. Clark, R. R. Kadesch, and R. W. Grow. Technical rept. no. OSR-16 on Contract AF 49(638)462. 1 Sep 59, 56p. 16 refs. AFOSR-TN-60-13; AD-232 499.
Order from LC mi$3.60, ph$9.30 PB 146 005

Spectrographic observations were made for Cu projectiles impacting into Cu targets in various controlled atmospheres. Atomic Cu lines are the predominant feature of the impact flash of Cu-to-Cu impacts in a medium of Ar.

White Sands [Missile Range] N. Mex.
ASKANIA CINE-THEODOLITE PROCEDURE, by Freda P. Apostolas. Aug 57, 62p. 5 refs. Technical memo. 446; AD-139 343.
Order from LC mi$3.90, ph$10.80 PB 146 697

The description of Askania Theodolite cameras and the procedures followed in the reduction of data from Askania films are discussed in this report, which is a summary of camera descriptions, reading equipment, least-square solution, and determination of errors in the final data. The purpose of this report is to serve as an introduction to procedures and a reference manual for those interested in data reduction from Askania films. (Author)

Ship Building

George Washington U., Washington, D. C.
EVALUATION OF DATA FOR THE USS TIRU (SS 416), SUPPLEMENT, by J. E. Hamilton. Rept. on Logistics Research Proj. Contract Nonr-761(05). 11 May 59, 108p. Serial T-98(a)/59.
Order from LC mi$5.70, ph$16.80 PB 145 964

Office of Scientific Research and Development. Div. 6.
METHODS OF SUBMARINE BUOYANCY CONTROL. Summary technical rept. vol. 6B, Contract OEMsr-1131. 1946, declassified 17 July 58, 89p. 49 refs.
Order from LC mi$4.80, ph$13.80 PB 139 776

Technical Research Group, Syosset, N. Y.
ON SHIP FORMS HAVING MINIMUM WAVE RESISTANCE, by Samuel Karp, Jack Kotik, and Jerome Lurye. Scientific rept. on 1 on Contract Nonr-2427(00). 20 Mar 59, 60p. 16 refs. Rept. on TRG-119-SR-1.
Order from LC mi$3.60, ph$9.30 PB 145 793

In the present paper, which deals with the strut of minimum wave resistance, this difficulty is resolved by formulating the problem in a manner different from usual. The reformulated problem is then shown to have a unique solution in the form of a minimizing hull shape which, while not precisely a strut, is nevertheless very closely related to one in two ways: (1) to the first order in some parameter expressing the thinness, e.g., the width at the midsection, the minimizing shape is a strut, and (2) the shape approaches a strut asymptotically for large depths. Associated with the process of obtaining this solution are several mathematical steps which are still to be justified rigorously, but provisionally they appear correct.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Quartermaster Research and Engineering Center, Natick, Mass.
OCCURRENCE OF HIGH TEMPERATURES IN YUMA STORAGE DUMPS, by William L. Porter and Nico H. Roos. Nov 59, 72p. 15 refs. Technical rept. EP-121; AD-231 917.
Order from LC mi$4.50, ph$12.30 PB 146 064

Temperature in 4 differently protected storage-dump stacks were studied under extreme hot-dry conditions on desert terrain at Yuma, Arizona, during a 43-day period. Carton air and food temperatures were recorded in stacks exposed in the following ways: (1) open and unprotected; (2) protected by a raised paulin fly; (3) protected by a tightly-lashed paulin; and (4) protected by a raised paulin fly with addition of reflective foil laid on the stack surface. In both extremes and means of temperature, the tightly-covered paulin stack is a much more severe storage environment than the other three types observed, which differ little among themselves in long-term storage stress. In these three stacks, those having greater stack protection showed a reduction in maximum temperatures, range of temperature and duration of higher temperatures, but effective storage temperatures were similar. Mean storage temperature tended to rise with increased airmass moisture, because daily minimum temperatures were raised by back radiation from water vapor and the prevailing thin, high, nocturnal cloudiness.

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. for 1 Sep 54-1 Jan 55 on Contract DA 49-007-MD-582. [1955] 8p.
Order from LC mi$1.80, ph$1.80 PB 146 663

Three studies were started September 1, 1954. These were: (1) A study of the effect of an irradiated diet of the mother on the offspring. (2) A longevity study to determine whether irradiation of a food affects of the life span of an animal. (3) A study of the effect of irradiation of the diet on its folic acid content using chicks as the experimental animals. The results obtained are described in this progress report. Rats were used in (1) and (2).

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAI PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 2, 1 Sep 54-1 Apr 55, on Contract DA 49-007-MD-582. [1955] 8p.
Order from LC mi$1.80, ph$1.80 PB 146 664

All data obtained since this project was initiated in September 1954 are given in this report. The effect of an irradiated diet of the mother on the offspring. Observations on the first generation. Incidence of blindness in offspring of mothers receiving various diets. Effect of an irradiated diet on the growth and life span of rats. An irradiated diet and the growth of chicks. An irradiated diet, the survival of chicks, and hematocrit value. (See also PB 146 663)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 3, 1 Sep 54-1 July 55, on Contract DA 49-007-MD-582. [1955] 8p. AD-96 317.
Order from LC mi$1.80, ph$1.80 PB 146 668

All data obtained since this project was initiated in September 1954 are given in this report: The effect of an irradiated diet of the mother on the offspring; Observations on the first and second generations; A long range effect of an irradiated diet on reproduction rats - observations on litters; The incidence of blindness in offspring; Effect of an irradiated diet on the growth and life span; An irradiated diet and the growth of chicks; Folic acid content of tissues; Enzymes. (See also PB 146 664)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 4, 1 July-1 Oct 55, on Contract DA 49-007-MD-582. [1955] 14p.
Order from LC mi$2.40, ph$3.30 PB 146 667

All data obtained on reproduction and longevity studies with rats since this project was initiated in September 1954 are given in this report. The effect of an irradiated diet of the mother on the offstpring. Observations on the first, second and third generations. (See also PB 146 668)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 5, 1 Oct 55-1 Jan 56, on Contract DA 49-007-MD-582. [1956] 21p.
Order from LC mi$2.70, ph$4.80 PB 146 666

Four generations of rats receiving irradiated and untreated diets have been started in reproduction and longevity studies. As measured by the number and percent of young weaned, the irradiated diet is equal to the untreated diet for reproduction and lactation in the first and second generation, but inferior to the untreated diet in the third generation. With regard to life span, so far, the irradiated and untreated diet have been equal in nutritive value. Chicks receiving an irradiated diet supplemented with vitamins A, D and E consistently grew at a slightly slower rate than those receiving the untreated diet. When the complete diet was irradiated and was not supplemented with vitamins A, D and E, the chicks grew slowly and the mortality was high. Definite symptoms of vitamins A and E deficiency were evident. Studies carried out to determine the effect of irradiation on individual vitamins show that the vitamin K activity of menadione and vitamin K_5 was destroyed by irradiation at a dose of 3 X 10 rep. Choline was not affected by irradiation of the diet or by irradiation of a solution of choline. Endogenous respiration of liver homogenate from rats receiving an irradiated diet increased over 100 percent, but there was no significant change in the liver cytrochrome oxidase or liver xanthine oxidase. (See also PB 146 667)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 6, 1 Jan 56-1 Apr 56, on Contract DA 49-007-MD-582. [1956] 22p.
Order from LC mi$2.70, ph$4.80 PB 146 665

Observations on four generations of rats receiving irradiated and untreated diets have continued in reproduction and longevity studies. As measured by the number and percent of young weaned, the irradiated diet is essentially equal to the untreated diet for reproduction and lactation in the first and second generation. The irradiated diet has been slightly inferior to the untreated diet in the third generation. Females in the fourth generation which received either the irradiated or untreated diet have weaned a small percent of their young. However, there was no essential difference in the two diets. With regard to length of life, the irradiated and untreated diets are about equal in nutritive value. With regard to growth, the untreated diet is slightly superior to the irradiated diet in seven out of eight cases. The difference between the weights of males has been greater than that between the females. The males in first and second generations which received the irradiated diet appear to be loosing weight slightly faster than those receiving the untreated diet. Studies with chicks during the past three months have been chiefly to check some of the earlier trials. Observations agree with those given in Progress Report V and it is concluded that choline is not destroyed by irradiation of the diet. (See also PB 146 666)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 7, 1 Apr-1 July 56, on Contract DA 49-007-MD-582. [1956] 23p.
Order from LC mi$2.70, ph$4.80 PB 146 669

The percent of young weaned was less on irradiated diet. The number of young born per litter has been essentially the same in both groups. Rats have consumed approximately the same amount of diet in both groups. The incidence of blindness was slightly higher in young from the irradiated diet. Chicks receiving irradiated diets consistently grew at a slower rate than those receiving the untreated diet. Chicks receiving a solution which contained a mixture of thiamine, pyridoxine, riboflavin, pantothenic acid and folic acid, that had been irradiated, developed typical symptoms of thiamine and pantothenic acid deficiency when the solution was supplied at a low level. When the quantity supplied was in excess, the irradiated and untreated solutions were approximately equal. (See also PB 146 665)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 8, 1 July-1 Oct 56, on Contract DA 49-007-MD-582. [1956] 19p.
Order from LC mi$2.40, ph$3.30 PB 146 670

The observations on the rats are essentially the same as those given in Progress Report VII. The results with irradiated protein were variable, and definite conclusions were impossible with regard to specific effects of irradiation. Preliminary studies indicated that biotin activity of a diet or of a solution were not decreased by the irradiation procedure. (See also PB 146 669)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITIONAL PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. Progress rept. 9, 1 Oct 56-1 Jan 57, on Contract DA 49-007-MD-582. [1957] 16p.
Order from LC mi$2.40, ph$3.30 PB 146 671

The percent of litters and of young weaned in the four generations was slightly less on the irradiated diet. Twenty females in the irradiated group in the first and second generations produced a larger total number of young than the same number in the untreated.

The untreated group produced a large total number of young in the third and fourth generations. The number of young per litter was essentially the same in both groups. The incidence of blindness continued to be higher in young from females receiving the irradiated diet. Vitamins A and alpha tocopherol were destroyed when the complete diet was irradiated. There was some destruction of thiamine, riboflavin, pyridoxine, pantothenic acid and folic acid when a solution containing these vitamins was irradiated. A diet composed entirely of irradiated foods should be supplemented with a complete vitamin mixture in order to insure an adequate supply of vitamins. (See also PB 146 670)

Texas Agricultural Experiment Station, College Station.
A LONG RANGE INVESTIGATION OF THE NUTRITION PROPERTIES OF IRRADIATED FOOD, by L. R. Richardson. General progress rept. 12 (Progress rept. 4 on Long Term Feeding Study on Chicken and Green Beans) 1 Mar-15 Sep 58, on Contract DA 49-007-md-582.
Order from LC mi$2.70, ph$4.80 PB 146 849

Rats receiving various combinations of control and irradiated chicken and green beans have been observed in parent, F_1 and F_2 generation. Growth, fertility and reproduction, weights of organs, and hematological values were within normal of the rats receiving control and green beans and chicken or green beans and chicken irradiated at a dose level of 2.79×10^6 rad or 5.58×10^6 rad. It is concluded that irradiation at the two dose levels has not decreased the nutritive value of the green beans and chicken. A urinary discharge is prevalent in mature male rats and renal stones were found in kidneys and bladders of both male and female rats. The abnormalities were present in rats receiving the control green beans and chicken and therefore their presence is not attributed to irradiation of the food. A second test on the incidence of congential blindness shows that the incidence is still higher in the young from mothers receiving the irradiated than in those from mothers receiving the non-irradiated diet. Repeat tests with irradiated pork and beef fatty tissue confirm the observations described in earlier reports, that diets containing control beef fatty tissue could be stored for 3 weeks without serious loss in nutritive value. Diets containing control pork fatty tissue decreased in nutritive value. Preliminary tests indicated that prolonged prothrombin times developed in male rats receiving diets containing irradiated beef or diets containing untreated beef and oxidized cod liver oil or oxidized wheat germ oil. (See also PB 146 848)

Texas Agricultural Experiment Station, College Station.
A LONG TERM FEEDING STUDY ON CHICKEN AND GREEN BEANS, by L. R. Richardson. Progress rept. 1 on Contract DA 49-007-md-582. [1957] 9p. AD-144 188.
Order from LC mi$1.80, ph$1.80 PB 146 847

A study is being conducted on chicken and green beans irradiated at different dose levels. The gain in weight of individual male and female rats receiving these foods was recorded after 12 weeks. There was no difference between the rats that received the control diet and those that received any combination of the irradiated chicken and green beans. Hematological studies revealed no difference between the control rats and the test subjects.

Texas Agricultural Experiment Station, College Station.
A LONG TERM FEEDING STUDY ON CHICKEN AND GREEN BEANS, by L. R. Richardson. Progress rept. 2 on Contract DA 49-007-md-582. 31 Oct 57, 11p. AD-150 174.
Order from LC mi$2.40, ph$3.30 PB 146 848

Young have been produced by every female receiving the irradiated and control chicken and green bean diets in the reproduction study. A few males have not sired litters; however, the percentage of male siring litters in the irradiated group was higher than in the control group. Overall data obtained so far indicate that the nutritive value of the irradiated foods is essentially the same as that of the non-irradiated. (See also PB 146 847)

Vanderbilt U. School of Medicine, Nashville, Tenn.
LONG-TERM FEEDING EXPERIMENT ON IRRADIATED CHICKEN, BEEF AND JAM, by Frank R. Blood. Progress rept. no. 3-A, 13 June-15 Sep 58 on Contract DA 49-007-md-779. [1958] 13p.
Order from LC mi$2.40, ph$3.30 PB 146 822

The beagles have now been fed irradiated foods for thirty-six weeks. Diets containing 35% of solids of boned chicken, ground beef, and pineapple jam irradiated at 0-, 2.79- and 5.58 megarads have continued to be acceptable to all animals. Hematologic examinations performed at the close of this period reveal normal values for all dogs. Urine analyses done after thirty-six weeks continue to reveal that the dogs receiving the jam diet, which has a high sugar content, continue to have glycosuria. A negative Benedict and albumin test were obtained on all dogs on the chicken and beef diets. During the first nine months of feeding no other effects have been noted in any of the animals. (Author)

Vanderbilt U. School of Medicine, Nashville, Tenn.
LONG-TERM MONKEY FEEDING EXPERIMENT ON IRRADIATED PEACHES, WHOLE ORANGES AND PEELED ORANGES, TWELFTH TO TWENTY-FOURTH WEEK, by Frank R. Blood. Progress rept. no. 2-B, 14 Apr-12 July 58, on Contract DA 49-007-md-779. [1959] 15p.
Order from LC mi$2.40, ph$3.30 PB 146 824

The long-term feeding experiment with monkeys to determine the wholesomeness of irradiated peaches, whole oranges and peeled oranges has been continued as described in Progress Report No. 1 for Monkeys. Hematologic examinations made during the twenty-fourth week show normal values for hemoglobin, PCV and white blood cell count, but both the control and experimental animals have a high eosinophil count. However, an eosinophilia is present in most of the monkeys in the colony at Vanderbilt and does not

appear to be related to feeding diets containing irradiated foods. Other than the eosinophilia, the animals have appeared normal during the first six months of the experiment, with no effects directly related to the incorporation of irradiated foods in the diet. (Author)

Vanderbilt U. School of Medicine, Nashville, Tenn.
LONG-TERM MONKEY FEEDING EXPERIMENT ON IRRADIATED PEACHES, WHOLE ORANGES AND PEELED ORANGES, TWENTY-FOURTH TO THIRTY-SIXTH WEEK, by Frank R. Blood. Progress rept. no. 3-B, 12 July-12 Oct 58, on Contract DA 49-007-md-779. [1958] 15p.
Order from LC mi$2.40, ph$3.30 PB 146 821

Rhesus Monkeys receiving irradiated peaches, whole oranges and peeled oranges have been on experimental diets for thirty-six weeks. This long-term feeding experiment has been continued as described in Progress Reports No. 1 and No. 2-B for Monkeys. Hematologic examinations of these animals continue to show normal values. The eosinophil counts, which were found to be high after twenty-four weeks (Progress Report No. 2B), have returned to normal in all but one monkey in the group receiving peaches and show improvement in those monkeys receiving whole and peeled oranges. One monkey on X-level peeled oranges expired during this period from dysentry. No effects due to the toxicity of the irradiated foods have been noted. (Author) (See also PB 146 824)

Vanderbilt U. School of Medicine, Nashville, Tenn.
LONG-TERM RAT FEEDING EXPERIMENT ON IRRADIATED BEEF, TWELFTH TO TWENTY-FOURTH WEEK, by Frank R. Blood. Progress rept. no. 2C, 3 June-3 Sep 58, on Contract DA 49-007-md-779. [1958] 18p.
Order from LC mi$2.40, ph$3.30 PB 146 823

The long-term feeding experiment of irradiated beef to three replicates of rats to determine the wholesomeness of irradiated food stored 6 months at room temperature has been continued as described in Progress Report No. 1 for rats. Replicate No. 2B (rats receiving no vitamin supplements) has also been continued. During the first twenty-four weeks of feeding no effects related to the toxicity of the irradiated beef have been noted. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Aerojet-General Corp., Azusa, Calif.
CHARGED-COLLOID PROPULSION SYSTEM, by R. D. Schultz and L. K. Branson. Rept. on Contract AF 49(638)656. Dec 59, 35p. 24 refs. Rept. no. 1728; AFOSR-TN-60-212; AD-230 620.
Order from LC mi$3.00, ph$6.30 PB 146 178

Theoretical and experimental research is described leading toward a space propulsion system in which microscopic oil droplets are produced with a high positive charge and accelerated electrostatically to exhaust velocities of over 50,000 miles per hour with a specific impulse of over 2200 seconds. This type of rocket system may prove to be of considerable value for controlling the orbit of an earth satellite, for earth-moon missions, and possibly for deep-space exploration such as a Mars or Venus probe. (Author)

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
EXPERIMENTAL INVESTIGATIONS OF PLASMA ACCELERATORS FOR SPACE VEHICLE GUIDANCE AND PROPULSION, by Bernard Gorowitz, K. Moses, and P. Gloersen. Rept. on Contract AF 04(647)269. 23 Nov 59, 25p. 5 refs. Technical Information Series R59SD466. AD-230 770.
Order from LC mi$2.70, ph$4.80 PB 145 717

A description is given of experimental studies concerning the possible application of a pulsed plasma accelerating device for space propulsion and attitude control. The particular laboratory model discussed employs an electric discharge to create a plasma which is electromagnetically accelerated into a high vacuum chamber. Specific impulses obtained with the accelerator have been in the range of 1000-20,000 seconds. Measurements indicate efficiency of conversion of stored electrical energy to mechanical energy as high as 60%.

Armed Services Technical Information Agency, Arlington, Va.
ROCKET PROPELLANTS. Report Bibliography. Mar 60, 59p. 292 refs. AD-233 500.
Order from OTS $1.50 PB 161 654

The bibliography is a compilation of approximately 292 abstracts of unclassified reports on liquid and solid propellants which were added to the ASTIA collection from 1953 to 15 Feb 1960. The first part of the bibliography includes separate sections dealing with general information on solid rocket propellants and on liquid rocket propellants. The second part of the bibliography includes sections for each of the following compositions used in rocket propellants: (1) acetylenes, (2) amines, (3) ammonia, (4) ammonium perchlorate, (5) boron hydrides, (6) ethylene oxide, (7) fluorine, (8) hydrazines, (9) hydrocarbons, (10) hydrogen, (11) hydrogen peroxide, (12) lithium compounds, (13) methanol, (14) nitric acid, (15) nitrogen, (16) nitrogenfluorine compounds, (17) nitrogen oxides, (18) nitroparaffins, (19) oxygen, (20) ozone, (21) perchloryl fluoride, and (22) thiophosphites. Abstract entries in each subdivision of the first and second parts are arranged alphabetically by corporate author, numerically by contract number and by date. Only final or summary reports were included in the bibliography, except when the final report was not received or when a progress report contained significant information which was not included in the final report. A bibliography of confidential entries on solid and liquid propellants (AS-315 500) was compiled separately. (Author)

James Forrestal Research Center, Princeton, N. J.
PROJECT SQUID. Semi-annual progress rept. for 1 Oct 58-31 Mar 59 on Contract Nonr-1858(25). 1 Apr 59, 101p. 49 refs.
Order from LC mi$5.70, ph$16.80 PB 145 886

Covers work done in the following four fields: Fluid mechanics, transport and transfer processes, chemical kinetics, combustion phenomena. (See also PB 137 703)

Jet Propulsion Center, Purdue U., Lafayette, Ind.
EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER BY FORCED CONVECTION FROM THE HOT GAS TO A COOLED STAINLESS STEEL RADIAL INFLOW GAS TURBINE ROTOR, by Thomas R. Swartwout. Final rept. on Contracts N7onr-394(15) and Nonr-1100(10). Jan 58, /8p. 22 refs. Rept. no. F-58-2; PRF 688 and 1499.
Order from LC mi$4.50, ph$12.30 PB 138 325

An investigation was made of the heat transferred by forced convection from the hot gases flowing through a 12.2 inch diameter radial in-flow turbine rotor fabricated from Universal-Cyclops A-286 alloy, to the cooling air flowing over the back surface of the rotor. The cooling air was injected near the tip of the rotor, flowed over the back surface of the rotor, and was discharged around the shaft. The turbine was operated with turbine inlet gas temperatures of 800 F, 1050 F, and 1200 F; pressure ratios of 1.5 to 1.8; and coolant ratios (weight rate of flow of cooling air/weight rate of flow of turbine gases) of 4 to 7 per cent; all experiments were conducted at a constant rotor speed of 16,000 rpm. The correlation of the heat transfer film coefficients for the hot gas side of the rotor previously developed at the Gas Turbine Laboratory, Purdue University, from experiments with lower turbine inlet temperatures was verified with the data obtained at the higher turbine inlet gas temperatures by employing a thermal analyzer based on the analogy between the flow of heat and of electricity.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE SYNTHESIS OF RESIN INTERMEDIATES BY REACTIONS WITH ETHYLENE OXIDE, by Peter L. Nichols, Jr., John D. Ingham and others. Rept. on Contract DA 04-495-ORD-18. 16 Sep 54, 49p. 38 refs. Rept. no. 20-84.
Order from LC mi$3.30, ph$7.80 PB 146 856

The chemistry of the openings of the ethylene oxide ring has been studied from the viewpoint of developing synthetic methods for the preparation of new and useful propellant materials and their intermediates. Experimental conditions were chosen such that the ring openings proceeded by the familiar bimolecular nucleophilic substitution reaction. Acid-catalyzed and uncatalyzed additions were studied in both aqueous and nonaqueous media.

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
SOME ENGINEERING ASPECTS OF THE MAGNETOHYDRODYNAMIC PINCH PROCESS FOR SPACE PROPULSION, by Irving Granet and William J. Guman. Rept. on Contract AF 49(638)552. Nov 59, 44p. 16 refs. PPL Rept. no. 120; AFOSR-TN-60-86.
Order from LC mi$3.30, ph$7.80 PB 145 841

This paper is divided into three sections: (1) A description of several analytical models currently in use to describe the pinch process, the approximations contained in each, and their limitations. (2) Based upon conclusions drawn from Section I, the "snow plow" (4) method was selected for a systematic analysis of a propulsion system with various combinations of the input parameters. (3) Conclusions based upon the analytical, computational and experimental work are given and some comparison is made with work reported in the current technical literature.

Rocketdyne, Canoga Park, Calif.
ACCELERATOR DESIGN TECHNIQUES FOR ION THRUST DEVICES, by S. L. Ellenberg. Rept. on Contract AF 49(638)344. 12 Feb 59, 45p. 7 refs. R-1430; AFOSR TN-59-194.
Order from LC mi$3.30, ph$7.80 PB 139 229

This report summarizes many of the problems associated with the ion accelerating section of the ion thrust device. Several methods for designing an ion accelerator are discussed and a specific design calculation is performed. A generalized description of a variety of ion accelerator geometries is presented.

Manufacturing Equipment and Processes

Aeon Labs., Egham, Surrey (Gt. Brit.)
A STUDY OF METAL CUTTING BY THE EXAMINATION IN THE ELECTRON MICROSCOPE OF SECTIONS CUT WITH A DIAMOND KNIFE, by R. Phillips. Annual technical rept. (Final) for 1 Dec 58-30 Nov 59 on Contract DA 91-591-EUC-989. 30 Nov 59, 43p. 5 refs. AD-231 399.
Order from LC mi$3.30, ph$7.80 PB 145 952

A transmission electron optical study of thin sections of cubic metals showed that the cutting process produced (1) broad bands of variable width in the direction of cutting (knife marks), (2) folds normal to the direction of cutting, and (3) a structure consisting basically of parallel lines of the order of 500 A spacing approximately normal to the direction of cutting.

Aeroprojects, Inc., West Chester, Pa.
FUNDAMENTALS OF ULTRASONIC WELDING. PHASE I, by J. Byron Jones, Nicholas Maropis and others. Final rept. for 1 Dec 57-1 Dec 58 on Contract NOas 58-108-c. May 59, 109p. 18 refs. Research rept. no. 59-105.
Order from OTS $2.50 PB 161 677

The investigations are oriented to the development of a phenomenological theory of ultrasonic or vibratory welding that will account for the observed effects. This Phase I of an extended research program is concerned with the development of techniques to permit quantitative investigation of the internal cyclic stresses, transient temperatures, and net energy associated with the generation of such metallurgical bonds. Preliminary information on the energy required to generate ultrasonic welds in several materials was obtained with a view to predicting ultrasonic weldability in terms of the more familiar material properties. (Author)

Air Materiel Command, Wright-Patterson AFB, Ohio.
PRYM PROCESS OF FABRICATING SEAMLESS HOLLOW BLADES FOR GAS TURBINES, by R. W. Biddle. 5 Nov 53, declassified [4 Sep 48]. 36p. F-TR-2146-ND; ATI-23 288.
Order from LC mi$3.00, ph$6.30 PB 146 164

A detailed description of the process, material, and equipment used in the fabrication of hollow turbine blades from sheet stock is given. The blade described was used in the Jumo 004 turbojet engine and consists of a rhomboid-shaped base. The material from which the blades were made is a nickel-chromium composition soft-annealed steel with some manganese, titanium, silicon with traces of sulphur and lead, with a strength of from 43 to 50 T/in.^{2} Blades are brazed to the wheel disk with a newly-developed silver brazing agent at an oven temperature of from 1150° to 1170°C. A listing of tools, gages, and fixtures required for the production of 200 blades per hour is given. The description of the operations performed by each piece of equipment is also included.

Cincinnati Milling Machine Co., Ohio.
HIGH TEMPERATURE MACHINING METHODS. PHASE I. EVALUATION OF ELEVATED TEMPERATURE MACHINING METHODS, by William Pentland, Clarence L. Mehl and Jens L. Wennberg. Rept. no. 1, 5 Sep 59-5 Feb 60, on Contract AF 33(600)40066. [1960] 187p. 52 refs.
Order from OTS $3.00 PB 161 680

A history of hot machining is presented and the results of an industry survey indicate the problem areas in cutting high strength materials for which elevated temperature techniques should be developed. Orthogonal cutting and tool-life turning tests, face milling and drilling tests were carried out on four representative aircraft materials, heat treated to the 350-600 BHN hardness range and the results of these are analyzed. The materials used were AISI 4340, Thermold J, 17-4 MO and 17-7 PH. A discussion of the potential of various heating methods is made and descriptions are included of practical evaluations using flame, furnace, induction, and radio-frequency resistance heating techniques. Studies of heat distribution and flow within workpieces are described and hazards of the process evaluated.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
BIBLIOGRAPHY ON EXPLOSIVE METAL WORKING, by C. T. Olofson and F. W. Boulger. 7 Apr 60, 18p. 210 refs. DMIC memo. 51.
Order from OTS $0.50 PB 161 201

A considerable amount of effort has been and is being devoted to investigating the advantages and limitations of using explosive energy in metal-working operations. This bibliography was prepared in response to requests by groups considering experimental programs in this field.

Driver, Wilbur B., Co., Newark, N. J.
INDUSTRIAL PREPAREDNESS STUDY ON NON-NICKEL BEARING ALLOY BRAID WIRE, by William L. Stryker. Final rept. for 23 Aug 57-5 Sep 58 on Contract DA 36-039-sc-72780. [1958] 16p; AD 212 204.
Order from LC mi$2.40, ph$3.30 PB 145 703

Experimental forming of braid wire for cable from a nickel-free austenitic stainless steel containing 15.85% manganese, 14.02% chromium, 0.12% carbon, and 0.15% nitrogen.

General Electric Co., Utica, N. Y.
AUTOMATIC COMPONENT ASSEMBLY SYSTEM, by William R. Seigle. Final rept. on Contract DA 36-039-sc-70255. [1959] 130p. AD-216 617.
Order from LC mi$6.30, ph$19.80 PB 145 725

The automatic component assembly system (ACAS) demonstrated a way to use an incremental dimensioning system in electronic assembly hardware. The problem of programmed automation is no longer whether programmed electronic control is a valid concept, but whether to use tape or card programming. The principle of batch-sequential assembly operation introduced by the ACAS appears to be a major advance in production technology; it offers maximum machine utilization for either in-line or unitized machine systems. The actual implementation of a hardware program demonstrated the necessity for having incremental dimensioning standards on components as well as on the base, printed wiring or otherwise, upon which the components are to be mounted. A distinct advantage of mechanized assembly methods is the accurate and reliable electromechanical control of process parameters which is superior to manual control. The mechanized soldering technique employed by ACAS shows the quality and efficiency improvements made possible by mechanization. The appendixes contain a programming manual and the ACAS equipment design parameters.

Lockheed Aircraft Corp. [Burbank, Calif.]
HIGH ENERGY RATE METAL FORMING, by A. F. Watts and Glen N. Rardin. Interim technical rept. no. 8, for 1 Jan-31 Mar 60, on Contract AF 33(600)35543. [1960] 11p. LR 14408.
Order from LC mi$2.40, ph$3.30 PB 146 776

Tests were conducted previously on a two feet diameter water tank to establish procedures and materials most suitable for reducing the stresses in the walls of a tank during an explosive forming cycle. On the basis of these tests a full scale tank was designed and constructed. One feature of this tank is that the tank walls are not mechanically connected to the base. An aerator was included in the design based upon tests conducted previously.

North American Aviation, Inc., Downey, Calif.
PROPERTIES OF RESISTANCE SPOTWELD 24S-T3 AND 75S-T6 ALUMINUM ALLOY SHEET AND 17-7PH STAINLESS STEEL SHEET AT DEPRESSED AND ELEVATED TEMPERATURES, by E. J. Pelochino and J. R. Bellah. Rept. on Contract W33-038-ac-14191. 1 Feb 54, 143p. Rept. no. AL-1840; AD-29 182.
Order from LC mi$7.20, ph$22.80 PB 146 559

Design properties and test results at room, elevated and depressed temperatures of resistance spotwelded joints are presented. The major portion of the program was devoted to testing clad 24S-T3 and 75S-T6 aluminum alloy sheet and 17-7PH stainless steel in two conditions, THD (hardened and aged) and SA (stretched and aged). Bare 24S-T3, 75S-T6 and clad 61S-T6 aluminum alloy sheet was also tested. The results include spotweld shear, tensile, and combined shear and tensile strengths for various temperatures, exposure times and sheet thicknesses.

Stanford Research Inst., Menlo Park, Calif.
FEASIBILITY STUDY OF PLASMA WELDING OF REFRACTORY METALS. Progress rept. no. 2, 1 Sep-1 Nov 59, on Contract NOas-59-6234C. [1959] 2p. SRI Project SU-2927.
Order from LC mi$1.80, ph$1.80 PB 145 814

This study is concerned with the adaptation of the plasma jet to the welding of refractory metals such as Ta, Mo, Ti, Zr, and W. In order to adapt the plasma jet to welding, it is necessary to produce a jet of small diameter and to reduce the effects of high gas velocity in the jet.

Transport, Traction and Hoist Facilities

Army Transportation Research and Engineering Command, Fort Eustis, Va.
TUG HAWSER PULL STUDY, by Charles D. Roach. Sep 59, 18p. 1 ref. Research Technical memo. RTM 30; AD-230 923.
Order from LC mi$2.40, ph$3.30 PB 145 701

The calculations contained in this memorandum are designed to give a reasonably accurate estimate of the towrope pull of a normal single-screw tug at any speed within the usual towing speed range.

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DIGITAL COMPUTER PROGRAM FOR ACCELERATION PERFORMANCE, TRACKED VEHICLES, by Robert Arno. Rept. on Contract DA 20-089-ORD-39246. 25 Jan 60, 46p. Rept. no. RR-8.
Order from LC mi$3.30, ph$7.80 PB 146 761

A general computer program was written for the Electrodata 204 "Datatron" Digital Computer to calculate acceleration performance and related characteristics of tracked vehicles. Vehicle performance is determined at prescribed time intervals during acceleration from standstill to maximum velocity. Other additional data supplied by this program are vehicle speed, distance traveled, time of travel, sprocket torque, tractive effort, rolling resistance, drawbar pull, and acceleration. (Author)

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DIGITAL COMPUTER PROGRAM FOR WHEELED VEHICLE MOBILITY COMPUTATION, by Alexander Edwards. Rept. on Contract DA 20-089-ORD-39246. Jan 60, 78p. Rept. no. RR-7.
Order from LC mi$4.50, ph$12.30 PB 146 760

A general computer program was written for the Electrodata 204 Digital Computer to permit rapid solution of wheeled vehicle mobility performance. Curves of sinkage and drawbar pull versus mud and snow soil consistencies were plotted of various sized tires for preliminary design guidance. (Author)

MATERIALS

Bureau of Yards and Docks, Washington, D. C.
PRESERVATION, PACKAGING, AND PACKING OF "C" COGNIZANCE MATERIEL. Rev. 29 July 57, 73p. Technical pub. NAVDOCKS TP-PW-14; BUDOCKSINST 4030.1B.
Order from OTS $2.00 PB 161 539

This publication presents detailed instructions pertaining to the cleaning, preservation, packaging, marking, depreservation, and exercising of "C" Cognizance Materiel for (a) dead storage and (b) live storage. The processes specified herein are intended to render a functional service rather than to improve the appearance of materiel, and shall be so used.

Inland Testing Labs. [Morton Grove, Ill.]
UNIFORM DUPLICATION OF ENVIRONMENTAL TEST RESULTS. PART I. INFORMATION SURVEY, by Paul Gottfried, Chester G. Polak, and John McGee. Rept. on Contract AF 33(616)5413. Oct 58, 73p. 16 refs. WADC Technical rept. 58-613, Pt. I; AD-205 774.
Order from LC mi$4.50, ph$12.30 PB 146 574

The following is an account of work performed in the first of three phases on research to amplify and supplement certain detail in USAF specifications MIL-E-5272 and MIL-E-4970. This phase consisted of a literature survey, visits to industry and Government installations, and the development and distribution of a questionnaire. A tabulation of the responses to the questionnaire is also given and some of the recommendations are included. (Author)

Inland Testing Labs. [Morton Grove, Ill.]
UNIFORM DUPLICATION OF ENVIRONMENTAL TEST RESULTS. PART II. SURVEY ANALYSIS, by Paul Gottfried, Chester G. Polak, and John McGee. Rept. on Contract AF 33(616)5413. Nov 58, 52p. WADC Technical rept. 58-613, Pt. II; AD-205 775.
Order from LC mi$3.60, ph$9.30 PB 146 573

The report contained herein is an analysis and evaluation of the information obtained during the research and investigation conducted in Part I of this program. The factual or statistical presentation of this information was included in the Part I Technical Report. This report will be concerned only with the information which applies directly to nonrepeatability or nonuniformity of the environmental tests, specifically the tests of humidity, high temperature, low temperature, temperature shock, and sand and dust as specified in specifications MIL-E-5272 and MIL-E-4970. The analysis includes recommendations designed to clarify each of the specified test procedures and to improve the repeatability of the tests in such a manner that the test may be duplicated in diverse testing installations. Appendix I of this report contains the recommended revisions for specification MIL-E-5272 employing the results of the literature analysis. Appendix II of this report contains a recommended detail equipment specification to be used in conjunction with revised specification MIL-E-5272. The purpose of the detail specification is to establish a comparative test program which will evaluate the effectiveness of the proposed specification revisions and recommendations. (Author) (See also PB 146 574)

Materials Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
CONFERENCE ON HIGH TEMPERATURE POLYMER AND FLUID SYNTHESIS, HELD IN DAYTON, OHIO, 23-24 OCTOBER 1957, by Calvin H. Schmid. Rept. on Rubber, Plastic, and Composite Materials. Jan 58, 221p. 18 refs. WADC Technical rept. 57-657; AD-142 285.
Order from OTS $3.50 PB 161 663

Contents:
Materials bottleneck
Principles of inorganic polymerization
Phosphinoborine polymers
Chelate polymers - poly (bis-β-diketones)
Coordination polymers
WADC internal polymer research program
Stannosiloxane polymers
High temperature polymers
Studies of heteroatomic fluorine compounds
Fluoroalkyl silicone polymers
Polymerization by heterogeneous catalysis
Fluorinated polyesters and polyamides
Improved silicone resins
Maleimide heat resistant resins
WADC internal fluid synthesis program
ARYL silanes
Synthesis of polyxylylyldimethylsilane and polyxylylyldimethylsiloxane
High-temperature base stock fluids
Synthesis and evaluation of thermally stable fluids based on ferrocene
Chain type polyphenyls
Liquid ureas
High temperature stable semi-organic fluids

Ceramics and Refractories

American Electro Metal Div., Firth Sterling, Inc., Yonkers, N. Y.
AN INVESTIGATION OF THE MECHANICAL PROPERTIES OF CERMETS AS RELATED TO THE MICROSTRUCTURE, by Ira Binder. Rept. for 15 May 58-1 June 59 on Ceramic and Cermet Materials, Contract AF 33(616)5084. Jan 60, 102p. 7 refs. WADC Technical rept. 58-432, Pt. 2.
Order from OTS $2.50 PB 161 656

TiC/Ni compositions with 10, 20, and 40 percent nickel were tested for transverse rupture strengths up to 1600°C. Transverse bend, cantilever beam, hot deformation, and hot extrusion experiments were performed in order to study the onset of plastic deformation. These materials were plastically deformed, and their microstructures were studied to learn about the mode of deformation. Plastic flow of the nickel binder and alignment of the carbide grains were discovered. Other refractory hardmetal compositions, both single-phase and cemented, were tested in transverse rupture up to 1600°C and were also subjected to various forms of hot deformation. Transverse strength peaks, versus temperature, were found for each material in the range 800 - 1300°C. Reasons for this behavior are developed. Microstructures of these materials were examined in connection with the strength tests and deformation studies. (Author) (See also PB 151 722)

Armour Research Foundation, Chicago, Ill.
THE MECHANICAL PROTECTION OF THE W/Ir THERMOCOUPLE, by Gary Steven and Walter C. Troy. Rept. no. 18, 16 June 49, 6p. NEPA 1059-ARM-18; AD-204 056.
Order from LC mi$1.80, ph$1.80 PB 138 320

The W/Ir thermocouple was subjected to a series of tests designed to determine its behavior under different atmospheric conditions. An order was placed for zirconia bricks and tubes to be used as components in a gas fired high temperature furnace. The construction of the molybdenum wound high temperature furnace for the NEPA division was temporarily set aside pending a decision as to the heating space requirements. (See also PB 137 033)

Clevite Research Center, Cleveland, Ohio.
STUDY OF AGING OF HIGH PIEZOELECTRIC COUPLING CERAMICS, by F. Kulcsar and R. Gerson. Final rept. for 15 Aug 56-15 Aug 57 on Contract DA 36-039-sc-72832. 27 Aug 57, 64p. 6 ref 6 refs. AD-158 008.
Order from LC mi$3.90, ph$10.80 PB 146 530

A systematic study of aging in electromechanical parameters of poled ferroelectric ceramics was undertaken. The modified lead titanate zirconate composition showed an aging rate of 0.13% decade up to 200 days after poling. The stability of the material

with respect to thermal variation needs to be improved. The samples treated by γ-irradiation showed exceptional stability during room temperature storage (10 to 200 days after irradiation). The average change in resonant frequency (4 samples) was well under 0.5%. The heat treatment yields a small but significant improvement in aging characteristics. A poling temperature close to 30° to 70°C resulted in an earlier flattening of the aging curve. Several lead titanate zirconate ceramics with additions of 3- and 5-valent element oxides all had low mechanical Q values. Similar compositions with all of the ZrO_2 replaced by HfO_2 showed poor shelf aging with respect to resonant frequency. Additions of Cr_2O_3 or V_3O_8 to lead titinate zirconate compositions produced stable ceramics with mechanical Q's from 300 to 400 and good resonant frequency stabilities in the case of Cr_2O_3. Best results were obtained with a 0.70- to 0.75-wt % addition. A preliminary prestabilizing treatment (10 successive quenchings from oil at 250°C into oil at 25°C) is desirable after poling in order to minimize temperature hysteresis effects. The source of the ZrO_2 appeared to be an important performance factor.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE DETERMINATION OF OXYGEN, NITROGEN, HYDROGEN, AND CARBON IN MOLYBDENUM, TUNGSTEN, COLUMBIUM, AND TANTALUM, by Manley W. Mallett. 31 Mar 60, 21p. 34 refs. DMIC memo. 49.
Order from OTS $0.50 PB 161 199

Oxygen: neutron activation, fluorination, other halogenation, fractography, mass spectrometry, solid mass spectrometry, isotopic dilution, emission spectrometry, vacuum fusion, inert-gas fusion, molybdenum, tungsten, columbium (niobium), tantalum; Hydrogen; Nitrogen: solution-distillation method, alkali fusion method, other methods; Carbon: gravimetric procedure, gasometric procedure, conductometric procedure.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DIFFUSION RATES AND SOLUBILITIES OF INTERSTITIALS IN REFRACTORY METALS, by W. D. Klopp and Vincent D. Barth. 4 Apr 60, 13p. 45 refs. DMIC memo. 50.
Order from OTS $0.50 PB 161 200

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF COLUMBIUM AND COLUMBIUM-BASE ALLOYS, by E. S. Bartlett and J. A. Houck. Rept. on Contract AF 18(600)1375. 22 Feb 60, 66p. 69 refs. DMIC rept. 125.
Order from OTS $1.75 PB 151 082

The current state of knowledge of the physical and mechanical properties of columbium and its alloy is reviewed. Columbium has good potential as an alloying base because of its low neutron-capture cross section (reactor applications) and high melting point, and related potential high-temperature strength (air- and space-vehicles structural applications). Pure columbium is soft and ductile and does not possess good strength at temperatures above 1600 F. Elevated-temperature strengthening is accomplished by solid-solution-strengthening (with tungsten or molybdenum) and dispersion-hardening (zirconium plus carbon) mechanisms. The effects of singular and combined alloying additions on fabricability and low- and high-temperature strength are discussed. The properties of current commercial and advanced laboratory alloys are correlated with strengthening mechanisms. A Cb-15W-5Mo-1Zr-0.05C-0.05 O alloy, with 100 hour, 2200 F rupture stress of 17,000 psi, is the most promising alloy to be developed to date. (Author)

Emhart Mfg. Co., Hartford, Conn.
INVESTIGATION OF FLAKE LAMINATE, by E. K. Lane, Jr. Final rept. for 23 Aug 54-30 Jan 58 on Contracts DAI-28-017-501-ORD(P)-1490 and DAI-19-059-501-ORD(P)-2302. [1958] 65p. AD-202 831.
Order from OTS $1.75 PB 161 679

Development of a method of producing a glass flake laminate. Methods investigated included trying to make glass flake by: Rolling Glass Beads, Rolling Glass Tape, Blowing Extruded Ribbon, Drawing Tape from a Lip, Drawing Tape from a Slot, Stretching Film by Diverging Wires, Stretching Glass Film by Rims Having Parallel Axes, and Stretching Glass Film by Rims Having Inclined Axes. Of all these methods, the apparatus which stretched glass film on rims having inclined axes proved to the most successful. Experimental work points to production of a continuous ribbon of glass film as a possibility.

National Bureau of Standards, Washington, D. C.
BASIC STUDY OF PARTICLE-IMPACT PROCESSES FOR APPLYING CERAMIC AND CERMET COATINGS. PHASE I. VELOCITY MEASUREMENTS OF FLAME-SPRAYED ALUMINUM OXIDE PARTICLES, by Dwight G. Moore, Warren D. Hayes, Jr. and Alfred W. Crigler. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)58-19. Oct 59, 22p. 8 refs. WADC Technical rept. 59-658, Pt. 1.
Order from OTS $0.75 PB 161 685

The velocities of flame-sprayed particles of aluminum oxide from both a rod-type and powder-type oxyacetylene gun were determined with (1) a high-speed cinecamera, (2) a streak camera, and (3) a rotating disc velocimeter. An analysis of the measurements indicated that each of the three methods had potential weaknesses. In the two photographic methods, the film was exposed by the radiant energy emitted by the particles themselves; the results of these measurements were such as to suggest that the smaller (and presumably faster) particles were not being recorded on the film. The rotating-disc velocimeter method was based on measuring the displacement of the pattern of sprayed particles on a rotating disc caused by a "shadow bar" attached to the disc at a fixed distance toward the spray gun. This method gave an average velocity for only the adhering particles. The average velocities obtained with the rotating-disc velocimeter varied with distance from the gun nozzle. The peak velocity for the rod gun was 566 ft./sec.; for the powder gun, 145 ft./sec. (Author)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
MAGNESIA, by M. A. Schwartz. Feb 48, 121p. 103 refs. NEPA 463 IHR-E14.
Order from LC mi$6.30, ph$19.80 PB 146 223

Magnesia and its compounds such as spinel, forsterite, etc. have gained prominence in recent years as important super-refractory materials. The increased number of companies producing magnesia has resulted in making it more available in greater purity and at lower cost. An important development in this respect has been its extraction from sea-water. Improved methods of electric sintering and fusing of the material has also assisted in producing an improved product; and this material, by itself and in combination with other materials will undoubtedly offer increasing inducements for high temperature research. In reporting on the property data of magnesia, conflicting results are very evident, which is due mainly to the various grades of magnesia tested. Wherever possible, descriptions of the samples used in conducting tests will be included.

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
THORIA, by M. A. Schwartz. Dec 48, 43p. 30 refs. NEPA 875 EMR-42 (Supersedes sections on Thoria in NEPA 309-IHR-14).
Order from LC mi$3.30, ph$7.80 PB 146 222

Fuels, Lubricants, and Hydraulic Fluids

Hefco Labs., Inc. Detroit, Mich.
THE CHEMICAL STABILIZATION OF NITROMETHANE AND TETRANITROMETHANE FOR USE IN MONOFUEL COMBINATIONS. Technical rept. for Dec 48-May 49 on Rocket Fuels, Contract N7onr-473, T.O. 1. May 49, declassified 16 Aug 55. 77p. 5 refs. ATI-58097.
Order from LC mi$4.50, ph$12.30 PB 146 519

Progress made in the investigation of the chemical stabilization of nitromethane and intranitromethane for use in monofuel combinations is reported. Relatively less work has been done on new fuel than on refinements of the testing techniques and the development of new testing methods. The techniques and methods discussed are mechanical and explosive impact testing, sand bomb testing, thermal stability testing, and thermal testing. A new thermal testing apparatus has been designed with which it is hoped that direct measurements of the temperature and pressure of fuels during the course of reaction can be obtained. The apparatus consists essentially of a test cavity closed by a thin membrane and a hardened steel cap.

Hefco Labs., Inc., Detroit, Mich.
THE CHEMICAL STABILIZATION OF NITRO METHANE AND TETRANITROMETHANE FOR USE IN MONOFUEL COMBINATIONS. Technical rept. for June 49-Feb 50 on Rocket Fuels, Contract N7onr-473, T.O. 1. [1950] declassified 16 Aug 55, 70p. 4 refs. ATI-77 605.
Order from LC mi$3.90, ph$10.80 PB 146 288

Progress made in the study of the chemical stabilization of nitromethane and tetraitromethane for use in rocket propellants is reported. A large part of the time was spent in an examination of the purity of the two components of the system, a study of methods of measuring and improving the purity, and of the determination of the purified materials. A study was made of the phase diagram of the nitromethane-tetranitromethane system. Previous work on the analysis of the combustion gases has been re-examined and improvements have been made in the analytical procedure. Work was also accomplished on inhibitors for the detonation of mixtures of nitromethane and tetranitromethane by explosive impact and on the explosive impact sensitivity of mixtures. Preliminary tests have been made with the new thermal stability apparatus. (Author)

Naval Boiler and Turbine Lab., Philadelphia, Pa.
EVALUATION OF H_2O WASHING TECHNIQUES FOR NAVY SPECIAL FUEL OILS, by H. M. Foltes. Evaluation rept. 2 Mar 59, 14p. NBTL Test P-336; AD-214 345.
Order from LC mi$2.40, ph$3.30 PB 145 823

Water washing of fuel oils reduces the sodium content to a great extent but has only a small effect on the removal of organic vanadium compounds present in fuel oils. Mono and dibasic ammonium phosphates, employed as water washing agents, resulted in lower ash contents than do magnesium or calcium salts.

Naval Ordnance Test Station, China Lake, Calif.
OPTIMUM PROPORTIONING OF TWO PROPELLANTS TO OBTAIN MAXIMUM BURNT VELOCITY, by R. H. Olds. 7 Apr 58. 65p. 5 refs. NOTS 2002; NAVORD rept. 5873; AD-163 092.
Order from LC mi$3.90, ph$10.80 PB 145 910

Using burnt velocity as a measure of performance, it is shown that better performance may be obtained from combinations of two propellants than can be obtained from either propellant alone. The improved performance depends upon the relative densities of the two propellants as well as upon their energies. Optimum performance results from a suitably programmed variation of propellant proportions throughout burning. The present work confirms an earlier effort by Lorell and Hibbs of the Jet Propulsion Laboratory and extends the analysis to some cases not previously considered. (Author)

Phillips Petroleum Co., Bartlesville, Okla.
GAS TURBINE AND JET ENGINE FUELS, by George D. Kittredge. Summary rept. for 1 July 57-30 June 58 on Contract NOas-58-310-d. 22 Sep 58, 79p. 10 refs. Research Div. rept. 2182-58R;

AD-205 981.
Order from LC mi$4.50, ph$12.30 PB 146 632

Completion of the 96 week storage stability program discussed in earlier contract reports has confirmed preliminary findings that no serious deterioration has taken place with the JP-5 specification test fuels during this term of ambient temperature storage, in terms of either existent gum content or CFR Fuel Coker ratings. Hot room storage at 110 F (indicated to be roughly four times as severe as ambient storage) did cause JP-5 fuels from West Coast and Gulf Coast sources to go "off spec" in terms of gum content after 48 weeks time. Two-inch combustor testwork at moderate-to-high pressure levels has established a relationship between radiant heat flux across the flame zone and metal temperatures. Flame tube metal burn-off rates also agreed reasonably well with transverse radiation intensity and flame tube temperature. Fuel type was shown to influence radiant heating of the combustor liner in the following order of decreasing severity -- aromatics, naphthenes and paraffins, followed by an alcohol.

Rock Island Arsenal Lab., Ill.
INVESTIGATION OF RESIN SYSTEMS AS BONDING AGENTS FOR DRY LUBRICANTS, by F. S. Meade and G. P. Murphy. 4 June 59, 32p. 8 refs. Rept. no. 59-1515; AD-217 315.
Order from LC mi$3.00, ph$6.30 PB 146 485

Eighteen resin systems were pigmented with micro-size molybdenum disulfied in four pigment-to-resin ratios: 0:1, 1:1, 3:1, and 9:1, to obtain dry lubricant formulations. The lubricating properties of the cured dry lubricant formulations were evaluated by means of a Shell Four-Ball Wear Tester, Shell Four-Ball Extreme Pressure Tester, Falex Lubricant Test, and Cincinnati Stick-Slip Tester. The dry lubricant formulations were also examined for storage stability after at least 12 months storage at room temperature. The molybdenum disulfide resin bonded dry lubricants were statistically ranked as to their over-all lubricating effectiveness. Dry lubricant formulations incorporating the same type of resins supplied by different sources were not necessarily ranked the same. The most effective pigment-to-resin ration was 9:1 and the most effective resin systems at this pigment-to-resin ratio, taking into consideration both lubricative properties and storage stability, were epoxy-phenolic and epoxy-polyamide resin systems. (Author)

Leather and Textiles

Fabric Research Labs., Inc., Dedham, Mass.
SOME ASPECTS OF BENDING RIGIDITY OF SINGLES YARNS, by Milton M. Platt, William G. Klein, and Walter J. Hamburger. Technical rept. no. 7 on Contract Nonr-1422(00). 15 Mar 59, 59p. 11 refs.
Order from LC mi$3.60, ph$9.30 PB 145 927

Theoretical analyses are given of the effects of fiber properties and yarn structure on singles yarn bending rigidity. The two extreme cases of (a) complete freedom and (b) no freedom of relative fiber motion are analyzed. The effects on yarn rigidity of fiber dimensions, fiber stiffness, torsional to bending rigidity ratio, yarn density, size, and twist, fiber clustering, and prior relaxation treatments are analytically investigated. (See also PB 143 610)

Materials Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
EVALUATION OF NYLON "6" CORDS, RIBBON AND TAPES, by C. F. Holmes, Jr. Rept. for June 54-June 58 on Air Force Textile Materials. Jan 59, 14p. WADC Technical note 59-14.
Order from LC mi$2.40, ph$3.30 PB 146 278

The purpose of this evaluation was to determine if materials made from nylon "6" are suitable substitutes for materials made from nylon "66". This was accomplished by manufacturing certain tapes, ribbons, cords and threads in accordance with the construction requirements of appropriate specifications except that nylon "6" was used in the place of nylon "66". The materials were then tested to determine if they met the physical requirements of the specifications. It was found that some of the materials did not meet some of the breaking strength and elongation requirements of the appropriate specification. Materials made from nylon "6" can not, therefore, be used indiscriminately in the place of nylon "66" materials. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
DEVELOPMENT OF SHADE STANDARD AND TOLERANCES FOR USAF BLUE 85 SERVICE OVERCOAT, by Frank J. Rizzo, Constantine J. Megas, and others. Rept. for 23 Sep 53-19 Dec 58 on Air Force Textile Materials, Contract AF 33(616)53-221. Jan 60, 67p. 11 refs. WADC Technical rept. 59-397.
Order from OTS $1.75 PB 161 684

The work involved development of a formulation of high order colorfastness properties, for Air Force Service Overcoat, practical for the Industry to apply routinely, and application of such formulation to the preparation of a new shade standard and a practical range of color tolerances. The resultant studies here reported have fulfilled the stated requirements. The formulation is colorfast; the tolerance range is of a degree of spacing permissible in end use without apparent inconvenience to the Industry in attainment. Colorfastness of the tolerance range relative to standard is such that uniformity in appearance throughout the useful life of the garment seems reasonably assured.

Plastics

Army Prosthetics Research Lab., Washington, D.C.
DILAMINAR COSMETIC GLOVES, by Allen Winer. 6 Mar 59, 8p. 1 ref. Technical rept. no. 5915; AD-212 658.
Order from LC mi$1.80, ph$1.80 PB 146 214

A latex dipping method has been developed to produce abrasion resistant cosmetic gloves by using a dilaminar approach. This new method apparently eliminates the serious problem of poor resistance to abrasion and tack development which has thus far retarded the use of this laboratory's standard terpolymer latex for cosmetic gloves.

Army Prosthetics Research Lab., Washington, D. C.
REVISED SUNLAMP EXPOSURE TEST FOR VINYL FILMS, by James T. Hill. Sep 58, 6p. Technical rept. no. 5824; AD-203 928.
Order from LC mi$1.80, ph$1.80 PB 146 854

A method used to accelerate the aging of vinyl materials consists of exposing the test specimens for 3 weeks to a sunlamp and measuring the color changes that occur in these specimens. In order to duplicate sunlamp exposure tests it is necessary to expose the samples to the same amount of radiant energy. In order to increase the precision of duplication it is necessary to continuously measure the energy from these lamps and thus expose the samples to equal amounts of radiation. For this reason an investigation was conducted to develop a method of measuring U. V. energy.

Midwest Research Inst., Kansas City, Mo.
FABRICATION AND DEVELOPMENT OF COMPOSITE PLASTIC PLATES. Final rept., Phase 2, 16 July 58-14 Apr 59, on Contract NOas 58-563-c. 6 Jan 60, 45p. 17 refs. AD-232 235.
Order from LC mi$3.30, ph$7.80 PB 145 904

Transparent thermosetting plastics were used in making composite aircraft glazing materials. These plastics were cast in situ on "hot stretched" acrylic sheet. It will provide an insulating layer to protect the acrylic from the high skin temperatures encountered on supersonic aircraft. This program consists of two parts. Phase I, completed in August, 1958, was the fabrication of a composite material from hot stretched acrylic and an allyl resin. Phase II is discussed in this report. The diglycidyl ether of bisphenol A, an epoxy resin, was crosslinked with hexahydrophthalic anhydride using benzyltrimethylammonium chloride as a catalyst and triphenyl phosphite as an antioxidant. This system was cast onto a curved section of hot stretched acrylic. The resultant composite was nearly water-white and very transparent. (See also PB 144 890)

Naval Ordnance Lab., White Oak, Md.
DIFFERENTIAL THERMAL ANALYSIS OF POLYMERIC MATERIALS, by Hugh C. Anderson. 18 Feb 59, 29p. 11 refs. NAVORD rept. 6210; AD-218 198.
Order from OTS $0.75 PB 161 676

The assembly and operation of a differential thermal analyzer is described. Its versatility, order of precision and accuracy is demonstrated. The analyzer is shown to be an important tool in studying the thermal processes which take place when a polymeric material is pyrolyzed. (Author)

Naval Ordnance Lab., White Oak, Md.
A NEW METHOD FOR DETERMINING THE SECOND ORDER TRANSITION IN POLYMERS, by R. W. Warfield. 10 Mar 59, 17p. 18 refs. NAVORD rept. 6285.
Order from LC mi$2.40, ph$3.30 PB 145 819

A new method is described for determining the second order transition in polymers. The method is based upon an analysis of the temperature dependence of electrical resistivity. When resistivity is plotted vs. temperature, a change in slope occurs at the transition point. Results obtained by this method have been shown to agree closely with independent specific heat determinations and with published values. The nature of the second order transition in polymers is discussed. (Author)

Naval Ordnance Lab., White Oak, Md.
THE SPECIFIC HEAT OF THERMOSETTING POLYMERS, by R. W. Warfield, M. C. Petree and P. Donovan. 14 Jan 59, 21p. 19 refs. NAVORD rept. 6255; AD-216 802.
Order from LC mi$2.70, ph$4.80 PB 145 822

Specific heat, as a function of temperature has been determined over the range of 30°C to 160°C for a number of thermosetting polymers. The data were obtained by means of an adiabatic calorimeter. In agreement with theory, the specific heats of the polymers showed a progressive increase with increasing temperature. In many cases large increases in specific heat have been observed which are indicative of second order transitions within the polymer. (Author)

Naval Ordnance Lab., White Oak, Md.
A STUDY OF THE POLYMERIZATION OF THERMOSETTING POLYMERS BY ELECTRICAL RESISTIVITY TECHNIQUES, by R. W. Warfield and M. C. Petree. 5 Aug 59, 22p. 20 refs. NAVORD rept. 6702.
Order from LC mi$2.70, ph$4.80 PB 145 821

Electrical volume resistivity measurements made isothermally during polymerization have been used to study the bulk polymerization of epoxide, polyester and polyurethane polymers. Whenever possible, kinetic parameters have been calculated. The existenc of micelles in the solid polymer is postulated as exp aining the observed differences in the E_C values for these crosslinked polymers. The results of this study indicate that electrical resistivity measurements are sensitive to the rate and extent of polymerization and appear to be useful in studying the structure of the solid polymer.

Rubber and Elastomers

Institute of Rubber Research, U. of Akron, Ohio.
STRESS RELAXATION AND STRUCTURE OF HIGH TEMPERATURE ELASTOMERS, by Maurice Morton, V. R. Allen, and R. D. Gates. Technical rept. no. 4 for 1 Mar-31 May 59 on Contract Nonr-2573(00). [1959] 26p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 146 230

Natural rubber vulcanizates, having different types ot crosslinks, have been found to have very similar sol versus degradation relations. Based on this and other factors, it is proposed that the degradation reaction for these vulcanizates is primarily a random chain scission process. Also, in order to explain the difference between the theoretical relation and the experimental results, it is proposed that this scission of chemical bonds is accompanied by the simultaneous release of chain entanglements ("physical" crosslinks). This, therefore, results in a concurrent crosslink destruction and random chain scission.
(See also PB 144 960)

Rock Island Arsenal Lab., Ill.
HIGH TEMPERATURE PROPERTIES OF ELASTOMER VULCANIZATES, by E. W. Bergstrom.
21 Jan 60, 47p. 2 refs. Technical rept. no. 60-188.
Order from OTS $1.25 PB 161 689

The high temperature capabilities and limitations of vulcanizates prepared from many of the currently available elastomers were determined. The physical properties of vulcanizates were measured both after aging and at various high temperatures. The vulcanizates were then rated as to heat resistance on the basis of retention of tensile strength. Results of a great many tests and formulations are presented.

Rock Island Arsenal Lab., Ill.
ORGANO METALLIC SOAPS AND POLYHYDRIC COMPOUNDS AS HEAT STABLE INHIBITORS FOR SBR VULCANIZATES, by Frank B. Testroet.
29 Dec 59, 17p. 4 refs. Rept. no. 59-3249; AD-233 082L.
Order from OTS $0.50 PB 161 678

Organo metallic soaps and polyhydric compounds, separately and in combination with each other, were evaluated to determine the capacity of these materials for protecting SBR vulcanizates from the deleterious effect of heat aging. Although these materials have little value as heat stable inhibitors when used separately, it appears that when combined, a synergistic effect is obtained which leads to protection of the vulcanizates during heat aging.

MATHEMATICS

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON THE ADJOINT SEMIGROUP AND SOME PROBLEMS IN THE THEORY OF APPROXIMATION, by Karel De Leeuw. Technical note no. 3 on Contract AF 49(638)294. 13 Apr 59, 36p. 8 refs. AFOSR-TN-59-214; AD-211 776.
Order from LC mi$3.00, ph$6.30 PB 145 742

Results of P. L. Butzer concerning the identification of saturation classes arising in the theory of approximation are extended to non-reflexive Banach spaces by the consideration of adjoint semigroups. (Author)

Applied Mathematics and Statistics Labs., Stanford U., Calif.
ON TIME SERIES ANALYSIS AND REPRODUCING KERNEL SPACES, by N. Donald Ylvisaker. Technical rept. no. 1 on Contract DA 04-200-ORD-996.
4 Nov 59, 43p. 10 refs; AD-229-913.
Order from LC mi$3.30, ph$7.80 PB 145 715

The representation of a second order process by a reproducing kernel space is here taken on the real line. Section 2 is devoted to some aspects of the general theory of reproducing kernel spaces and to the particular case in which K is a kernel on E_2 of the form $K(s, t) = k(s-t)$.

California U., Berkeley.
DISTRIBUTIONS AND GENERAL THEORY OF DIFFERENTIAL OPERATORS, by François Trèves. Technical rept. no. 1 on Contract AF 49(638)604.
Jan 60, 134p. 4 refs. AFOSR-TN-60-34.
Order from LC mi$6.90, ph$21.30 PB 146 082

These notes correspond to a series of lectures given at the University of California in Berkeley during the term of Fall 1959. The purpose of those lectures was to introduce students to the techniques of topological linear spaces and Schwartz's distributions in the field of linear partial differential equations. Actually only a few topics are studied and the lectures are essentially concerned with the case of constant coefficients, more precisely with the general theory, that is to say with the properties independent from type. These notes do not contain any new result; they are essentially excerpts from works by L. Hörmander, B. Malgrange and L. Schwartz.

Cornell U., Ithaca, N. Y.
ON A SERIES OF COSECANTS II, by Harry Kesten. Rept. on Contract Nonr-401(03). [1959] 18p.
6 refs. AD-213 329.
Order from LC mi$2.40, ph$3.30 PB 145 995

Florida State U., Tallahassee.
OPENNESS OF THE DERIVATIVE OF A COMPLEX FUNCTION, by Robert L. Plunkett. Rept. on Contract AF 49(638)598. Sep 59, 9p. 3 refs. AFOSR-TN-59-1120.
Order from LC mi$1.80, ph$1.80 PB 145 769

The principal object of this paper is to present a purely topological proof of the strong openness of the derivative of a complex function. This openness is, of course, a direct consequence of the existence of the second derivative, but the proof of that existence still requires the use of powerful techniques of function theory which depend on complex integration. The proof presented here is therefore necessarily independent of the existence of the second derivative.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A DERIVATION OF THE BASIC EQUATIONS FOR HYDRODYNAMIC LUBRICATION WITH A FLUID HAVING CONSTANT PROPERTIES, by Harold G. Elrod. Interim rept. on Contract Nonr-2342(00).

Apr 59, 21p. 2 refs. Rept. no. I-A2049-5.
Order from LC mi$2.70, ph$4.80 PB 145 943

In this report small parameter techniques are used to derive Reynolds' lubrication equations, and refinements thereof, from the full Navier-Stokes equation, for fluids having constant properties. An effort has been made to retain vigor in the development comparable to that used in present-day boundary-layer developments. Analytical techniques similar to those employed here have been adapted to the derivation of equations applicable to fluids having pressure and temperature-dependent properties, such as gases. The results will be presented in a subsequent report.

Institute for Advanced Study, Princeton, N. J.
INTRINSIC OPERATORS IN THREE-SPACE, by Victor L. Shapiro. Rept. on Contract AF 49(638)253.
May 59, 17p. 9 refs. AFOSR-TN-59-499; AD-215 924.
Order from LC mi$2.40, ph$3.30 PB 146 213

The following theorem is proved: Let D be a domain in Euclidean 3-space and let v be a continuous vector field defined in D. Then a necessary and sufficient condition that v be locally in D the gradient of a potential of a distribution with continuous density, is that the intrinsic curl of v be zero in D and the intrinsic divergence of v be continuous in D.

Institute of Mathematical Sciences, New York U., N. Y.
ON THE DIRICHLET PROBLEM FOR THE REDUCED WAVE EQUATION, by Rolf Leis. Rept. on Contract AF 49(638)229. June 59, 25p. 12 refs.
Research rept. no. BR-30; AFOSR-TN-59-945.
Order from LC mi$2.70, ph$4.80 PB 145 743

In this paper, an existence theorem for the exterior Dirichlet problem for the reduced wave equation will be given for piecewise smooth surfaces. (Author)

Johns Hopkins U., Baltimore, Md.
ON LOCAL AND GLOBAL PROPERTIES OF CONVEX SETS AND HYPERSURFACES, by Richard Sacksteder. Doctoral thesis. Technical note no. 14 on Contract AF 18(603)41. Nov 59, 47p.
28 refs. AFOSR-TN-59-1294.
Order from LC mi$3.30, ph$7.80 PB 145 774

In the first chapters, there is obtained a generalization of a theorem of Tietze characterizing convex sets by local properties. This result is used in the second chapter to prove the main result: Let S be a (sufficiently smooth) isometric immersion of a complete n-dimensional Riemannian manifold M^n in a Euclidean space E^{n+1} with the intrinsic property that the second fundamental form of S is semi-definite at every point and definite at some point. Then S is the boundary of a convex body (although if M^n is not complete, S need not even be locally convex). The third chapter deals with a number of topics. Examples are given to show that theorems of Hilbert and Weyl, concerning extrema of principle curvatures or of mean and Gauss curvatures at non-umbilic points, are false without suitable smoothness assumptions. (Author)

Leyden U. (Netherlands).
RELATIONS BETWEEN PATH INTEGRALS AND THE VARIATIONAL PRINCIPLES OF HAMILTON, by J. Vlieger, P. Mazur, and S. R. de Groot. Technical note on Contract AF 61(052)16. 16 July 59, 9p.
7 refs. AFOSR-TN-59-959; AD-226 407.
Order from LC mi$1.80, ph$1.80 PB 146 019

Groenewold's representation (Kgl. Danske Videnskab. Selskab mat. -fsy. Medd. 30:1956) for the propagation of the Schrödinger equation is shown to lead to the so-called modified Hamilton Principle. (Author)

Liège U. (Belgium).
PROBLEMS AND METHODS IN PARTIAL DIFFERENTIAL EQUATIONS. PART III: DIFFERENTIATION OF THE FINITE PART AND OF THE LOGARITHMIC PART OF SOME DIVERGENT INTEGRALS WITH APPLICATIONS TO THE CAUCHY PROBLEM, by F. J. Bureau. Technical (scientific) note no. 1 on Contract AF 61(052)86. Oct 59, 92p.
28 refs. AFOSR-TN-59-963.
Order from LC mi$5.40, ph$15.30 PB 145 744

This report represents a part of a group of lectures given at Duke University during the academic year 1955-56. It introduces the theory of the finite part and the logarithmic part of some divergent integrals and applies it to the study of the Cauchy problem for the wave equation, the damped wave equation and the singular equation of Euler-Poisson-Darboux.

Mathematics Research Center, U. of Wisconsin, Madison.
THE LOCATION OF THE ZERO OF INFRAPOLYNOMIALS, by Morris Marden. Rept. on Contract DA 11-022-ORD-2059. Nov 58, 23p. 18 refs. MRC Technical summary rept. no. 55; AD-209 996.
Order from LC mi$2.70, ph$4.80 PB 146 021

See also PB 128 618

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
AN APPLICATION OF THE POTENTIAL ANALOGY TO SOLVING HURWITZ POLYNOMIAL EQUATIONS, by Henry G. Ansell. Rept. on Contract AF 30(602)1709. 24 Sep 58, 34p. 11 refs. Research rept. R-686-58; PIB-614; RADC-TN-58-391; AD-148 889.
Order from LC mi$3.00, ph$6.30 PB 146 179

A method of locating the zeros of Hurwitz polynomials with the aid of a conducting sheet is presented. The technique is a compromise between purely computational solution, and solution by digital computer, in that the purely computational work is greatly simplified, and the analogue technique used is simple to set

up and operate. Computationally, the proposed method requires solving polynomial equations of reduced order having only real, positive roots. For example, determining by this method the zeros of a quartic Hurwitz polynomial merely requires factoring quadratics for real roots. The equipment used consists essentially of a uniform-resistivity sheet, a power source supplying electrodes with direct current, and a d. c. null voltage detector (e. g., a vacuum tube voltmeter). The method requires detecting null voltages on the surface of the conducting sheet. The basis of the method is explained, and illustrative examples given. (Author)

Mathematics Research Center, U. of Wisconsin, Madison.
FUNCTIONS OF RESTRICTED VARIATION, by Preston C. Hammer and John C. Holladay. Rept. on Contract DA 11-022-ORD-2059. Nov 58, 23p. 15 refs. MRC Technical Summary rept. no. 58; AD-207 994.
Order from LC mi$2.70, ph$4.80 PB 146 257

For real-valued functions defined on a simply ordered set, we introduce the concept of the k-variations which result from limiting the number of points in a partition to k . These k-variations exist finitely for bounded functions. If for a given function the sequence of differences between (k + 1)-variations and k-variations has the limit zero as k increases we say the function is of restricted variation, In this paper various properties of functions of restricted variation are derived. It is shown that there exists an extension of the simply ordered set S to a simply ordered compact set S* such that every function f of restricted variation on S may be extended to a function f* continuous on S* and conversely.

Mathematics Research Center, U. of Wisconsin, Madison.
OPTIMAL APPROXIMATIONS AND ERROR BOUNDS, by Michael Golomb and H. F. Weinberger. Rept. on Contract DA 11-022-ORD-2059. Oct 58, 75p. 29 refs. MRC Technical Summary rept. no. 49; AD-208 052.
Order from LC mi$4.50, ph$12.30 PB 146 256

Most known error estimates for approximation processes assign one, or at most a few different expressions for the error, to any particular process. It is a matter of luck whether or not the computer has available the information about the unknown function required by the particular expression and whether or not the error bound based on this expression uses all the information he does have. One may make the general statement that the more refined an approximation process is, the higher are the derivatives of the unknown function occurring in the error term, and hence the more likely it is that their magnitude is unknown. The purpose of the present paper is to free the numerical analyst from "the slings and arrows of outrageous fortune" by supplying him with the means of estimating errors in terms of what he knows. The general problem studied is: how to derive from a given amount of information about the unknown function u the total range of possible values of the functional F(u).

Minnesota U., Minneapolis.
POLYNOMINALS DEFINED BY A DIFFERENCE SYSTEM, by Glen Baxter. Technical rept. no. 11 on Contract AF 18(603)30. 15 Oct 59, 77p. 6 refs. AFOSR-TN-60-93.
Order from LC mi$4.50, ph$12.30 PB 145 761

A study is made of the polynomials $u_n(t)$ and $v_n(t)$ which are defined by the difference system

$$\begin{cases} \Delta u_n = \alpha_n e^{int} v_n \\ \Delta v_n = \beta_n e^{-int} u_n , \end{cases}$$

where α_n and β_n are presumed known. A relation between u_n and v_n and orthogonal polynomials as defined by Szegö is also considered. Application is made of the results to the problem of determining the distribution of max $(S_0, \ldots, S_n)$ and min $(S_0, \ldots, S_n)$ for the partial sums S_n of a sequence of independent, identically distributed random variables. (Author)

North Carolina U., Chapel Hill.
EVALUATION OF DETERMINANTS, CHARACTERISTIC EQUATIONS AND THEIR ROOTS FOR A CLASS OF PATTERNED MATRICES, by S. N. Roy, B. G. Greenberg and A. E. Sarhan. Technical rept. no. 10 on Estimation of Parameters by Order Statistics, Contracts DA 36-034-ORD-2184 and AF 49(638)213. 22 Dec 59, 28p. 5 refs. AFOSR-TN-60-200; OOR rept. 1597, 14-M.
Order from LC mi$2.70, ph$4.80 PB 145 994

Northwestern Technological Inst., Evanston, Ill.
MIXING ROUTINES FOR A CLASS OF COUPLED MODELS, by A. Charnes and W. W. Cooper (Carnegie Inst. of Tech.) ONR Research memo. no. 18 on Temporal Planning and Management Decision under Risk and Uncertainty, Contract Nonr-1228(10) and Planning and Control of Industrial Operations, Contract Nonr-760(01). May 59, 11p. 11 refs. AD-220 606.
Order from LC mi$2.40, ph$3.30 PB 145 976

Princeton U., N. J.
ALGEBRAS OF HOLOMORPHIC FUNCTIONS ON ONE-DIMENSIONAL VARIETIES, by Hugo Rossi. Rept. on Contract AF 49(638)692. Oct 59, 38p. 12 refs. AFOSR-TN-59-1179.
Order from LC mi$3.00, ph$6.30 PB 145 771

This note studies one-dimensional analytic spaces with emphasis on the maximality problem of the algebra of holomorphic functions on a compact subset, first considered for Riemann surfaces by John Wermer. It is proven that this is the only case where such an algebra is maximal. Representations of subalgebras of holomorphic functions on Riemann surfaces as algebras on an analytic is also considered. (Author)

Purdue U. [Lafayette, Ind.]
NORMAL OPERATORS ON THE BANACH SPACE $L^p(-\infty, \infty)$ I. BOUNDED OPERATORS, by G. L. Krabbe. Technical note no. 2 on Contract AF 49(638)505. 10 Nov 59, 5p. 5 refs. AFOSR-TN-59-579; AD-217 026.
Order from LC mi$1.80, ph$1.80 PB 146 006

Purdue U., Lafayette, Ind.
NORMAL OPERATORS ON THE BANACH SPACE $L^p(-\infty, \infty)$. PART II. UNBOUNDED OPERATORS, by G. L. Krabbe. Rept. on Contract AF 49(638)505. 20 Nov 59, 37p. 16 refs. AFOSR-TN-59-1212.
Order from LC mi$3.00, ph$6.30 PB 145 933

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORY AND APPLICATION OF THE SEPARABLE CLASS OF RANDOM PROCESSES, by Albert H. Nuttall. Doctoral thesis. Rept. on Contract DA 36-039-sc-64637. 26 May 58, 62p. 16 refs. Technical rept. 343; AD-214 552.
Order from LC mi$3.90, ph$10.80 PB 145 781

The separable class of random processes is defined as that class of random processes for which the g-function,

$$g(x_2, \tau) = \int_{-\infty}^{\infty} (x_1 - \mu)\, p(x_1, x_2; \tau)\, dx_1$$

separates into the product of two functions, one a function only of x_2, the other a function only of τ. The second-order probability density function of the process is $p(x_1, x_2; \tau)$ and μ is its mean. Various methods of determining whether a random process is separable are developed, and basic properties of the separable class are derived.

RIAS, Baltimore, Md.
THE BANG-BANG PRINCIPLE, by J. P. LaSalle. Rept. on Contract AF 49(638)382. Nov 59, 23p. 10 refs. Technical rept. 59-5; AFOSR-TN-59-1142.
Order from LC mi$2.70, ph$4.80 PB 145 770

It has for sometime been an intuitive principle that if a system is to be guided to an objective in minimum time and the steering is limited, then optimal steering can only be achieved by at all times using the maximum steering available. This has been called the "bang-bang" principle. The validity of this principle and the extent of control that can be achieved are the main topics discussed in this paper. The system being controlled is assumed to be linear and considered as a function of the time the steering enters linearly. The coefficients need not be constants although some aspects of the constant coefficient case are simpler. (Author)

RIAS, Baltimore, Md.
CONTROLS: AN APPLICATION OF THE DIRECT METHOD OF LIAPUNOV, by S. Lefschetz. Rept. on Contract AF 49(638)382. Dec 59, 20p. 4 refs. Technical rept. 59-8; AFOSR-TN-59-1219.
Order from LC mi$2.40, ph$3.30 PB 146 150

RIAS, Baltimore, Md.
LIAPUNOV'S FUNCTION AND BOUNDEDNESS OF SOLUTIONS, by T. Yoshizawa. Rept. on Contract AF 49(638)382. Dec 59, 15p. 6 refs. Technical rept. 59-7; AFOSR-TN-59-1218.
Order from LC mi$2.40, ph$3.30 PB 146 151

RIAS, Baltimore, Md.
ON THE CHARACTERISTIC EXPONENTS OF LINEAR PERIODIC DIFFERENTIAL SYSTEMS, by Jack K. Hale. Rept. on Contract AF 49(638)382. Dec 59, 20p. 22 refs. Technical rept. 59-6; AFOSR-TN-59-1220. AD-231 589.
Order from LC mi$2.40, ph$3.30 PB 146 149

Rutgers State U., New Brunswick, N. J.
THE CONJUGATE FOURIER-STIELTJES INTEGRAL IN THE PLANE, by Victor L. Shapiro. Rept. on Contract AF 18(600)1595. 27 Oct 58, 5p. 7 refs. AFOSR-TN-58-935.
Order from LC mi$1.80, ph$1.80 PB 145 741

In this report, the following theorem is proved: Let K(x) be a planar Calderon-Zygmund kernel in class Lip $(\alpha, 2)$, $1/2 < \alpha < 1$, and let k(y) be its principal-valued Fourier transform. Let F be a countably additive set function defined on the Borel sets of the plane of finite total variation and let f be the Fourier-Stieltjes transform of F. Then $\int_{E_2} e^{-|y|/R} e^{i(y, x)} f(y)\, k(y)\, dy$ tends to a finite limit almost everywhere as $R \to \infty$. (Author)

Sibley School of Mechanical Engineering, Cornell U., Ithaca, N. Y.
A NOTE ON THE LIMITING RELATIVE EFFICIENCY OF THE WALD SEQUENTIAL PROBABILITY RATIO TEST, by Robert Bechhofer. Technical rept. no. 15 on Contract AF 49(638)230. 8 Jan 60, 7p. 9 refs. AFOSR-TN-60-35.
Order from LC mi$1.80, ph$1.80 PB 145 776

The efficiency (measured in terms of ratio of average sample size to single-sample size) of the Wald sequential probability ratio test relative to the best competing single-sample procedure for testing $H_0 : \theta = \theta_{0_2}$ vs $H_1 : \theta = \theta_1$ $(\theta_0 < \theta_1)$ when X is distributed $N(X \mid \theta, \sigma^2)$ with known σ^2 is studied for fixed $(\theta, \theta_0, \theta_1)$ as the specified probabilities of error, $\alpha = P$ [Reject $H_0 \mid \theta = \theta_0$] and $\beta = P$ [Accepted $H_0 \mid \theta = \theta_1$], approach zero. The limit is shown to depend on the relative rates at which α and β approach zero. In particular, when $a\ \alpha = \beta$ $(a > 0)$ this limiting relative efficiency is equal to $(\theta_1 - \theta_0)/(4 \mid \theta_1 + \theta_0 - 2\theta \mid)$. The practical implications of this result are discussed. (Author)

Washington U., St. Louis, Mo.
THE COHOMOLOGY THEORY OF A PAIR OF GROUPS, by F. Haimo and S. MacLane. Rept. on Contracts AF 49(638)218 and AF [18] (600)1383. Apr 60, 26p. 12 refs. AFOSR-TN-60-115.
Order from LC mi$2.70, ph$4.80 PB 146 781

A cohomology theory is developed for a pair of groups B_1 and B_2 with coefficients in an abelian group A, as in a 1950 paper of R Baer.

Washington U., St. Louis, Mo.
VARIATION DIMINISHING HANKEL TRANSFORMS, by I. I. Hirschman, Jr. Rept. on Contract AF 49(638)218. Apr 60, 40p. 15 refs. AFOSR-TN-60-358.
Order from LC mi$3.00, ph$6.30 PB 146 782

Wayne State U., Detroit, Mich.
ELEMENTS OF THE THEORY OF EXTREME VALUES, by Benjamin Epstein. Technical rept. no. 2 on Contract Nonr-2575(00). 15 Apr 59, 31p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 145 946

The statistical theory of extreme values has, in recent years, been very useful in connection with a variety of applied problems. However, the engineer faced with the task of learning the elements of this theory and then applying it, finds that the literature is both extensive and difficult. He has to digest many new definitions, terms, and concepts before he can apply the theory. This is neither desirable nor necessary. While the theory of extreme values, viewed in its entirety, is a beautiful and in places esoteric theory, its basic elements can be given in a fairly compact form. Such a presentation is given in this paper.

Wayne State U., Detroit, Mich.
ON THE HOMOTOPY PROPERTIES OF THE COMPONENTS OF THE MAPPING SPACE X^{S^p}, by Sebastian S. Koh. Technical note no. 7 on Contract AF 49(638)179. Mar 60, 14p. 11 refs. AFOSR-TN-60-272.
Order from LC mi$2.40, ph$3.30 PB 146 766

The objective of this note is to study whether the various components of the mapping space of all continuous maps from a given sphere S^p into another sphere S^q are of the same homotopy type. Because of the recent results of the homotopy groups of spheres, more general information has been deduced about the homotopy types of these components than the existing results found by G. W. Whitehead and S. T. Hu fourteen years ago. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
UNBIASED, CONTINUOUS PARAMETER ESTIMATORS OF THE MEAN OF RANDOM PROCESSES (AVERAGING FUNCTIONS) by P. J. Beutler. Rept. on Proj. Michigan, Contract DA 36-039-sc-78801. May 59, 17p. 7 refs. Rept. no. 2900-13-T; AD-215 965.
Order from LC mi$2.40, ph$3.30 PB 145 998

A class of realizable weighting functions constitute unbiased estimators of the (invariant) mean of a random process. All such weighting functions are limit equivalent with respect to a stretched or compressed time scale, if a mean square error criterion is employed. These limit properties hold for nonstationary as well as stationary processes. An approximation theorem is stated and proved, the extension of the proof to nonstationary processes again being indicated. The following optimization problem is treated. A nonstationary process has time varying mean a(t), where a(t) is restricted to some specified class. From the set of realizable filters unbiased with respect to a(t), and having memory T, find that filter which gives the best estimate of $a(t_o)$ at time $t_o + t_p$, t_p being an interval over which prediction is required. "Best" is again interpreted in a mean square sense. The solution to the optimization problem is expressed in the form of an integral equation.

Wisconsin U., Madison.
FOURIER TRANSFORMS, CONFORMAL MAPPING, ENTIRE FUNCTIONS, AND ASYMPTOTIC SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS, by Jacob Korevaar. Final rept. for 1 June 51-30 Sep 59 on Contract N7onr-285(07). 1959, 11p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 146 212

(See also PB 136 398)

Computing Devices

Air Force Cambridge Research Center, Bedford, Mass.
INTERPRETIVE ROUTINE FOR COMPLEX NUMBERS, by R. H. Urbano. Mar 59, 11p. Cambridge Computer Series no. 2; AFCRC-TN-59-154; AD-212 462.
Order from LC mi$2.40, ph$3.30 PB 146 153

Air Force Cambridge Research Center, Bedford, Mass.
A NOTE ON LEAST-SQUARES CIRCLES, by R. H. Urbano and H. F. Mattson. Mar 59, 5p. Cambridge Computer Series no. 1; AFCRC-TN-59-153; AD-212 461.
Order from LC mi$1.80, ph$1.80 PB 146 154

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY. Rept. on Contract AF 19(604)4947. 1 Dec 59, 816p. Scientific rept. no. AF-57; AFCRC-TN-60-139.
Order from LC mi$11.10, ph$124.20 PB 145 870

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE MAGNETIC PROPERTIES OF THIN FILMS, by J. B. Goodenough and D. O. Smith. Rept. on Contract AF 19(122)458. 27 Jan 59, 42p. 61 refs. Technical rept. no. 197; AD-210 730.
Order from LC mi$3.30, ph$7.80 PB 146 498

Magnetic properties of thin Permalloy films and also MnBi films which have their easy-magnetization axis perpendicular to the plane of the film. The engineering parameters of importance for high-speed-memory applications are defined. Several appendices are devoted to some instrumentation that has been found useful in magnetic-film research.

Philco Corp., Philadelphia, Pa.
STUDY AND EXPERIMENTATION IN THE FIELD OF ANALOG-DIGITAL CONVERSION OF SAMPLING AND HOLDING CIRCUITS, by Joseph Yacyk. Final rept. for 15 Feb-15 Aug 59 on Contract AF 19(604)5229. 27 May 59, 27p. Philco 2210-F; AFCRC-TR-59-375.
Order from LC mi$2.70, ph$4.80 PB 145 758

This project consisted of a study program to evolve methods and circuits for sampling an input function by narrow sampling pulses, and storing the sampled value for a time long enough to read and encode it. A number of design specifications were set as an objective for the study. The circuit work during the final three-month period was given to establishing the optimum design of the double diode-bridge circuit, and designing and testing low-distortion input and output circuits.

Stanford Electronics Labs., Stanford U., Calif.
A CLASS OF MULTIPLE-ERROR-CORRECTING BINARY CODES FOR NON-INDEPENDENT ERRORS, by P. Fire. Technical rept. no. 55 on Contract Nonr-225(24). 24 Apr 59, 50p. 10 refs.
Order from OTS $3.30, ph$7.80 PB 145 801

In many data transmission and processing systems, the occurrence of multiple errors within a word is known to be a nonindependent phenomenon, i.e., the probability of an error occurring in a particular binary digit (binit) of the word is conditional on whether any errors occurred in some number of preceding binits. A class of parity-check error-correcting codes, specifically designed to cope with this situation, is described in this paper. These codes have the peculiar property that the check word derived in the normal decoding process is composed of two subwords, one defining the errors' pattern and the other indicating the error pattern's location within the word. The corrupted word is corrected merely by adding the shifted error-pattern subword to the indicated incorrect portion of the received word.

Washington U., Seattle. Div. of Counseling and Testing Services.
A PREDICTOR ELIMINATION PROGRAM WITH PREDICTOR RETAINMENT FOR THE IBM TYPE 650, by Dennis E. Hamilton. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). Apr 59, 9p. 5 refs; AD-229 938
Order from LC mi$1.80, ph$1.80 PB 145 797

This program is a modification of the predictor selection programs previously reported. The process utilizes a form of the general matrix reduction theorem developed by Horst and previously reported. The extent of the modification has been to include the following changes in procedure: (1) detection of the predictor variable with the least contribution to the coefficient of predictive efficiency, (2) retainment of any number of the predictor variables until those not designated have been removed from the battery, (3) acceptance of input matrices that have been multiplied by scaling factors. Absolute or differential elimination may be employed.

MECHANICS

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
ELASTIC STABILITY OF THIN-WALLED CYLINDERS AND CONES WITH INTERNAL PRESSURE UNDER AXIAL COMPRESSION, by Robert P. Lofblad, Jr. Rept. on Contract Nonr-1841(22). May 59, 28p. 7 refs. Technical rept. 25-29.
Order from LC mi$2.70, ph$4.80 PB 145 729

A study of the elastic stability of thin-walled pressurized cones was conducted in order to observe buckling characteristics and mode shapes.

Brown U. Div. of Applied Mathematics, Providence, R. I.
ON THE ABSOLUTE MINIMUM WEIGHT DESIGN OF FRAMED STRUCTURES, by Jacques Heyman. Technical rept. no. 36 on Contract Nonr-562(10). May 58, 21p. 3 refs. C11-36; AD-159 730.
Order from LC mi$2.70, ph$4.80 PB 139 064

The following theorem is discussed: if the cross section of the members of a frame is varied continuously so that the strength of the frame follows the bending moment diagram, then, provided the design is carried out in a certain way, the frame will have absolute minimum material consumption. The theorem is applied to determine the minimum weight of some simple continuous beam systems. A trial and error relaxation technique was developed which balances angles of rotation at supports. One of the problems is solved numerically to illustrate the technique. The designs are compared with more practical designs in which the cross-section of the members varies discontinuously.

Brown U. Div of Applied Mathematics, Providence, R. I.
ON THE PROPAGATION OF A CRACK IN AN ELASTIC-BRITTLE MATERIAL, by J. W. Craggs. Technical rept. no. 48 on Contract Nonr-562(10). May 59, 18p. 6 refs. C11-48.
Order from LC mi$2.40, ph$3.30 PB 146 174

Illinois U., Urbana.
INVESTIGATION OF RESISTANCE AND BEHAVIOR OF REINFORCED CONCRETE MEMBERS SUBJECTED TO DYNAMIC LOADING, by A. Feldman and C. P. Siess. Rept. on Contract DA 49-129-eng-344. 30 Sep 56, 158p. 5 refs. Civil Engineering Studies, Structural Research Series no. 125; AFSWP-929; AD-121 624.
Order from LC mi$7.50, ph$24.30 PB 136 240

The primary objectives of the work described in this report were: to adapt the available equipment and manufacture the additional equipment necessary to carry out the proposed tests; to check the operation of the equipment as individual units and as a unified whole; to develop testing techniques through the testing of pilot beams; and to make analyses of various single-degree-of-freedom systems under different loading pulses to obtain information which will be of value in the interpretation of future tests. Among the additional equipment fabricated were reaction measuring supports which simulate simple support conditions while permitting the measurement of uplift as well as downward reaction. Static tests were made on two beam specimens and provided an adequate evaluation of the behavior and reliability of the loading, measuring, and recording equipment.

Brown U. Div. of Engineering, Providence, R. I.
ON THERMALLY STRESSED ELASTIC-PLASTIC SHELLS, by E. T. Onat and S. Yamantürk (Brown U. Div. of Applied Mathematics). Technical rept. no. 12 on Contract Nonr-562(20). May 59, 26p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 146 169

The elastic-plastic behavior of rotationally symmetric sandwich shells is considered in the presence of the thermal effects arising from thermal straining and the temperature dependence of the yield strength. The mathematical nature of the problem is discussed in some detail for the case of cylindrical shells. (Author)

Illinois U., Urbana.
THEORY OF NON-HOMOGENEOUS ANISOTROPIC ELASTIC SHELLS SUBJECTED TO ARBITRARY TEMPERATURE DISTRIBUTION, by R. E. Miller, A. P. Boresi, and H. L. Langhaar. Technical rept. no. 4 on Contract Nonr-1834(14). Apr 59, 67p. 11 refs. T. & A. M. Rept. no. 143.
Order from LC mi$3.90, ph$10.80 PB 145 784

This paper presents a general theory for small deformations of anisotropic elastic shells subjected to arbitrary temperature distribution. The shells are assumed to be homogeneous through the thickness except for the coefficient of thermal expansion but are otherwise unrestricted with regards to homogeneity and isotropy. The theory is specialized for arbitrary cylinders, circular cones, spheres, and axially symmetrical orthotropic shells of revolution. In addition, two special problems are analyzed. (Author)

Institute of Engineering Research, U. of California, Berkeley.
ON PLANE STRESS SOLUTION OF A COMPRESSIBLE WEDGE WITH THE USE OF MISES' YIELD CONDITION, by A. Kalnins. Technical rept. no. 3 on Contract Nonr-222(69). May 59, 11p. 7 refs. Series no. 131, issue no. 3; AD-220 347.
Order from LC mi$2.40, ph$3.30 PB 146 229

A solution is presented for an acute, compressible, elastic, perfectly plastic wedge in the state of plane stress subjected to uniform pressure on one face. Mises' yield condition and its associated flow rules are employed.

Institute of Engineering Research, U. of California, Berkeley.
ON RIGID BODY DISPLACEMENTS IN THE THEORY OF THIN ELASTIC SHELLS, by P. M. Naghdi. Technical rept. no. 2 on Contract Nonr-222(69). Apr 59, 9p. 4 refs. Series 131, Issue 2.
Order from LC mi$1.80, ph$1.80 PB 146 002

Institute of Engineering Research, U. of California, Berkeley.
ON SAINT-VENANT'S PRINCIPLE: ELASTIC SHELLS AND PLATES, by P. M. Naghdi. Technical rept. no. 1 on Contract Nonr-222(69). Apr 59, 23p. 20 refs. Series no. 131, issue no. 1.
Order from LC mi$2.70, ph$4.80 PB 146 081

This investigation is concerned with an examination of the validity of Saint-Venant's principle in the theory of thin elastic shells and plates. With the aid of an integral formula derived for the displacements and their relevant partial derivatives of all orders at a fixed point of the shell middle surface, the conclusions reached may be roughly stated as follows: If the loads acting on the shell maintained in equilibrium are purely edge loads, then the orders of magnitude of the displacements and stresses are in accord with the traditional statement of Saint-Venant's principle. On the other hand, if the loads on the shell are purely surface loads, then the conclusions concerning the orders of magnitude of the displacements and stresses are the same as those of the modified Saint-Venant principle. (Author)

Institute of Flight Structures, Columbia U., New York.
EFFECT OF VARIATION OF VISCOSITY ON CREEP DEFLECTIONS OF COLUMNS, by G. W. Dillon, Jr. Technical rept. no. 8 on Contract Nonr-266(34). June 59, 46p. 27 refs. CU 2-59-ONR-266(34)-CE; AD-225 531.
Order from LC mi$3.30, ph$7.80 PB 146 514

The problem considered is that of a long column of rectangular cross section of a nonhomogeneous, nonlineraly viscoelastic (Maxwell) material. The nonhomogeneity considered is an exponential variation of the fluidity in the thickness coordinate of the bar. This type of variation might be caused by a linear temperature gradient across the bar. An approximate solution is obtained which yields finite values of the column lifetime (critical time) for a nonlinear material.

Polytechnic Inst. of Brooklyn, N. Y.
ON A COMPARISON OF ELASTICITY AND SHELL THEORY SOLUTIONS, by Jerome M. Klosner and Joseph Kempner. Rept. on Contract Nonr-839(17). May 59, 35p. 14 refs. PIBL rept. no. 493.
Order from LC mi$3.00, ph$6.30 PB 145 726

A shear deformation shell theory is applied to the problem of a long circular cylindrical shell subjected to a uniform circumferential radial line load. Comparisons of the resulting stresses and displacements are then made with the results of the elasticity solution for a ratio of inner to outer radius of the shell equal to 0.9. Classical shell theories are also used in the comparison. (Author)

Purdue U. Div. of Engineering Sciences, Lafayette, Ind.
IMPACT AND MOVING LOADS ON A SLIGHTLY CURVED ELASTIC HALF SPACE, by A. Cemal Eringen and J. Clifton Samuels. Technical rept. no. 13 on Contract Nonr-1100(02). Jan 58, 29p. 1 ref. AD-153 619.
Order from LC mi$2.70, ph$4.80 PB 139 313

Two-dimensional Fourier transforms are employed to threat the two-dimensional dynamic problem of elastic half space having a slightly wavy boundary. The various boundary curves considered include square and triangular-bumps and holes and sinusoidal and periodic boundaries. The number of different types of surface loadings considered are (i) normal tractions and zero shear, (ii) impulsive normal tractions and zero shear, (iii) suddenly applied normal tractions and zero shear, (iv) concentrated normal load and zero shear, (v) concentrated impulsive load and zero shear, (vi) pulsating normal load and zero shear, (vii) moving loads, (viii) pulsating moving loads, (ix) vertical and horizontal loads, (x) moving vertical loads. Stress and displacement components for special cases of the loads described in (i), (iii), (vi), and (vii) acting on a sinusoidal boundary lead to a solution which requires evaluation of a single indefinite integral. Closed form results are given for a uniform pulsating pressure load. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
BUCKLING OF A COLUMN WITH RANDOM INITIAL DISPLACEMENTS, by William E. Boyce. Rept. on Contract AF 18(600)1586. 22 Feb 60, 18p. 5 refs. MathRep no. 32; AFOSR-TN-60-150.
Order from LC mi$2.40, ph$3.30 PB 145 863

This paper discusses the relation between the load and the mean transverse displacement of the column when the initial configuration of the column is random in nature.

Rensselaer Polytechnic Inst., Troy, N. Y.
A GENERALIZATION OF THE PHASE RELATIONS IN A FORCED HARMONIC OSCILLATOR, by B. A. Fleishman. Rept. on Contract AF 49(638)514. 18 Dec 59, 12p. 2 refs. MathRep. no. 30; AFOSR-TN-59-1178.
Order from LC mi$2.40, ph$3.30 PB 145 999

When a simple harmonic oscillator is subjected to a sinusoidally varying external force whose frequency is different from the natural frequency of the oscillator, there is a simple and well-known phase relation between the purely forced response and the forcing function. They will have the same or opposite signs (except when both functions vanish) according as the forcing frequency is less or greater than the natural frequency. It is shown here that when the sinusoidal forcing function is replaced by any member of a wide class of periodic functions, the relation between the signs of the forcing function and the forced response continues to hold when the forcing frequency is greater than the natural frequency, but no longer holds in the other case. (Author)

Aerodynamics and Pneumatics

Aerojet-General Corp., Azusa, Calif.
THE MIXING OF VAPOR AND LIQUID JETS, by Joseph Levy. Rept. for 1 July 56-15 Oct 57 on Contract Nonr-869(00). 15 Oct 57, 69p. 4 refs. Rept. no. 1344 (Final); AD-152 896.
Order from LC mi$3.90, ph$10.80 PB 138 085

This study includes an experimental investigation of the processes that occur in the mixing of high-velocity jets of steam and water. The study was aimed at the accumulation of data which may shed light on the mechanism of mass, momentum, and heat transfer in such systems. The present report describes the work during which substantial improvements in the instrumentation were achieved and several series of tests were made. The results of these tests provide precise and detailed information on the processes that occur during the mixing of high-velocity jets of vapor and of cold liquid. The system studied consisted of a central, circular, steam jet surrounded by an annular jet of high-velocity water. The investigations consisted of: A. Traverses across the jets, at various distances from the nozzles, to measure the stagnation temperature, stagnation pressure, and static pressure. B. Traverses along the jet centerline, to measure the same quantities as in A, above. C. Measurements of the total momentum of the resultant water jet downstream of the mixing and condensing region.

Aeronautical Research Inst. of Sweden.
AN EXPERIMENTAL INVESTIGATION OF SUPERSONIC WING-BODY INTERFERENCE AND COMPARISON WITH SECOND-ORDER THEORY, by Georg Drougge and Marten T. Landahl. Technical note no. 2 on Contract AF 61(052)75. Dec 59, 26p. 6 refs. Rept. AU-II-93: 2; AFOSR-TN-60-257.
Order from LC mi$2.70, ph$4.80 PB 145 854

Approximate second-order solutions for the supersonic flow around wing-body combinations were calculated using two different theoretical models. An approximate formula common to the two models was also found for the second-order interference term. In order to test the theory, wind-tunnel experiments on non-lifting cone-cylinder bodies in combination with wings of simple shapes were performed and are described in the present report. Pressure distributions were measured at M = 3 and M = 4, both around the bodies and on the wings separately, as well as in combination, and it was found that the second-order interference was predicted quite well by the simplified theory. (See also PB 145 854)

Arnold Engineering Development Center [Tullahoma, Tenn.].
"MORGANDYNE" HEAT-TRANSFER TRANSDUCER AND A FLAME-TORCH CALIBRATION TECHNIQUE FOR HYPERVELOCITY WIND TUNNELS, by Charles C. Morgan and Jack C. Andrews. Rept. on ARO, Inc., Contract AF 40(600)800. Feb 60, 73p. 6 refs. AEDC-TR-60-1. AD-232 236.
Order from LC mi$4.50, ph$12.30 PB 145 750

This report describes the transducers and related calibration equipment used to measure the transient heat transfer rates in the arc-heated Hotshot hypervelocity wind tunnels. Thermistor and thin film gages are described briefly, and a variable reluctance Morgandyne gage is covered in detail. Water jet and oxyacetylene torch equipment for the calibration of transient heat transfer gages is described. The torch calibration system has been developed for heat transfer rates from 90 to 400 Btu/ft^2-sec. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
ONE-DIMENSIONAL EQUILIBRIUM SPECTRA IN ISOTROPIC TURBULENCE, by W. H. Reid. Technical rept. no. 27 on Contract Nonr-562(07). May 59, 29p. 12 refs. 562(07)/27.
Order from LC mi$2.70, ph$4.80 PB 145 977

The one-dimensional equilibrium spectra in isotropic turbulence are given for the physical transfer theories of Heisenberg, Kovásznay, and Obukhoff. These results are then compared with the experimental measurements of the spectrum of $\partial u_1/\partial x_1^3$ fluctuations. For two of the theories (Heisenberg's and Kovasznay's) reasonable agreement is obtained for $k\eta < 0.4$ but for larger values of $k\eta$ there is considerable divergence between the theoretical and experimental results. The relationship between the equilibrium and similarity spectra are also discussed for these two theories. (Author)

Guggenheim Jet Propulsion Center, Princeton, N. J.
ONE-DIMENSIONAL REAL FLUID FLOW, by Gerald Rosen. Rept. on Project Squid, Contract Nonr-1858(25). May 59, 19p. 9 refs. Technical rept. PR-89-P.
Order from LC mi$2.40, ph$3.30 PB 146 401

The velocity of unsteady, one-dimensional real fluid flows is rigorously eliminated from the governing equations. A class of exact solutions for polytropic processes is then derived and discussed. The general solution for tangent-gas behavior is presented. (Author)

Institute for System Research, U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING ON AN AIR VEHICLE: A REVIEW OF THE LITERATURE [PART 15] by M. Z. Krzywoblocki. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Jan 59, 67p. 199 refs. WADC Technical note 56-360, Pt. 15; AD-161 018.
Order from OTS $1.75 PB 161 548

This work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The present segment of the work includes material reviewed by the author in the period July 1955 through September 1955. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly; others are listed without comment. (Author) (See also PB 161 442)

Institute for System Research, U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING ON AN AIR VEHICLE: A REVIEW OF THE LITERATURE [PART 24] by M. Z. Krzywoblocki. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Jan 60, 241p. 996 refs. WADC Technical note 56-360, Pt. 24; AD-161 022.
Order from OTS $3.50 PB 161 549

This work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The present segment of the work includes material reviewed by the author in the period October 1957 through December 1957. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly; others are listed without comment. (Author) (See also PB 161 442)

James Forrestal Research Center, Princeton, N. J.
INTERACTION OF A TWO-DIMENSIONAL INVISCID INCOMPRESSIBLE JET FACING A HYPERSONIC STREAM, by S. H. Lam. Rept. on Contract AF 49(638)465. Mar 59, 34p. 3 refs. Rept. no. 447; AFOSR-TN-59-274; AD-212 708.
Order from LC mi$3.00, ph$6.30 PB 146 018

At hypersonic speeds, if one protrudes a thin spike from the nose of a blunt body, such that the spike is at zero angle of attack with respect to the oncoming stream, the boundary layer on the spike will thicken and separate before it reaches the nose of the blunt body, and it will reattach somewhere downstream on the shoulder of the blunt body. The flow pattern is drastically different from that of a flow over a blunt body without a spike, since the hypersonic flow now effectively flows over a rather slender body. The drag is greatly reduced, and preliminary data show that the heat transfer rate to the blunt body itself is greatly reduced also. The hot spot on this spike-blunt body configuration is now at the tip of the thin spike (and probably also on the part of the spike before separation occurs) which must be protected by suitable cooling.

James Forrestal Research Center, Princeton, N. J.
SHOCK INDUCED UNSTEADY LAMINAR COMPRESSIBLE BOUNDARY LAYERS ON A SEMI-INFINITE FLAT PLATE, by Sau-Hai Lam and Luigi Crocco. Rept. on Contract AF 18(600)498. Sep 58, 111p. 19 refs. Rept. no. 428; AFOSR-TN-58-581; AD-162 101.
Order from LC mi$6.00, ph$18.30 PB 146 017

The physical problem under study in this report is the shock induced two-dimensional unsteady laminar compressible boundary layer on a semi-infinite flat plate. The shock is considered to have constant strength and it advances into a quiescent gas. The flat plate is at zero incidence and is at rest.

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
TRANSONIC FLOWS PAST SYMMETRICAL AIRFOILS WITH ATTACHED SHOCK WAVE ($M_\infty < 1$); PART II, by Silvio Nocilla. Technical note 9 on Contract AF 61(514)1124. July 58, 28p. 5 refs. AFOSR-TN-58-943; AD-205 083.
Order from LC mi$2.70, ph$4.80 PB 138 056

The present paper pursues a recent study of the A. and extends to the whole field the determination of the transonic flow past symmetrical airfoils at high subsonic free Mach number, with attached shock wave. The developed theory is then applied to the study of "Tomotika - Tamada's profiles" for which the velocity-distribution on the profile, the sonic line and the shock line are numerically determined. (Author) (See also PB 134 861)

Mississippi State U. [State College].
A NEW SIMPLIFIED FORM OF NAVIER-STOKES EQUATIONS FOR CURVILINEAR FLOWS, by Maneshwar Chandra Mathur. Research rept. no. 24 on Contract Nonr-978(01). 30 May 59, 74p. 6 refs. AD-225 177.
Order from LC mi$4.50, ph$12.30 PB 146 258

The flow around elliptical inlets having leading edges of small radii of curvature was studied. By measuring the order of magnitude of terms in the Navier-Stokes boundary layer equations for curvilinear flows, it was found that the second Navier-Stokes equation as simplified by Tollmien was not valid in the region of separation on the leading edge. Two additional terms were found which should be included in the second Navier-Stokes equation for curvilinear flows. The equations were then simplified to a new form. (Author)

Princeton U., N. J.
APPROXIMATE SOLUTIONS FOR SUPERSONIC FLOW OVER WEDGES AND CONES, by A. G. Hammitt and K. R. A. Murthy. Rept. on Contract AF 49(638)465. Apr 59, 25p. 7 refs. Rept. no. 449; AFOSR-TN-59-304; AD-213 088.
Order from LC mi$2.70, ph$4.80 PB 146 007

Approximate solutions for the supersonic flow of a gas at relatively high Mach numbers over wedges and cones are presented. These methods provide simple and accurate results over a wide range of Mach number and specific heat ratios.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
AERODYNAMIC INVESTIGATION OF SLED CONFIGURATIONS FOR THE HOLLOMAN TRACK, by Rudolf Hermann, Frederick Moynihan, and Walter Melnik. Rept. on Contract AF 29(600)1227. June 59, 210p. 19 refs. AFMDC-TR-59-18.
Order from LC mi$9.30, ph$31.80 PB 145 739

Results of wind tunnel and theoretical investigations of the aerodynamic characteristics of supersonic sleds are presented and discussed. The wind tunnel investigation consists of lift, drag, and pitching moment measurements for families of rectangular and circular cross-section sleds mounted on a simulated Holloman track. Sled geometric variables studied include the effects of height above the trough, slipper beams, nose shape, body shape, body width, body thickness, body length, and angle of attack. For all sled configurations, the ground effect results in positive lift forces and for many the lift is on the order of and even larger than the drag. Some general conclusions to minimize the lift and drag are: keep the sled bottom at or above the rail level; use a semi-pyramid nose with the flat side down; make the sled bottom rounded with the generatrix parallel with the ground; use a body width about three-fourths of a track width; keep the body thickness as small as possible, and if necessary to further reduce the lift, use a small negative angle of attack.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
BOUNDARY LAYER TRANSITION WITH GAS INJECTION, by C. J. Scott and G. E. Anderson. Rept. on Contract AF 18(600)1226. July 58, 32p. 24 refs. Research rept. no. 151; AFOSR-TN-58-786; AD-202 112.
Order from LC mi$3.00, ph$6.30 PB 145 740

Experiments were conducted on a porous 16° cone at Mach number of 3.7 to ascertain the effects of gas injection on the stability of the laminar boundary layer. Observed zero-heat-transfer transition Reynolds numbers decrease with increased injection but this effect was overcome by the cooling possible with injection. (Author)

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
INTEGRAL LAMINAR BOUNDARY LAYER SOLUTIONS USING THE CROCCO VARIABLES, by C. J. Scott. Rept. on Contract AF 18(600)1226. Aug 59, 23p. 18 refs. Engineering memo. no. 86; AFOSR-TN-59-1304.
Order from LC mi$2.70, ph$4.80 PB 145 775

An analysis is presented which predicts the skin friction and surface heat transfer characteristics of a compressible laminar boundary layer. The present formulation is restricted to constant specific heat and Prandtl number and a linear variation of fluid viscosity with temperature. Regions where the analysis may be extended are pointed out. For the injection cases considered, the coolant gas is considered to be identical to the main stream fluid. Numerical examples are presented for constant pressure, impermeable and permeable surfaces, with upstream and downstream transpiration cooling and strip injection. Surface temperature distributions are presented for the case of constant surface injection with uniform reservoir temperature. In the cases where similarity exists, the method is tested by comparisons with exact solutions which are free from the limitations of the present analysis. (Author)

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
LAMINAR, TRANSITIONAL AND TURBULENT MASS TRANSFER COOLING EXPERIMENTS AT MACH NUMBERS FROM 3 TO 5, by C. J. Scott, G. E. G. E. Anderson, and D. R. Elgin. Rept. for Nov 54-Aug 57 on Contract AF 18(600)1226. Aug 59, 31p. 20 refs. Research rept. no. 162; AFOSR-TN-59-1305.
Order from LC mi$3.00, ph$6.30 PB 145 760

A summary is presented of experimental research work on porous-wall mass transfer cooling effects. Two coolants, air and helium, were included in all of the investigations. Laminar, transitional, and turbulent boundary layers on constant pressure surfaces were investigated using flat plates and cones. A porous hemisphere was used to examine the effect of non-uniform surface pressure. The experimental results covering relatively low temperatures and low speeds confirm analytical boundary layer predictions on the relative effectiveness of the two gases in reducing heat transfer although quantitative agreement does not exist. The available theories do not correctly indicate the general trends of experimental temperature recovery factors. Transition Reynolds number decreases caused by injection could be overcome by the cooling made possible by the injection process. Both laminar and turbulent boundary layers could be "blown-off" the bodies by excessive coolant injection. (Author)

Rosemount Aeronautical Labs., U. of Minnesota, Menneapolis.
MASS TRANSFER COOLING EXPERIMENTS ON A HEMISPHERE AT M=5, by G. E. Anderson, C. J. Scott, and D. R. Elgin. Rept. on Contract AF 18(600)1226. Aug 59, 31p. 16 refs. Research rept. no. 166; AFOSR-TN-59-1306; AD-231 975.
Order from LC mi$3.00, ph$6.30 PB 145 788

A segmented, porous hemisphere was designed and constructed to provide a constant temperature surface with helium mass transfer cooling. The variation of surface heat transfer with helium injection rate and with position on the hemisphere surface was measured. The data is presented along with available analytical results. (Author)

Technische Hochschule, Munich (West Germany).
A NUMERICAL APPROACH TO THE QUESTION OF STABILITY OF SUPERSONIC ENCLOSURES IN AN OTHERWISE SUBSONIC FLOW FIELD, by Wolfgang Werner. Technical note no. 12 on Contract AF 61(514)1080. 7 Dec 59, 36p. AFOSR-TN-60-256.
Order from LC mi$3.00, ph$6.30 PB 145 855

Information is given on a numerical investigation of stability of transonic flows past a profile. An "exceptional" solution is calculated describing a steady, continous transonic flow. This solution is used as initial data for a time dependent numerical calculation. Result seems to indicate existence of stable transonic flows with shocks. (Author)

Technische Hochschule, Karlsruhe (West Germany).
THEORETICAL INVESTIGATIONS ON RING AIRFOILS, by Johannes Weissinger. Rept. on Contract AF 61(514)1207. Jan 60, 115p. 10 refs. AFOSR-TN-60-343.
Order from LC mi$6.00, ph$18.30 PB 146 435

The effects of interference between a ring airfoil and a slender central body are studied. Simple formulas for the lift and the pitching moment are derived from a more thorough theory by considerations taken from lifting line and three quarter point theory. Numerical results are given for ellipsoidal bodies. Two methods for computing the three-dimensional laminar boundary layer on ring airfoils are developed. The first is based on an expansion with respect to the angle of attack, the second is an iteration procedure. In both methods a v. Kármán-Pohlhausen procedure is used. The wall streamlines and the separation line are shown. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE MOTION OF A SUBMERGED BODY MOVING VERTICALLY TOWARDS A FREE SURFACE, by T. C. Woo. Technical rept. no. 28 on Contract Nonr-562(07). May 59, 28p. 5 refs. 562(07)/28.
Order from LC mi$2.70, ph$4.80 PB 146 260

The motion of a submerged body moving vertically upwards towards a free surface is treated by three methods. In the image method we approximate the boundary condition on the free surface and thus obtain the velocity potential, the velocity field, etc., by properly adjusting the motion of an image sphere. In the second method use is made of the relation between the velocity potential and the corresponding impulsive pressure system. The last method gives some preliminary results treating the problem in the Lagrangian description of fluid motion. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
REFRACTION SHOCK WAVES IN A NON-UNIFORM OCEAN, by Maurice Holt and Sainsbury L. Strack. Technical rept. no. 18 on Contract Nonr-562(07). May 59, 15p. 3 refs. 562(07)/18.
Order from LC mi$2.40, ph$3.30 PB 146 255

In an ocean the temperature is approximately constant in a shallow layer near the surface; below this layer the temperature decreases with depth. As a result when an explosion is initiated at a point in the non-uniform part of the ocean marked refraction effects occur. These are especially noticeable in the shadow zone formed below the boundary between the uniform and non-uniform regions. Near the source of the explosion the pressure pulse has the usual shape of initial peak followed by exponential decay. In the shadow zone, however, the pulse shape is changed and the initial pressure jump at the head of the wave is followed by a further continuous increase to a maximum behind the front.

Office of Scientific Research and Development. Div. 6.
FLUID DYNAMICS. Summary technical rept. vol. 20, Contract OEMsr-1131. 1946, declassified 17 July 58, 301p. 81 refs.
Order from LC mi$11.10, ph$47.10 PB 139 775

Polytechnic Inst. of Brooklyn, N. Y.
A STUDY OF SIMILARITY TRANSFORMATIONS FOR THE EQUATIONS OF TWO-DIMENSIONAL INCOMPRESSIBLE VISCOUS FLUID FLOW, by Koon-Sang Wan. Rept. on Contract AF 49(638)445. Dec 59, 26p. 9 refs. PIBAL Rept. no. 537; AFOSR-TN-59-1257.
Order from LC mi$2.70, ph$4.80 PB 145 773

In this report, the investigation is carried out to obtain the possible similarity transformations to a laminar flow equation and the Navier-Stokes equation for two-dimensional unsteady and steady flows in both cartesian and polar coordinates. As a result, additional similarity transformations are obtained. These transformations include those obtained previously in the boundary layer theory as special cases. (Author)

Stevens Inst. of Tech., Hoboken, N. J.
FINAL REPORT, by Joel L. Lebowitz. Rept. for 15 June-15 Sep 59 on Contract AF 49(638)352. [1959] 23p. 9 refs. AFOSR-TR-59-150.
Order from LC mi$2.70, ph$4.80 PB 145 714

METALLURGY

American Brake Shoe Co., Mahwah, N. J.
THE MACHINABILITY OF AUSTENITIC MANGANESE STEELS, by Howard S. Avery and Henry J. Chapin. Final summary rept. on Contract NObs-72243. 15 Sep 58, 185p. 51 refs. Metallurgical Dept. Case rept. 1122-5; AD-214 726.
Order from LC mi$8.40, ep$30.30 PB 146 814

Machinability equivalent to that of 304 (19Cr:9Ni) stainless steel together with the strength, economy and non-magnetic properties of 12% manganese steel were sought. The effects of lead, silver, sulfur, selenium, bismuth, zirconium, and carbon were investigated. Of these, bismuth and lower carbon seemed most fruitful. The objectives were considered met by a 20% manganese steel with 0.60%C to which 1% bismuth was added, with a recovery of 0.2-0.4%Bi. This alloy could be lathe turned at 265 SFM, threaded, drilled and tapped. Force requirements and friction in machining are well below those of standard Hadfield's manganese steel. After toughening by water quenching from about 1900°F. this steel is non-magnetic, has Izod impact resistance above 55 foot-lbs., yield strength from 35,000 to 45,000 psi, tensile strength above 87,000 psi and elongation of 40% or more.

Allison Div., General Motors Corp., Indianapolis, Ind.
EFFECT OF BORON CONTAINING HIGH ENERGY FUEL COMBUSTION PRODUCTS ON THE PROPERTIES OF STATICALLY STRESSED HIGH TEMPERATURE ALLOYS, by George L. Vonnegut and William Mahler. Rept. for 1 May 58-31 July 59 on Aviation Fuels, Contract AF 33(616)5753. Jan 60, 70p. WADC Technical rept. 59-317.
Order from OTS $1.75 PB 161 658

Details are presented concerning development and operation of test apparatus, and the results of metallurgical evaluation to determine effects of boron containing (TMBO-TMBA) high energy fuel combustion products on the stress rupture behavior and structures of representative nickel, and cobalt, base high temperature alloys. Results of tests demonstrated that the stress rupture behavior of either stressed or unstressed alloys was not affected by the boron containing fuel combustion products in times up to 50 hours at the respective exposure temperatures. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
BRAZING FOR HIGH-TEMPERATURE SERVICE, by A. F. Haskins and R. M. Evans. 29 Mar 60, 15p. 62 refs. DMIC memo. 48.
Order from OTS $0.50 PB 161 198

The purpose of this memorandum is to summarize the extent of advancement in the field of brazing for service temperatures in excess of 600 F. In recent years, the need for parts fabricated from high-temperature, high-strength corrosion-resistant alloys has imposed a demand for brazing filler metals which are compatible with these base metals and their usage usage. The joining of complex structures has, in many cases, demanded that these filler metals be used without flux and that departures from the conventional brazing processes be made. This memorandum is designed to summarize available technical information on the brazing process and the brazing filler metals used to join these high-temperature materials. Because of the volume of literature available, it is impossible to include the tabular and graphical presentations which are so important. Therefore, a rather complete bibliography of source material is included.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
NOTES ON THE DIFFUSION BONDING OF METALS, by R. M. Evans. 20 Apr 60, 10p. 23 refs. DMIC memo. 53.
Order from OTS $0.50 PB 161 203

Industrial Test Lab., Philadelphia Naval Shipyard, Pa.
STUDY OF THE REACTIONS OF THIOUREA IN PICKLING SOLUTIONS UTILIZING RADIOTRACER METHODS, by T. F. Boyd and M. Galan. Feb 59, 17p. 2 refs. Research and Development rept. no. 6200D-5; AD-214 298.
Order from LC mi$2.40, ph$3.30 PB 145 834

The amount of thiourea adsorbed on steel during pickling was determined by radiotracer techniques. Small amounts of thiourea were chemisorbed on the steel. Dissolution of the steel was proportional to acid concentration and time in pickling bath and independent of iron concentration. Inhibition increased rapidly at low concentrations of thiourea, up to about 30 mg/L. The inhibition increased at a significantly lower rate with higher concentrations. When the pickling bath was operated continuously most of the thiourea was decomposed or lost from the solution by

carryout on the steel; only a small amount was accounted for by adsorption on the steel. (Author)

Metallurgical Lab., Norfolk Naval Shipyard, Portsmouth, Va.
RECENT LABORATORY FINDINGS ON HOT DIP GALVANIZED HIGH TENSILE STEEL PLATES, by H. H. Walkup, H. W. Wotring, and L. R. Abbot, Jr. Oct 57, 81p. Development rept. NNSY C-380 Rept. 5387.
Order from LC mi$4.80, ph$13.80 PB 146 233

The bend test and weight of coating requirements for hot dipped galvanized high tensile steel plate of Military Specification MIL-S-16113 B (NAVY) were investigated in order to determine if they are realistic and representative of the coatings on commercially galvanized plates. Also, information was obtained on the galvanizing practices that are used by eleven galvanizing activities, on the relative value of the bend, chisel and hammer tests for determining the adherence of the coatings and on the relation between the results for average thickness of coating as determined by magnetic, micrometer and stripping test methods. (Author)

Nowotny, Hans, Vienna (Austria).
STRUCTURAL INVESTIGATIONS IN COMBINED SILICIDE AND BORIDE CERMETS, by Hans Nowotny. Final technical rept. for 1 Jan 59-20 Jan 60 on Contract DA 91-591-EUC-1009. [1960] 38p. 25 refs.
Order from LC mi$3.00, ph$6.30 PB 145 949

Structural investigations by X-ray techniques established: metal-rich phases in the tantalum-boron system are Ta_2B and Ta_3B_2, metal-rich phases in vanadium-boron and niobium-boron are respectively Nb_3B_2 and V_3B_2 of U_3Si_2-structure. Part of the phase diagram: niobium-boron-silicon has been determined.

Office of Scientific Research and Development. Div. 18.
WAR METALLURGY. Summary technical rept. vol. 1, Contract OEMsr-1131. 1946, declassified 1958, 181p. 609 refs.
Order from LC mi$8.40, ph$28.80 PB 139 772

Republic Steel Corp., Canton, Ohio.
INVESTIGATION OF THE HIGH TEMPERATURE PROPERTIES OF HS88 AUSTENITIC STEEL MODIFIED BY ADDITIONS OF MOLYBDENUM, TUNGSTEN, TITANIUM, BORON, COBALT, ALUMINUM AND NITROGEN, by V. W. Whitmer, S. W. Poole, and R. C. Griffin. Rept. on Contract AF 33(616)178. 1 Feb 54, 37p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 146 285

A study of the effect of composition modifications on notch toughness of a base analysis containing 11-14% chromium and 13-17% nickel (HS88). The base composition was modified with varying additions of molybdenum, cobalt, tungsten, titanium, boron, aluminum, and nitrogen. The analyses tested, revealed no apparent degree of notch sensitivity when annealed at 1775°F, hot-cold worked 21% and 31% at 1375°F and 1325°F respectively and stress rupture tested at both 1200°F and 1350°F.

(Metallurgy, 15 July 60)

Ferrous Metals

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
MAGNETIC VISCOSITY AND ANNEALING IN MAGNETIC FIELD. THEORY OF THE MAGNETIC VISCOSITY DUE TO SOLUTE ATOM PAIRS, by Giuseppe Biorci, Andrea Ferro, and Giorgio Montalenti. Technical rept. 3a on Investigation of Magnetic Relaxation Due to Rotation of Couples of Solute Atoms, Contract AF 61(514)1331. Nov 59, 104p. 73 refs. AFPSR-TN-60-193.
Order from LC mi$5.70, ph$16.80 PB 145 861

The diffusion viscosity due to the rotation of couples of solute atoms in alloys is studied. The relationship between annealing of alloys in a magnetic field and magnetic after-effect is established. The theory has been tested on Fe-Si and Fe-Al alloys of various compositions.

Watertown Arsenal Labs., Mass.
LOW TEMPERATURE PLASTIC FLOW AND FRACTURE TENSION PROPERTIES OF HEAT-TREATED SAE 4340 STEEL, by Frank R. Larson and John Nunes. Dec 59, 56p. 35 refs. Technical rept. no. WAL TR 834.2/1; AD-231 700.
Order from LC mi$3.60, ph$9.30 PB 145 890

True-stress true-strain tension properties of a heat-treated SAE 4340 steel were obtained at a testing speed of 0.01-inch per minute over a range of temperatures from +200° to -196°C. The flow stress at a constant true strain is closely described by a reciprocal absolute temperature function.

Structural Metallurgy and Corrosion

California Inst. of Tech., Pasadena.
METALLURGICAL APPLICATIONS OF ELECTRON PROBE ANALYSIS, by David B. Wittry. Interim technical rept. no. 6 on Design and Development of an Electronic X-Ray Probe for the Study of Alloys and of the Structure of Metals, Contract DA 04-495-ORD-1076. Dec 59, 21p. 16 refs. OOR rept. 1920. 1-Met.
Order from LC mi$2.70, ph$4.80 PB 145 724

The concentration profile of chromium in chromized iron. Analysis of the widmanstatten structure in meteoritic iron. Phase identification in titanium-copper and titanium-silver alloys. Concentration fluctuations in solid solution alloys.

Climax Molybdenum Co. of Michigan, Detroit.
DEVELOPMENT OF HIGH STRENGTHS AND HIGH RECRYSTALLIZATION TEMPERATURES IN MOLYBDENUM-BASE ALLOYS, by M. Semchyshen, Gordon D. McArdle and Robert Q. Barr. Rept. on Metallic Materials, Contract AF 33(616)2861. Feb 59, 128p. 9 refs. WADC-TR-58-551; AD-209 383.
Order from OTS $2.75 PB 161 542

Initial studies involved higher alloy castings than had previously been evaluated. Evaluation of the soundness, machinability, hot hardness and forgeability, practicability of preparing large castings in the consumable electrode equipment, and extrusion of large bodies of molybdenum. The most outstanding molybdenum-base alloy developed during this program contained 0.46% titanium, 0.08% zirconium and 0.08% carbon. The alloy required one hour at 2950 F for complete recrystallization. In the stress-rupture test, this alloy required 79,000 psi at 1800 F for rupture in 100 hours. In addition to the ternary alloy, promising elevated temperature properties were exhibited by binary alloys containing 2.00% titanium, (0.14% carbon), and 0.3 and 0.5% zirconium (0.022 carbon).

Dow Chemical Co., Midland, Mich.
PROTECTIVE COATINGS ON MAGNESIUM ALLOYS INTENDED FOR USE ON COMPONENTS OF AIRBORNE VEHICLES. Final rept. for 1 July 57-1 Oct 58 on Contract DA 20-018-ORD-15406. [1958] 11lp. AD-215 169.
Order from LC mi$6.00, ph$18.30 PB 146 617

Studies of various metallic coatings for corrosion compatibility with magnesium indicated that tin is superior to all other plates. Combination plates of tin and/or alloys with other metals also were good such as tin-lead, tin-nickel, tin-chromium, tin-zinc and tin-cadmium. Indium also was relatively compatible. Tin plates as thin as 0.0002" were effective. All of these coatings were better than the now commonly used cadmium or zinc as a coating for steel (Fe) fasteners. Tin metallic powder in paint, hot metal spray coatings of tin and tin shims also provided an improved result. Very high purity aluminum gave excellent compatibility when used as a solid fastener but when electrodeposited over steel was quite ineffective. Combinations of a compatible metallic coating and an organic paint coating were more effective than either alone.

Illinois U., Urbana.
FACTORS INFLUENCING FRETTING FATIGUE STRENGTH, by H. T. Corten. Technical rept. no. 46 on The Behavior of Materials under Repeated Stress, Contract N6ori-071(04). June 55, 35p. 17 refs. T & AM rept. no. 88; AD-68 087.
Order from LC mi$3.00, ph$6.30 PB 146 578

The influence of clamping pressure on the fretting fatigue strength of 24S-T aluminum alloy was investigated. The strength was reduced to approximately 50 per cent of the unfretted fatigue strength due to clamping between aluminum clamping pads at a nominal pressure of 4000 psi. The influence of dissimilar clamping pad materials, including aluminum, brass, soft and hard steel, on the fretting endurance limit of hard steel was investigated. The strength of the hard steel specimens, due to fretting against aluminum, soft steel, brass, and hard steel clamping pads, was reduced to 91 per cent, 81 per cent, 59 per cent, and 50 per cent, respectively, of the unfretted endurance limit.

Illinois U., Urbana.
A STUDY OF THE MECHANISM OF FRACTURE IN TORSION, by P. G. Jones and T. J. Dolan. Final rept. on Contract Nonr-1774(01). May 56, 46p. 9 refs. T & AM rept. no. 97; AD-111 222.
Order from LC mi$3.30, ph$7.80 PB 146 576

An experimental investigation was conducted to determine the influence of the amount of available elastic strain energy on the shear fracture characteristics of several metals. Torsion tests were made on solid 1/2 in. cylindrical specimens notched to a root diameter of 3/8 in. Values of strain energy release rate for sudden fracture with no plastic deformation were determined for SAE 8727 Steel and were found to be considerably lower than those reported in the literature for tension and bending of various steels.

Illinois U., Urbana.
A WIRE FATIGUE MACHINE FOR INVESTIGATION OF THE INFLUENCE OF COMPLEX STRESS HISTORIES, by H. T. Corten and G. M. Sinclair. Technical rept. no. 41 on The Behavior of Materials under Repeated Stress, Contract N6ori-71(04). Apr 55, 31p. 6 refs. T & AM rept. no. 81; AD-64 455.
Order from LC mi$3.00, ph$6.30 PB 146 577

A wire fatigue testing machine that operates on the principle of a deflected rotating strut was designed to investigate fatigue life for complex stress histories, particularly those consisting of repeated blocks of cycles. For a comparative study of material behavior, wire fatigue testing incorporates several particularly desirable features, namely inexpensive specimens and small scatter of data.

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
AN INVESTIGATION OF THE RELATIONSHIP OF HOT-HARDNESS TO THE ELEVATED TEMPERATURE EXTRUSION BEHAVIOR OF SELECTED ARC-CAST MOLYBDENUM BASE ALLOYS, by John Robert Giancola. Rept. for 1 Jan-1 Nov 59 on Metallic Materials. Feb 60, 133p. 41 refs. WADD Technical rept. 59-26.
Order from OTS $2.75 PB 161 669

A study was conducted to determine the relationship between the hot hardness and the required extrusion forces and percent yield of sound material for molybdenum and molybdenum base alloys. The extrusion force was measured while the controllable variables were held constant. It was found that no definite relationship between hot hardness and the extrusion forces or yield of wound metal could be established. Extrusion and hot hardness data are presented for

unalloyed Mo, Mo-Ti, and Mo-Ti-Zr alloys along with apparent relationships between the extrusion temperature and both the average extrusion force and the percent yield. (Author)

Michigan U. Research Inst., Ann Arbor.
STUDIES OF HEAT-RESISTANT ALLOYS, by A. Phillip Coldren, Jerry E. White and others. Rept. for 15 Mar 58-15 June 59 on Refractory Metals, Contract AF 33(616)5466. Feb 60, 108p. 13 refs. WADC Technical rept. 59-606.
Order from OTS $2.50 PB 161 667

Results are reported for an investigation that was carried out to show the effect of hot working on the structure and properties of heat-resistant alloys. The rupture strength of hot rolled "A" Nickel at 100°F seemed to depend primarily on substructure; internal lattice strains as measured by hardness were relatively unimportant. At 800°F the creep resistance of "A" Nickel appeared to depend on internal strains and substructures more or less equally. The rupture properties of A-286 at 1200°F and 1350°F in the hot-rolled plus heat-treated condition could not be correlated with the small variations in the state of the γ'precipitate that were observed. A rough correlation was found between grain size and properties. In a ferritic steel ("17-22-A"V) an improvement in properties was effected by rolling austenite at temperatures too low for recrystallization. In a study of strain aging effects, results of constant-strain-rate tension tests on low carbon steel and A-286 Alloy suggested that forces of chemical attraction between N atoms and Si, Al, or Ti atoms stabilize Cotrell-type atmospheres, permitting them to be effective at higher-than-normal-temperatures. (Author)

Naval Ordnance Lab., White Oak, Md.
SOME ELEVATED TEMPERATURE PROPERTIES OF PRECIPITATION HARDENABLE IRON-ALUMINUM ALLOYS, by W. J. Buehler and C. G. Dalrymple. 8 Jan 60, 19p. 7 refs. NAVORD rept. 6728.
Order from OTS $0.50 PB 161 543

The effects of titanium and titanium plus carbon on some of the elevated temperature properties of the binary iron-aluminum alloys were studied. In every case the titanium-bearing alloys were evaluated in the precipitation hardened condition. A binary 8% aluminum-iron alloy, incapable of precipitation hardening, was used as a control. The data reveal that the titanium additions, when effectively utilized as a stable precipitated second phase, greatly increase the stress-rupture properties of an iron-aluminum alloy containing 8 percent aluminum by weight. (Author)

Naval Research Lab., Washington, D. C.
FACTORS INFLUENCING THE LEAD CORROSIVITY OF DIESTER-BASE OILS, by C. M. Murphy, H. Ravner, and C. O. Timmons. Interim rept. 29 Feb 60, 21p. 21 refs. NRL Rept. 5451.
Order from LC mi$2.70, ph$4.80 PB 144 526

The increase of lead corrosivity during storage of diester-base oils of Specification MIL-L-7808 prevents the stockpiling of adequate reserves. Lead corrosion is due to the progressive formation of the acid half ester (2-ethylhexyl hydrogen sebacate) resulting from the hydrolysis of sebacic acid diesters. Diester hydrolysis is catalyzed by acid phosphates, present in or formed from tricresyl phosphate, the antiwear additive. Aliphatic amines effectively neutralize these strong acids, thus negating their catalytic action. The most positive and generally applicable method of preventing diester oil deterioration is to exclude moisture. (Author)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
THE SOLUBILITY OF METALS AND ALLOYS IN LEAD-BISMUTH EUTECTIC AT TEMPERATURES UP TO 2200°F, by John F. Collins and H.R. Stephan. 12 Apr 51, 13p. 1 ref. NEPA 1803.
Order from LC mi$2.40, ph$3.30 PB 146 224

A survey of readily available high temperature alloys and metals was made with respect to their solubility in lead-bismuth eutectic. The temperature range of 900° to 2200°F, for times up to 100 hours was investigated. Selected stainless steels, special alloys, and refractory metals were tested by the agitated capsule method developed at NEPA. Evidence of selective solubility of nickel and manganese makes the high nickel alloys undesirable. A. I. S. I. Type 446 showed the least solubility among the alloys and molybdenum was the most resistant of the metals tested. (Author)

Northwestern U. [Evanston, Ill.]
DISLOCATION THEORY OF STRAIN AGING, by T. Mura, E. Lautenschlager and J. O. Brittain. Rept. on Contract AF 18(600)1598. 1 Feb 60, 20p. 6 refs. AFOSR-TN-60-206.
Order from LC mi$2.40, ph$3.30 PB 145 857

The return of the yield point following strain aging is due to the locking of dislocations by a solute atmosphere and is proportional to the number of solute atoms in the atmosphere along the dislocation. The theory was compared with a series of the experiments which were done under several aging temperatures, plastic strains, and aging stresses.

Pitman-Dunn Labs. [Group] Frankford Arsenal, Philadelphia, Pa.
SURVEY OF THE LITERATURE ON SODIUM MODIFICATION OF ALUMINUM-SILICON-MAGNESIUM ALLOYS, by R. C. Harris. Feb 54, 15p. 18 refs. Memo. rept. MR-556.
Order from LC mi$2.50, ph$3.30 PB 146 850

The effects of sodium on the microstructure and mechanical properties of aluminum-silicon alloys are described. From the work done on the subject several theories to account for the microstructural changes have been developed.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE FEASIBILITY OF NUCLEAR SHIELDING FOR ELECTRONIC CIRCUITRY, by Byron S. Gottfried and Alton L. Long. 24 Oct 58, 17p. 8 refs. USASRDL Technical rept. 1996.
Order from LC mi$2.40, ph$3.30 PB 145 754

Although it is possible to shield against nuclear radiation with known materials, there is no single known material which will effectively shield against all types of radiation emanating from an atomic weapon. An effective radiation shield must, therefore, consist of a combination of several materials, each being chosen for a particular type of radiation. Such a radiation shield would be extremely heavy and bulky. The use of special homogeneous mixtures or coatings offers no escape from the large bulk of material needed to shield against radiation. Therefore, while electronic systems may contain a radiation shield, the decision to employ such a shield should be made only when the designer is well aware of the disadvantages and shortcomings of such a design. (Author)

Fribourg U. (Switzerland).
GAS BUBBLE CHAMBER RESEARCH. Final rept. on Contract AF 61(514)1262. [1958] 37p. 14 refs. AFOSR-TR-60-25.
Order from LC mi$3.00, ph$6.30 PB 145 852

National Bureau of Standards, Washington, D. C.
ISOTOPIC ABUNDANCE RATIOS REPORTED FOR REFERENCE SAMPLES STOCKED BY THE NATIONAL BUREAU OF STANDARDS, by Fred L. Mohler. May 1960, 14p. 32 refs. Technical note no. 51.
Order from OTS $0.50 PB 161 552

The National Bureau of Standards maintains a stock of reference samples of isotopic abundance and this paper gives results that have been reported on measurements of these samples. Some information has been received on 24 of the 32 samples. The paper includes a list of the reference samples and tables of the results reported with notes on these results. (Author)

Nuclear Development Corp. of America, White Plains, N. Y.
DIFFERENTIAL ELASTIC NEUTRON SCATTERING CROSS SECTION OF OXYGEN, by H. Lustig. Final rept. for 17 Dec-30 Sep 59 on Contract DA 18-108-405-cml-295. 1 Nov 59, 16p. 19 refs. NDA 2111-3, Vol. A.
Order from LC mi$2.40, ph$3.30 PB 146 777

A set of elastic scattering angular distributions is presented for neutron energies up to 18 Mev. Calculations undertaken for the determination of resonance parameters in the incident neutron energy region from 2.5 to 4.0 Mev are described. (Author)

Ohio State U. Research Foundation, Columbus.
COLLISION CROSS SECTION STUDY OF CO_2, WITH A THEORETICAL STUDY OF TWO TRANSITIONS, by Jerome C. Shiloff and Edwin N. Lassettre. Scientific rept. no. 10 on Contract AF 19(122)642. July 57, 101p. 41 refs. AFCRC-TN-58-234; AD-228 596.
Order from LC mi$5.70, ph$16.80 PB 139 347

Differential collision cross section and generalized oscillator strengths were determined for 8 peaks in the CO_2 spectrum and at 9 excitation energies in the ionized continuum extending to 79.0 ev. Electrons of incident kinetic energy of about 500 ev are employed throughout. Two weak transitions at about 8.6 and 9.2 ev excitation energy were studied in detail. These transitions are so weak as to suggest that they would be forbidden except for vibrational distortion of the carbon dioxide molecules. Selection rules were treated in detail and a tentative assignment was made. (Author)

Palmer Physical Lab., Princeton U., N. J.
A COUNTER-CLOUD CHAMBER INVESTIGATION OF K^+ MESONS PRODUCED IN COSMIC RAYS, by Herbert Gursky. Doctoral thesis. Technical rept. no. 23 on Cosmic Ray and Elementary Particles Group Group, Contract Nonr-1858(06). 26 May 59, 124p. 37 refs. AD-218 589.
Order from LC mi$6.30, ph$19.80 PB 145 909

An experiment was carried out in which stopping K mesons were observed in a multiple cloud chamber. Simultaneously the decay lifetimes of the particles were recorded by associated electronic components. The cloud chamber was triggered when one scintillation counter recorded a decay coincidence with respect to another counter within a time interval of 15 to 115 mμ sec.

Pittsburgh U., Pa.
SOME CONSEQUENCES OF THE COMPOUND ION MODEL, by Elizabeth Baranger and Edward Gerjuoy. Technical rept. no. 5 on Capture-Loss and Ionization Cross-Sections of Ions and Neutral Particles, Contract Nonr-624(06). Apr 58, 21p. 22 refs.
Order from LC mi$2.70, ph$4.80 PB 138 611

Cross sections for excitation of atoms levels by electrons often vary sharply with energy near threshold, as if resonating with a state of the compound ion. Some consequences of this "compound ion model" of excitation are explored. In particular it is shown that information bearing on the validity of the model can be obtained from measurements of the angular distribution and polarization of the light emitted following excitation to radiating states. Possible applications to Hg and to He are discussed. (Author)

Physics Research Lab., U. of Illinois, Champaign.
TABLES OF CROSS SECTIONS FOR π^+ PHOTOPRODUCTION FROM HYDROGEN, ACCORDING TO THE THEORY OF CHEW, GOLDBERGER, LOW AND NAMBU, by C. S. Robinson. Technical rept. no. 8 on Contract Nonr-1834(05). 22 May 59, 32p.

6 refs. AD-219 255.
Order from LC mi$3.00, ph$6.30 PB 145 897

Contents:
The photoproduction amplitude
The cross section formula
Calculation of quantities in the center-of-mass system
Important dynamical quantities
Calculation of numerical values of differential cross sections
Effect of direct interaction terms appearing in cross section
Angular distributions
Total cross sections

Quartermaster Research and Engineering Center, Natick, Mass.
IRRADIATION "FACTOR-DEPENDENCY": STYRENE (MONOMER), by Ed. F. Degering, Charles Merritt and others. Nov 59, 38p. 6 refs. Radiation Chemistry Lab. series research rept. no. 1.
Order from LC mi$3.00, ph$6.30 PB 145 707

The irradiation-polymerization of vinyl monomers was selected for the evaluation of parameters, inasmuch as procedures for evaluating the over-all results were well defined for certain systems such as monomeric styrene. Results to date on the irradiation-induced polymerization of monomeric styrene, with variations in the parameters, comprise the material for this report.

Stanford U., Calif.
SIGNS OF THE GRAVITATIONAL MASS OF A POSITRON, by L. I. Schiff. Technical rept. no. 42 on Contract AF 18(600)545. Sep 58, 5p. 4 refs.
Rept. no. 545-42; AFOSR-TN-58-783; AD-202 008.
Order from LC mi$1.80, ph$1.80 PB 137 536

Suggestions are made that an antiparticle may have the opposite sign of gravitational mass from its corresponding particles. Work is presented to point out that this sign can be determined experimentally in the case of a positron. In these experiments the ratio of gravitational to inertial mass was measured for several substances, and the attempt made to detect differences in this ratio between one substance and another. No definite evidence for such differences was found. In several cases, the uncertainties in the fractional differences of the ratios were less than one part in 10^8 (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
PHOTOGRAPHY OF COSMIC RAY TRACKS WITH A CASCADE LUMINESCENT CHAMBER, by Lawrence W. Jones and Martin L. Perl. Rept. on Proj. Michigan, Contract DA 36-039-sc-78801. May 59, 14p. 8 refs. Rept. no. 2900-11-T; AD-216 789.
Order from LC mi$2.40, ph$3.30 PB 145 892

The tracks of minimum ionizing particles have been photographed in a luminescent chamber for what is believed to be the first time. A cascade luminescent chamber made up of three image tubes coupled with refractive optics has been used to photograph tracks of cosmic ray μ mesons in a sodium iodide crystal. The very high time resolution and postevent triggering achieved through these experiments will facilitate experimentation with impure beams from acceleration and with cosmic rays. This report describes the apparatus with details of measurement on image tube characteristics and the nature of background. The same type of apparatus is applicable to other problems where very weak light signals (several thousand photons total) must be photographed. (Author)

Instruments and Installations

Battelle Memorial Inst., Columbus, Ohio.
NEUTRON DOSIMETRY RESEARCH, by W. S. Diethorn, E. Paskell and others. Quarterly progress rept. no. 3, 15 Sep-14 Dec 57, on Contract DA 36-039-sc-73174. 24 Mar 58, 44p. 16 refs.
Order from LC mi$3.30, ph$7.80 PB 145 939

Systems of personnel neutron dosimetry are being investigated for application in mixed fields of fast-neutron and gamma radiation. In the first phase of the the study, silicon semiconductor devices and compound semiconductors are being prepared and irradiated for the purpose of determining their response to fast neutron doses less than 600 tissue rads. A paper study of ion-chamber performance during short bursts of high-intensity radiation is being conducted in the second phase of the program. The major purpose of this latter study is to determine the effect of ion recombination on chamber performance. (See also PB 137 194)

Battelle Memorial Inst., Columbus, Ohio.
PERSONNEL NEUTRON-DOSIMETRY SYSTEMS, by W. S. Diethorn, E. Paskell and others. Final rept. on Contract DA 36-039-sc-73174. 15 May 58, 44p. 23 refs.
Order from LC mi$3.30, ph$7.80 PB 145 938

In the early stages of the program three dosimetry areas were investigated: semiconductor devices, ion chambers, and chemical recoil-proton systems. The study on chemical recoil-proton dosimeter systems was terminated at the conclusion of a literature survey on this type of dosimeter. Before experimental work on the ion-chamber phase of the program was initiated the objective of this phase was changed, and subsequent efforts were directed toward a paper study of ion-chamber performance in short-burst, high-intensity radiation fields. In the semiconductor phase of the program studies were restricted to silicon and compound semiconductor devices. (See also PB 145 939)

Nuclear Reactions

Pennsylvania U., Philadelphia.
GAMMA-RAY ACTIVATION OF CARBON, by Leonard D. Cohen. Technical rept. no. 5 on Contract Nonr-551(17). [1959] 89p. 51 refs.
Order from LC mi$4.80, ph$13.80 PB 146 290

In this experiment carbon samples were activated by the monochromatic gamma-rays produced by the reaction $T(p, \gamma)He^4$. The gamma-ray energy was varied over the range 20.1 to 21.1 Mev by varying the energy of the protons produced by a Van de Graaff accelerator. The resolution (80 Kev) and sensitivity (0.4 mb) of this experiment were sufficient to detect structure in the $C^{12}(\gamma, n)C^{11}$ reaction. The results of this experiment show that structure in the reaction $C^{12}(\gamma, n)C^{11}$ does not exist to the extent predicted by L. Katz and co-workers. The results are not inconsistent with broader structure reported from the $C^{12}(\gamma, p)B^{11}$ reaction, the $B^{11}(p, \gamma)C^{12}$ reaction, and the $B^{11}(p, n)C^{11}$ reaction. A reaction cross-section verses photon energy curve for the $C^{12}(\gamma, n)C^{11}$ reaction is given.

Pittsburgh U., Pa.
INELASTIC COLLISION CROSS SECTIONS FOR PROTONS AND ATOMIC HYDROGEN ON MOLECULAR HYDROGEN, by R. Curran and T. M. Donahue. Technical rept. no. 8 on Capture-Loss and Ionization Cross-Sections of Ions and Neutral Particles, Contract Nonr-624(06). Apr 59, 42p. 18 refs.
Order from LC mi$3.30, ph$7.80 PB 145 929

Measurements of the single electron capture cross section, σ_{10}, for protons of energies 2.5 to 60 Kev are reported and measurements of single electron capture and loss cross sections for atomic hydrogen, σ_{01} and σ_{01} respectively, over the same energy range. Reported for the first time are measurements of the total cross section for production of ion pairs by hydrogen atoms in molecular hydrogen.

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
DEUTERON-INDUCED REACTIONS IN CARBON-14, by Wesley Eugene Moore. Doctoral thesis. Technical rept. no. XI on Precision Scattering of Nuclear Particles, Contract N7onr-32505. Apr 59, 93p. 39 refs. AD-217 716.
Order from LC mi$5.40, ph$15.30 PB 145 791

A study was made of the reactions $C^{14}(d, p)C^{15}$, $C^{14}(d, d')C^{14}$, $C^{14}(d, t)C^{13}$ and $C^{14}(d, \alpha)B^{12}$ using 14.9 Mev deuterons. High resolution magnetic analysis of both the incident beam and the charged reaction particles was used. Nine proton groups were related to the C^{15} ground state and to excited states at 0.745 ± 0.020, 3.09 ± 0.03, 5.94 ± 0.03, 0.38 ± 0.03, 7.32 ± 0.03, 8.41 ± 0.05, and possibly at 4.21 ± 0.03 and 7.47 ± 0.05 Mev. Angular distributions were obtained for 4 of these states and comparison with Butler stripping theory [Proc Roy Soc (London) 208:36, 1951] was used to fix the spins and parities of the C^{15} ground state ($l_n=0$, $J=1/2+$) and first excited state ($l_n=2$, $J=5/2+$). Reduced widths obtained are $(H)^2=0.093$ and 0.032, respectively. Known C^{14} levels were studied by observing the spectrum of inelastically scattered deuterons, and a new level at 7.010 ± 0.020 Mev was discovered. Ratios of reduced widths for the C^{13} 3.09- and 3.86-Mev levels, relative to the C^{13} ground state, indicate that the C^{14} ground state wave function has 0.4 and 13.4 per cent admixtures of $s^4p^8(2s)^2$ and $s^4p^8d^2$ configuration to the s^4p^{10} configuration. The strength of the $s^4p^8d^2$ admixture suggests that the anomalously long beta-decay half-life of C^{14} may be explained without invoking a tensor force. (Author)

Radioactivity

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
MAXIMUM PERMISSIBLE ACTIVITY (MPA) OF FISSION PRODUCTS IN AIR AND WATER VERSUS THE AGE OF THE PRODUCTS, by Donald L. Summers. Marvin C. Gaske, and James L. Dick. Dec 58, 14p. 7 refs. AFSWC-TN-58-30.
Order from LC mi$2.40, ph$3.30 PB 146 672

When mixed fission products are present in air and water, the maximum permissible activity (MPA) is dependent on the relative activity of the individual isotopes. This, in turn, is dependent on the age of the products. The MPA can be determined most accurately from measurements of the isotopic concentrations; however, the separation of mixed fission products into their constituent activities is extremely complicated and costly. In order to provide a simple method of evaluating the internal radiation hazard, the MPA's for ideal mixtures of fission products versus their ages were calculated and plotted. The resulting curves show that the MPA's change appreciably with time. An application of the curves can be found in AFSWC TN-58-29, Limits for Radiation Control and Release of Air Force Material Contaminated with Fission Products (Revised), soon to be published.

Lyman Lab. of Physics, Harvard U., Cambridge, Mass.
NUCLEAR SPECTRA OF THE THORIUM ACTIVE DEPOSIT, by Guy Trask Emery. Doctoral thesis. Rept. on Contract Nonr-1866(19). Apr 59, 94p. 228 refs. Technical rept. no. 1-9.
Order from LC mi$5.40, ph$15.30 PB 145 794

The relative intensities of the gamma rays of the descendants of radiothorium have been studied by measuring the photoelectron spectrum from thorium and platinum foils. Some of the previous work on the radiations from the thorium active deposit is reviewed. The level schemes of polonium 212, lead 208, thallium 208, and bismuth 212 are discussed in the light of the information found here and other recent information, and are compared with the predictions of the shell and collective models. A listing of much of the previous work on the radiations from and decay schemes of these nuclei is included.

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
MEASUREMENT OF SCATTERED GAMMA RAYS IN FOIL ACTIVATION, by Michael P. Charles. Rept. for June 58-Nov 59 on Materials Analysis and Evaluation Techniques. Dec 59, 22p. 5 refs. WADD Technical rept. 59-4.
Order from OTS $0.75 PB 161 687

It is the purpose of this report to determine the scattered radiation component of pure gamma-ray sources used in radiation effects studies. The method to be developed involves the excitation of metastable levels in such materials as In, Cd, Ag, Lu, Hg, Pt,

Hf, Sr, and Rh by gamma-ray inelastic scattering processes. The direct excitation of the metastable states is forbidden, but these levels can be excited indirectly if the Co^{60} gamma rays have been degraded in energy-so that the remaining energy corresponds to that of a level higher than the metastable levels but which decays immediately to the metastable level. Although the cross-sections for gamma-gamma activation at these levels have not been measured, the relative activation of such foils through out the irradiation volume was found to provide considerable information on the energy distribution of scattered radiation in the WADD kilocurie gamma ray sources. (Author)

Naval Research Lab., Washington, D. C.
CRITICAL ANALYSIS OF MEASUREMENTS OF THE GROSS FISSION PRODUCT ACTIVITY IN THE AIR AT GROUND LEVEL, by L. B. Lockhart, Jr. and R. L. Patterson, Jr. Interim rept. 19 Feb 60, 18p. 5 refs. NRL Rept. 5440.
Order from LC mi$2. 40, ph$3. 30 PB 144 112

A comparison of the fission product radioactivity in the air at a given site as determined by use of different techniques for collection of samples and measurement of radioactivity has shown widely divergent results to have been obtained. A study of the two widely different techniques in use at NRL has demonstrated that these discrepancies are due to the different counting and standardization techniques employed and to the inherent difficulty resulting from the changing β spectrum of fission products with age. The procedures employed for estimation of the radioactivity of samples collected in the NRL 80th-meridian program seem to be relatively insensitive to this changing β energy and to give particularly good results for the older debris. For the most accurate results the radioactivity of some one or more specific isotopes should be followed. (Author)

Stevens Inst. of Tech., Hoboken, N. J.
LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS, by E. R. Johnson. Quarterly rept. no. 8, 1 Mar-1 June 59, on Contract DA 36-039-sc-73146. [1959] 20p. 15 refs. AD-220 318.
Order from LC mi$2. 40, ph$3. 30 PB 145 881

Ceramic tubes when exposed to a total dose of 10^{19} nvt have a residual activity after two weeks exceeding 100 R/hr at the surface. The effect of this high residual activity in relation to tube life is discussed. The effect of nuclear radiation on subminature tubes, thin films, magnetic materials, and secondary emission is discussed. (Author) (See also PB 143 897)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SERVICE TEST OF AIRCREW ALERT BOOTS, by Norman C. Van Tassel. July 59, 9p. Technical note AAL-TN-59-14; AD-230 850.
Order from LC mi$1. 80, ph$1. 80 PB 146 235

The Dehner boot, which was developed for aircrew members operating under environmental conditions encountered within the Alaskan Air Command, was evaluated. The test item is a quick-donning boot equipped with a zipper attachment between 2 sets of laces for rapid placement and adjustability. The boot is put on and laced to fit comfortably. It is then removed by unzipping, and when it is to be donned again, it need only be slipped on and zipped up. Test results obtained from 50 individuals indicated that the boots would provide adequate thermal protection for $0^{o}F \pm 10^{o}$ depending on the degree of activity of the wearer. Results further indicated that the test boots with leather soles do not provide adequate protection on slippery surfaces, and present a safety hazard. The composition soles did provide adequate traction.

Columbia U. School of Engineering, New York.
THE DETERIORATION OF INVENTORY AND EQUIPMENT, by M. Klein and L. Rosenberg. Technical rept. no. 3 (N) on Contract Nonr-266(55). 15 Apr 59, 31p. 24 refs.
Order from LC mi$3. 00, ph$6. 30 PB 145 813

This paper describes problems relative to the management of goods which deteriorate. It is traditional to divide this class of items into a "constant efficiency" and a "diminishing efficiency" group.

Naval Supply Research and Development Facility, Bayonne, N. J.
DEVELOPMENT OF SHOE, FLEET, WATER-RESISTANT, by Milton Bailey. Rept. on Service Footwear. 15 Mar 59, 18p. 13 refs. Clothing and Textile Division rept. no. 37; AD 214 707.
Order from LC mi$2. 40, ph$3. 30 PB 145 832

Decks inundated with water continually pose a hazard to health, safety and well-being of naval personnel. Conventional footgear designed primarily for use on land, fails to afford the required protection when subjected to the corrosive elements of the sea. The inadequate shoes engender ills and discomforts associated with wet feet. The continuous wetting and drying of the shoes accelerate the deterioration process, requiring large stocks and issues to support the fleet. Since specialized footwear is not available, work was undertaken to develop a water-resistant shoe that would resolve these major shipboard problems. As a result, the Shoe, Fleet, Water-Resistant was developed. The new shoe incorporated a combination of advanced components, including water-resistant leather, non-marking heels and soles, and polyethylene counters. A new construction was also incorporated that enabled shoe seams to be sealed which barred the penetration of water through the stitch holes. Characteristics were created which it was expected would enable the new shoe to replace the General Purpose Shoe, the Field Shoe, the Flight Deck Shoe and the need for wearing rubbers with work shoes, and result in one work shoe for the Fleet instead of three. (Author)

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT NO. 22. Rept. on Contracts Nonr-1841(10), AF 30(635)2872, and AT(30-1)1937. Dec 57, 55p. 14 refs. [RADC TN-58-62; AD-148 615].
Order from LC mi$3. 60, ph$9. 30 PB 145 849

Dielectric spectroscopy: Volume VI of the tables of dielectric materials, frequency response of ferroelectrics, absorption centers in rutile, and electric spectroscopy of liquids and gases under pressure. Excitation, conduction, and breakdown: Internal photoeffect and exciton diffusion in Cd and Zn sulfides, space-charge build-up in alkali halides, conduction in hexane under high fields, electric conductivity in glass films, optical absorption of rutile, electrical conductivity of magnetite at high temperatures, impulse breakdown of alkali halides, theory of electrons in alkali halides, and instrumentation (Hall effect, IR from 40 to 200μ, and electron microscope). Ferroelectrics and ferromagnetics: Transition to the ferroelectric state in Ba titanate, ferrite properties, magnetic oxides under high pressure, rare-earth Fe perovskites, thermomagnetic measurements, magnetic resonance spectroscopy (paramagnetic defects in Si, and color centers in alkali halides). Single crystals: Garnet single crystals, tricone burner crystal-growing furnace, preparation of very pure alkali halide single crystals, purification of alkali halides by zone refining, influence of oriented growth on the perfection of crystals, color centers in body-centered cubic alkali halides, color centers in alkaline earth fluorides, O impurity in Si single crystals, and vertical divergence correction of the X-ray diffractometer. Ceramics: Reaction rate study in Ni ferrite formation, and atomizing burner performance. (See also PB 137 056)

Rutgers State U., Brunswick, N. J.
ANNUAL RESEARCH REPORT NO. 10. Rept. on Contracts Nonr-404(08) and AF 18(603)06. 1 Sep 56, 15p.
Order from LC mi$2. 40, ph$3. 30 PB 138 896

This research report is submitted in the form of reprints of publications that have appeared since the last Annual Report. The changes in the low temperature properties of tin produced by impurities. Saturation effect in chrome alum at 9900 gauss and helium temperatures. The magnetic resonance spectrum of dilute iron ammonium alum as a function of temperature. A steady-state free precession nuclear magnetic resonance technique. Determination of the quadrupole moment of Al from the splitting of nuclear resonance lines in alums.

Acoustics

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE SCATTERING CROSS SECTION OF A ROW OF CIRCULAR CYLINDERS, by Tai Tsun Wu and Harold Levine. Technical rept. no. 73 on Contract Nonr-225(11). 26 Mar 58, 42p. 7 refs. AD-162 710.
Order from LC mi$3. 30, ph$7. 80 PB 139 272

A plane wave is incident on a row of finite number of equi-spaced infinitely long cylinders of the same size. The direction of incidence is such that only one cylinder is illuminated in the sense of optics. For this geometry, the total scattering cross section is calculated in the limit where the cylinder radius is much larger than the wave length. Both the Dirichlet and the Neumann boundary conditions are treated. In electromagnetic problems, the Dirichlet (Neumann) boundary condition occurs when the electric (magnetic) vector of the incident wave is parallel to the axis of the cylinders. Some simple generalizations of this problem are stated in the final section. (Author)

Harris Transducer Corp., Woodbury, Conn.
THE THEORY OF ACOUSTIC REFLECTORS FOR SONAR APPLICATIONS. REPORT III. GENERAL THEORY OF PASSIVE ARRAYS, by H. K. Farr. Rept. on Contract Nonr-2720(00). 25 May 59, 32p. HTC-73-R3.
Order from LC mi$3. 00, ph$6. 30 PB 146 259

The purpose of this report is to present some general principles which are useful in analyzing arrays of passive acoustic elements (reflectors). The actual results for arrays of the specific type presently under study will be presented later. Consequently no "practical" results in the form of numerical information are included here. The present analysis is restricted to elements whose surfaces oscillate with some simple specified velocity pattern having an amplitude given by a known linear function of the sound pressure on the surface of the element. Examples of such elements are the end loaded cylindrical resonator (Poisson coupled cylinder) and the variable position resonator (V. P.) discussed in Reports I and II of this series. (See also PB 145 248)

Institute of Flight Structures, Columbia U., New York.
ACOUSTIC PULSE LOADING ON A TWO-DIMENSIONAL RIGID BOX IN THE VICINITY OF A FREE SURFACE, by M. B. Friedman. Technical rept. no. 22 on Contract Nonr-266(08). May 59, 8p. 3 refs. CU-1-59-ONR-266(08)-CE; AD-225 335.
Order from LC mi$1. 80, ph$1. 80 PB 146 074

The pressure loading on a box-shaped obstacle is determined in the presence of a free surface, produced by the impact of a pulse of constant strength. A period on the order of 2 transit times is considered. The normal to the incident pulse is inclined at 45^{o} with respect to the sides of the box.

Naval Research Lab., Washington, D. C.
THEORETICAL ANALYSIS OF ECHO FORMATION IN THE FLUCTUATION ENVIRONMENT OF THE SEA, by R. L. Steinberger. Interim rept. 16 Mar 60, 14p. NRL Rept. 5449.
Order from LC mi$2. 40, ph$3. 30 PB 144 476

The elements of a simplified geometric concept of the formation of underwater sound echoes are separated

and analyzed. The ever-present nonstatic behavior of the ocean is taken into consideration. The velocity potential of the echo is shown to contain two factors: one Z due to the shape of the reflector, the other A related to the instantaneous surface wave shape. The method of strip subdivision used in geometric optics is suggested for evaluation of the echo factor Z. (Author)

Office of Scientific Research and Development. Div. 6.
PHYSICS OF SOUND IN THE SEA. PART I. TRANSMISSION. [1945] 258p. 120 refs. Reprinted and distributed by the Committee on Undersea Warfare, National Research Council. Summary technical rept. vol. 8, pt. 1.
Order from OTS $4.00 PB 111 202

Contents:
Wave acoustics
Ray acoustics
Experimental procedures
Deep-water transmission
Shallow-water transmission
Intensity fluctuations
Explosions as sources of sound
Transmission of explosive sound in the sea
Note: this report was originally announced in USGRR, v. 20, p. 182, 6 Nov 53

Office of Scientific Research and Development. Div. 6.
PHYSICS OF SOUND IN THE SEA. PART II. REVERBERATION. [1945] 109p. 51 refs. Reprinted and distributed by the Committee on Undersea Warfare, National Research Council. Summary technical rept. vol. 8, pt. 2.
Order from OTS $2.50 PB 111 207

Contents:
Theory of reverberation intensity
Experimental procedures
Deep-water reverberation
Shallow-water reverberation
Variability and frequency characteristics
Note: this report was originally announced in USGRR, v. 20, p. 182, 6 Nov 53

Office of Scientific Research and Development. Div. 6.
PHYSICS OF SOUND IN THE SEA. PART III. REFLECTION OF SOUND FROM SUBMARINES AND SURFACE VESSELS. [1945] 110p. 63 refs. Reprinted and distributed by the Committee on Undersea Warfare, National Research Council. Summary technical rept. vol. 8, pt. 3.
Order from OTS $2.50 PB 111 208

Contents:
Principles
Theory
Direct measurement techniques
Indirect measurement techniques
Submarine target strengths
Surface vessel target strengths
Note: this report was originally announced in USGRR, v. 20, p. 182, 6 Nov 53

Office of Scientific Research and Development. Div. 6.
PHYSICS OF SOUND IN THE SEA. PART IV. ACOUSTIC PROPERTIES OF WAKES. [1945] 120p. 50 refs. Reprinted and distributed by Committees on Undersea Warfare, National Research Council. Summary techincal rept. vol. 8, pt. 4.
Order from OTS $2.50 PB 111 209

Contents:
Formation and dissolution of air bubbles
Acoustic theory of bubbles
Velocity and temperature structure
Technique of wake measurements
Wake geometry
Observed transmission through wakes
Observations of wake echoes
Role of bubbles in acoustic wakes
Note: this report was originally announced in USGRR, v. 20, p. 182, 6 Nov 53

Office of Scientific Research and Development. Div. 6.
PRINCIPLES AND APPLICATIONS OF UNDERWATER SOUND. 1946, declassified 10 Aug 51, 299p. 124 refs. Summary Technical rept. vol. 7.
Order from OTS $4.00 PB 161 682

Contents:
Part 1. Basic principles of underwater sound: theory of an ideal medium; refraction of sound; transmission of sound in the sea; oceanography of sound conditions; echoes, scattering and reverberation; wakes
Part 2. Echo ranging: acoustic output of sonars; target strength and echo level; maximum echo ranges when background noise is limiting; maximum echo ranges when reverberation is limiting; miscellaneous echo ranging applications
Part 3. Listening: the acoustic output of ships and submarines; background noise; hearing and recognition; sonic and supersonic listening
Note: this report was originally announced in USGRR, v. 23, p. 106, 18 Mar 55, as PB 116 199

Ultrasonic Corp., Cambridge, Mass.
UNDERWATER ACOUSTIC SOURCE, by A. A. Fowle and R. W. Moore. Rept. no. 2 (Final) for 1 Dec 51-31 Aug 52 on Contract Nonr-676(00). [1952] 105p. 9 refs. Rept. no. 111-2; AD-15 021.
Order from LC mi$5.70, ph$16.80 PB 146 500

Efforts were directed toward the development of a mechanical underwater sound transducer having an omni-directional one-plane radiation pattern, a frequency of 5 to 20 kc, and a power output of 1 w for a minimum of 8 sec. Three devices were considered: a fluid-driven diaphragm, a water-hammer device, and a Hartmann generator. The first 2 were to operate on pressurized water, and the third device was to operate on pressurized air. These devices did not have the necessary power output, and they required stored energy for operation. Possible uses of the devices are discussed, and theoretical and design data are included.

Willow Run Labs., U. of Michigan, Ann Arbor.
ACOUSTIC RADIATION FROM ISOTROPIC TURBULENCE, by W. C. Meecham and G. W. Ford. Rept. on Project Michigan, Contract DA 36-039-sc-78801. June 59, 10p. 9 refs. Rept. no. 2900-42-T.
Order from LC mi$1.80, ph$1.80 PB 146 254

For low Mach number turbulence, Lighthill has given a result which expresses the acoustic radiation of turbulent fluid in terms of a fourth-rank velocity correlation. Through the use of the Navier-Stokes equation this relation can be put in terms of the space-time pressure correlation. For very large Reynolds number turbulence (in the inertial subrange where Kolmogoroff's similarity principles are valid) this pressure correlation can be written in terms of a function of a single variable. Since the space-time correlation of the pressure is needed, convective effects must be considered. This is done here by introducing a new Lagrangian type of correlation which is defined in such a way that a similarity argument can be applied without difficulty from the convective effects. Such convective effects then enter only through negligible Doppler shifts.

Electricity and Magnetism

Electrical Engineering Research Lab., U. of Illinois, Urbana.
MAGNETODYNAMIC DIPOLAR FERRITE MODES, by William Henry Steier. Technical note no. 2 on Contract AF 18(603)62. 15 Jan 60, 78p. 39 refs. AFOSR-TN-60-135. AD-232 990.
Order from LC mi$4.50, ph$12.30 PB 145 732

An investigation has been made of the magnetodynamic dipolar modes of a ferrite rod between conducting sheets. Critically coupled mode Q's as high as 1100 have been measured. The advantages which these modes possess over other solved ferrite modes are pointed out.

Istituto Elettrotechnico Nazionale "Galileo Ferraris" (Italy).
EFFECT OF NEUTRON BOMBARDMENT ON THE MAGNETIC PROPERTIES OF IRON AND NICKEL OF VERY HIGH PERMEABILITY, II, by Giuseppe Biorci, Andrea Ferro, and Giorgio Montalenti. Technical note no. 2b on Contract AF 61(514)1331. Dec 59, 9p. 2 refs. AFOSR-TN-60-309.
Order from LC mi$1.80, ph$1.80 PB 146 436

Specimens have been irradiated with fast neutrons at room temperature with doses of 4×10^{17} and 1.2×10^{18} n/cm^2. After irradiation no appreciable change in the magnetic properties has been observed on nickel. On iron, on the contrary, a definite reduction of the maximum permeability and a small increase in coercive force, from 2,5 to 3 A/m has been observed.

Minnesota U., Minneapolis.
SINGLE-DOMAIN PARTICLES: NEW USES OF OLD THEOREMS, by W. F. Brown, Jr. Rept. on Contract AF 18(603)113. Feb 60, 29p. 24 refs. AFOSR-TN-60-61. AD-232 991.
Order from LC mi$2.70, ph$4.80 PB 145 858

This article describes applications of potential theory and classical dynamics to the theory of magnetization processes in "hard" magnetic materials. Many such materials owe their magnetic properties to the fact that they are composed of fine ferromagnetic particles separated by less magnetic regions. Calculation of static hysteresis loops requires consideration of stability conditions; analysis of magnetization reversals and of the behavior in microwave fields involves the dynamics of gyroscopic systems.

Electronics

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATIONS OF RARE-EARTH OXIDE CATHODES, by G. B. Gaines. Scientific rept. no. 1 on Contract AF 19(604)5691. 1 Dec 59, 12p. 9 refs. AFCRC-TN-60-108. AD-232 676.
Order from LC mi$2.40, ph$3.30 PB 145 734

The thermionic emission from two samples each of gadolinium oxide and neodymium oxide has been determined. At 1400°C, the emission from one gadolinium oxide sample was about 1 amp/cm^2. At the same temperature, both neodymium oxide samples exhibited an emission of about 0.1 amp/cm^2. The oxides were put on rhenium metal by electrophoresis. (Author)

Case Inst. of Tech., Cleveland, Ohio.
COMMUNICATIONS IN THE PRESENCE OF AN INTELLIGENT NOISE SOURCE. Technical note no. 2 on Contract AF 30(602)1847. Jan 59, 24p. RADC-TN-59-39; AD-210 117.
Order from LC mi$2.70, ph$4.80 PB 146 199

An analysis is made of some of the models discussed previously, and a new model of a communicator and jammer situation is described.

Diamond Ordnance Fuze Labs., Washington, D. C.
TWO-TURN SERIES-CONNECTED LOOP ANTENNA, by J. Herman. 15 Dec 59, 56p. 6 refs. TR-762.
Order from LC mi$3.60, ph$9.30 PB 146 227

The problem of a loop antenna consisting of two equal parallel coaxial turns, series-connected, has been solved and expressed in modal form. A numerical comparison of mode impedences for a single-turn loop and a two-turn loop, each turn having the same physical dimensions as the single turn, indicates that the two-turn loop is equivalent to a single turn of larger diameter than the actual size used. The method of solution is basic and can be extended to the cases of unequal size turns, concentric turns, and multiple turns. (Author)

Electron Tube and Microwave Lab., Calif. Inst. of Tech., Pasadena.
NONLINEAR EQUATIONS DESCRIBING BEAM TYPE CROSSED FIELD TRAVELING WAVE TUBES, by

J. W. Sedin. Technical rept. no. 6 on Contract Nonr-220(13). Oct 57, 33p. 10 refs. AD-158 004.
Order from LC mi$3.00, ph$6.30 PB 137 721

The equations governing the behavior of beam type crossed-field traveling wave tubes are formulated and presented. The geometry is assumed to be two-dimensional. The electron beam is treated as a number of cylinders of charge and space charge forces are included by calculating the field due to such a cylinder when it is placed between two perfectly conducting planes. The nonlinear equations are re-expressed in terms of normalized variables which make them suitable for machine computation. A brief discussion of the procedure for solving these equations numerically is included. (Author)

General Mills, Inc., Minneapolis, Minn.
SPUTTERING YIELDS, by G. K. Wehner. Annual rept. for 1 June 58-31 May 59 on Contract Nonr-1589(15), 31 May 59, 90p. 47 refs. Rept. no. 1902.
Order from LC mi$4.80, ph$13.80 PB 146 170

1. Sputtering yields of metals under normally incident Hg^+-ion bombardment, for liquid gallium and tin, and for solid metals. 2. Diagnosis of discharge conditions. 3. Velocities of sputtered atoms. 4. Sputtering yields in argon for Ag, Au, Cu, Ni, Pd, Fe, Mo, V, Ge, Ti, and Si in the energy range 30 to 600 ev. (See PB 138 569)

Michigan U. Research Inst., Ann Arbor.
CORRELATION BETWEEN NOISE VOLTAGES IN ANTENNA SYSTEMS, by P. G. Cath. Technical rept. no. 88 on Contract DA 36-039-sc-63203. Oct 58, 29p. 2 refs. 2262-190-T; AD-209 744.
Order from LC mi$2.70, ph$4.80 PB 146 253

To calculate the signal-to-noise ratio of the signal resulting when a number of antenna voltages are combined, it is necessary to know the degree of correlation between the individual noise components. In this report mathematical expressions are derived for the correlation between two noise voltages, induced in two antennas placed a known distance apart, assuming that the intensity of the noise arriving from each direction is known. The correlation coefficient is also derived for the nosie voltages generated in two channels of a direction finder. The results are applied, as an example, to the case of a two-element rotatable Adcock antenna. (Author)

Radiation Lab., Johns Hopkins U., Baltimore, Md.
THE FIELD THEORY OF ELECTRONIC WAVE GUIDES, by Philip Parzen. Rept. on Contract AF 33(616)3374. June 58, 119p. Technical rept. no. AF-52; AD-206 288.
Order from LC mi$6.00, ph$18.30 PB 146 698

Contents:
General field equations and small signal approximations
Propagation of space charge waves in electron beams
Effect of thermal velocities in electronic waveguides
Integral equation formulation of the helix sheath traveling wave amplifier

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge,
ELECTRON BEAM WAVES IN MICROWAVE TUBES, by H. A. Haus. Rept. on Contract DA 36-039-sc-64637. 8 Apr 58, 45p. 25 refs. Technical rept. 316; AD-210 913.
Order from LC mi$3.30, ph$7.80 PB 145 783

This paper presents a review of wave propagation along electron beams and of the interaction of these waves with the fields of microwave structures. It also provides the basis for a unified theory of microwave amplifiers with distributed interaction. The small-signal power theorem for beams with zero curl of the generalized momentum is derived. This theorem and the better-known theorem for longitudinal beams are interpreted. The waves along longitudinal beams, cylindrical Brillouin beams, and Brillouin strip-beams in crossed fields are reviewed and their small-signal power flows are studied. The interaction of waves in a longitudinal-beam, traveling-wave tube is analyzed with the aid of Pierce's coupling-of-modes formalism. The small-signal power theorem is used in deciding whether or not exponential growth of a wave signifies gain. Finally, a variational principle is derived for longitudinal beams and beams with zero curl of the generalized momentum. For reasonable trial fields, the principle leads to Pierce's coupling-of-modes formalism, and can also be applied to study cases of stronger coupling than those analyzable by the coupling-of-modes theory. Equations of the magnetron amplifier are derived from the variational principle.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORY OF NOISY TWO-PORT NETWORKS, by E. Folke Bolinder. Rept. on Contract DA 36-039-sc-64637. 14 June 58, 30p. 50 refs. Technical rept. 344.
Order from LC mi$2.70, ph$4.80 PB 145 782

A new geometric-analytic theory of noisy two-port networks is presented. It is based, geometrically, on the isometric sphere method, a generalization of the isometric circle method to three dimensions, and, analytically, on a three-dimensional conformal transformation which was originally derived by Poincaré and Picard. The transformation is used in a study of transformations of noise ensemble average ratios through bilateral two-port networks. The study is facilitated by interpreting the transformations as non-Euclidean movements in the Poincaré and Cayley-Klein models of three-dimensional hyperbolic space. By a simple extension, noise ensemble average transformations are performed in four-dimensional spaces by means of four-vectors which are analogous to the Stokes vectors used in optics and antenna theory. The new theory has been used for studying several problems pertaining to noisy two-port networks: the Rothe and Dahlke method of splitting a noisy two-port network into noisy and noisy-free parts, cascading of noisy two-port networks, noise tuning and noise matching, the wave representation of noisy two-port networks, and the optimum noise factor. (Author)

Molecular Physics and Spectroscopy

Johnson Research Foundation, U. of Pennsylvania, Philadelphia.
MEASUREMENT OF SMALL ABSORBANCY CHANGES IN MICROSPECTROSCOPY AND OF SMALL INTENSITIES IN MICROFLUORIMETRY, by Britton Chance. Annual rept. on Contract Nonr-551(26). [1959] 5p.
Order from LC mi$1.80, ph$1.80 PB 145 812

The purpose of this research is to investigate factors limiting the measurement of small absorbancy changes in microspectrophotometry and of small intensities in microfluorimetry. In the former case, the design, construction and test of a greatly improved form of a "Caspersson-Thorell" apparatus has been completed and its signal to noise ratio has been evaluated both from a theoretical standpoint and from the standpoint of its effectiveness in measuring enzymes in living cells. In addition to this, an alternative method for measuring enzymes themselves has been constructed and tested, namely a differential microfluorimeter of high sensitivity.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
MICROWAVE SPECTRUM, INTERNAL BARRIER, STRUCTURE, CONFORMATION, AND DIPOLE MOMENT OF ACETYL FLUORIDE, by Louis Pierce (U. of Notre Dame) and Lawrence C. Krisher. Rept. on Contract Nonr-1866(14). [1959] 28p. 16 refs.
Order from LC mi$2.70, ph$4.80 PB 145 748

The microwave spectra of eight isotopic species of acetyl fluoride are reported.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
THE MICROWAVE SPECTRUM OF ACETYL CYANIDE, by Lawrence C. Krisher and E. Bright Wilson, Jr. Rept. on Contract Nonr-1866(14). [1959] 31p. 25 refs.
Order from LC mi$3.00, ph$6.30 PB 145 746

The microwave spectra of eight isotopic species of acetyl cyanide have been investigated in the region 8,000 to 34,000 mc.

Materials Research Lab., Watertown Arsenal, Mass.
HARTREE-FOCK ATOMIC SCATTERING FACTORS FOR THE IRON TRANSITION SERIES, by A. J. Freeman and R. E. Watson (Mass. Inst. of Tech.). Jan 60. 33p. 37 refs. Rept. no. 69.
Order from LC mi$3.00, ph$6.30 PB 145 727

Atomic scattering factors for thirty-five atoms and ions of the iron group transition series (Sc through Cu) have been determined from Watson's recently calculated Hartree-Fock wave functions and compared with other available calculations. Principal scattering factors were also computed, following the methods of Freeman, for the 3d electrons of those atoms containing non-spherical charge distributions.

Naval Research Lab., Washington, D. C.
AN f/3.5 MEDIUM-DISPERSION GRATING SPECTROGRAPH, by F. D. Harrington. 22 Mar 60, 18p. 4 refs. NRL Rept. 5446.
Order from OTS $0.50 PB 161 420

The Meinel spectrograph is a medium-dispersion grating instrument with an aperture of f/3.5. The average reciprocal dispersion is 20.6 A/mm and 10.3 A/mm in the first- and second-order spectra, respectively. In the first order it has a wavelength coverage from 3317 A to 8468 A and a resolution of 0.5 A. The spectrograph was built around an optical design of Dr. A. B. Meinel of the Yerkes Observatory. The collimating and camera elements utilize spherical reflecting surfaces, and the aberrations of the complete optical system are compensated by a Schmidt-type correction mirror. The mechanical features of the spectrograph were designed and built by the U.S. Naval Research Laboratory. Because of its excellent f/number, the spectrograph has found numerous applications where either light levels were low or exposures in the microsecond time region were required. (Author)

Tennessee U., Knoxville.
MOLECULAR FORCE FIELDS OF ETHYLENE, ALLENE FORMALDEHYDE, KETENE AND DIAZOMETHANE by Charles Edward Bailey (Doctoral thesis) and William H. Fletcher. Technical rept. no. 6 on Contract DA 33-008-ORD-1166. 20 Dec 58, 191p. 54 refs. OOR rept. 1505.8-P; AD-209 779.
Order from LC mi$8.70, ph$30.30 PB 146 799

The orbital valency force field has been applied to C_2H_4, C_3H_4, CH_2O, CH_2CO, and CH_2N_2. Vibrational potential energies were simplified by assuming negligible H—H repulsions; the results justify this assumption. The repulsive force between non-bonded C and H atoms in C_2H_4, C_3H_4, and CH_2CO, and the non-bonded O and H atoms in CH_2O agreed with the calculated repulsion based on a Lennard-Jones potential. In CH_2N_2, an electrostatic attractive force was observed between the H atoms and one of the N atoms greater than the repulsive force between the H atom and the central N atom. Agreement between calculated frequencies and observed frequencies is excellent. (Author)

Texas A. and M. Coll., College Station.
ELECTRONIC SPECTRA OF SIMPLE MOLECULES, by J. B. Coon. Final rept. on Contract AF 18(600)439. 17 Dec 59, 27p. 80 refs. AFOSR-TR-59-206.
Order from LC mi$2.70, ph$4.80 PB 145 837

It is the purpose of the present program to obtain information about excited electronic states of simple molecules through a study of the ultraviolet absorption spectra of their vapors. Such experimental information is important for comparison with theoretical studies of the electronic structure of molecules which in turn lead to the prediction of the chemical and physical properties of the molecules in their various excited states.

Washington U., Seattle.
AFTERGLOW SPECTROSCOPY, by K. C. Clark. Final summary rept. for 1 Mar 56-15 Sep 58 on Contract AF 18(603)36. [1958] 8p. 13 refs. AFOSR-TR-60-4; AD-232 340.
Order from LC mi$1.80, ph$1.80 PB 145 853

Covers the following: (1) general discussion, (2) vacuum ultraviolet spectrometer, (3) echelle spectrograph, (4) diffusion gauge for active particles, (5) measurement of atom concentrations, (6) decay by three-body volume processes, (7) exponential decays, (8) diffusion rates and surface effects, and (9) quenching and stimulated emission.

Optics

Cornell U., Ithaca, N. Y.
X-RAY ABSORPTION COEFFICIENTS AND GEOMETRICAL COLLIMATION OF THE BEAM, by L. G. Parratt, J. O. Porteus and others. Technical rept. no. 14 on Contract AF 18(600)300. 1 Sep 58, 14p. 15 refs. AFOSR-TN-58-755; AD-201 614.
Order from LC mi$2.40, ph$3.30 PB 138 143

In recent years, in order to achieve high angular collimation of an intense x-ray beam in a measurement of an absorption coefficient, most investigators have used the action of a high-resolving-power monochromator to provide the collimation. In this case, if the absorber exhibits small-angle scattering (including multiple scattering) of significant intensity in a scattering cone as large as a few seconds of arc, the value of the coefficient depends upon the absorber-position with respect to the monochromator. A few measurements are reported with a two-crystal spectrometer to illustrate the points discussed. (Author)

Naval Research Lab., Washington, D. C.
INFLUENCE OF ATMOSPHERE ON OPTICAL RESOLUTION IN A TYPICAL NEVADA TUNNEL, by A. G. Rockman. Final rept. 31 Mar 60, 10p. 2 refs. NRL rept. 5459.
Order from LC mi$1.80, ph$1.80 PB 145 519

Tests were conducted to determine the optical resolution of an f/3.8 optical relay system (magnification 0.25) over a 1000-foot path in a Nevada tunnel and under a variety of atmospheric conditions. It was also necessary to measure the refractive bending of light beams under similar conditions. Theoretical (Rayleigh) resolution of a single optical element (lens or mirror) two feet in diameter working at a magnification of 0.25 with an object distance of 1000 feet would be about 14 lines/mm. The test system produced airpath resolutions of 6.4 to 9 lines/mm. The resolution apparently was not a function of direction or velocity of air flow in the tunnel system.

Office of Scientific Research and Development. Div. 16.
IMAGE FORMING INFRARED. Summary technical rept. vol. 4, Contract OEMsr-1131. 1946, declassified 17 July 58. 157p. 89 refs.
Order from LC mi$7.50, ph$24.30 PB 139 773

Office of Scientific Research and Development. Div. 16.
NON-IMAGE FORMING INFRARED. Summary technical rept. vol. 3, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 408p. 188 refs.
Order from LC mi$11.10, ph$60.60 PB 139 783

Polaroid Corp. [Cambridge, Mass.]
THE BOLOMETER WINDOW, by Jean T. Eddy and Mark Hyman, Jr. Final rept., Vol. II, Section A, Part 3 on Contract NOrd-6013. Mar 46, declassified 21 Oct 59, 11p.
Order from LC mi$2.40, ph$3.30 PB 146 273

An infrared filter with a transmission of 1% at 2 microns and of 75% at 9 microns has been developed for the bolometer window.

Polytechnic Research and Development Co., Inc., Brooklyn, N. Y.
INVESTIGATION OF PHOTOCONDUCTORS FOR INFRA RED DETECTION, by Floyd Banks. Final rept. on Contract N7onr-415, T. O. 2. 27 June 49, 45p. 18 refs. ATI-178 303.
Order from LC mi$3.30, ph$7.80 PB 146 608

The procedures followed during the course of the investigation fall conveniently into two categories; experiments with bulk material, and experiments with thin films, both evaporated and sputtered. The materials studied in bulk form were silver chloride silver sulphide, zinc oxide, and metal-to-insulator boundaries (samples of lead sulphide and molybdenum sulphide were prepared but no serious work attempted with them). The thin films studied were tellurium.

Radio Corp. of America, Princeton, N. J.
INFRARED PHOTOCONDUCTORS. Interim rept. no. 1, 9 Jan-9 Apr 50, on Contract N6onr-23603. 1 July 50, 16p. ATI-82 772.
Order from LC mi$2.40, ph$3.30 PB 146 612

An interim report is presented on infrared photoconductors, which have longer wavelength response than those at present known. It is shown that such photoconductors are either intrinsic or impurity-activated semiconductors for which the energy gaps between the uppermost filled band and the conduction band are small. The photon energy corresponding to 12 mu radiation is approx 0.1 ev. Therefore, a necessary condition for the existence of long wavelength photoconductivity is the existence of energy levels separated by about this amount and between which electronic transitions are permitted. Long wavelength response will be exhibited only by materials cooled to low temperature. A survey is made of suitable materials and data are given also on the behavior of "secondary" photoconductors.

Radio Corp. of America, Princeton, N. J.
INFRARED PHOTOCONDUCTORS. Interim rept. nos. 2-5, 9 Apr 50-Apr 51, on Contract N6onr-23603. July, Oct 50, Jan, Apr 51. 4 nos.
Order from LC

Interim rept. no. 2, 9 Apr-9 July 50, 32p. ATI-93 358. mi$3.00, ph$6.30, PB 146 613
Interim rept. no. 3, 15 July-15 Oct 50, 23p. ATI-92 420, mi$2.70, ph$4.80, PB 146 614
Interim rept. no. 4, Oct 50-Jan 51, 27p. ATI-96 721, mi$2.70, ph$4.80, PB 146 615
Interim rept. no. 5, Jan-Apr 51, 28p. ATI-105 728, mi$2.70, ph$4.80, PB 146 616
(See also PB 146 612)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
LIGHT, by George W. Stroke. Rept. on Contract DA 36-039-sc-78108. 9 Jan 59, 35p. 38 refs. Technical rept. 348; AD-216 193.
Order from LC mi$3.00, ph$6.30 PB 146 177

Contents:
General nature and theories of light
Classification of phenomena and theories involving light
Electromagnetic wave character of light
Relativistic effects in the behavior of light
Corpuscular nature of light

Solid State Physics

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MICROWAVE TECHNIQUES IN MEASUREMENT OF LIFETIME IN GERMANIUM, by A. P. Ramsa, H. Jacobs and F. A. Brand. 20 Oct 58, 21p. 7 refs. USASRDL Technical rept. 2004; AD-214 648.
Order from LC mi$2.70, ph$4.80 PB 145 753

A new method of measurement of lifetime in germanium single crystals is described. The technique utilized the absorption of microwave power upon injection of minority carriers. An analysis was made of possible experimental errors. (Author)

Brown U., Providence, R. I.
SOME SURFACE PROPERTIES OF INDIUM-ANTIMONIDE CRYSTALS. I. LOW-ENERGY ELECTRON-DIFFRACTION MEASUREMENTS, by H. E. Farnsworth, J. A. Dillon, Jr. and others. Final scientific rept. for 1 Sep 56-30 Sep 59 on Investigations of Surface Properties of Silicon and Other Conductors, Contract AF 19(604)1952. [1959] 21p. 9 refs. AFCRC-TR-59-197; AD-229 060.
Order from LC mi$2.70, ph$4.80 PB 145 930

Low energy electron diffraction studies have been made of five (111) and (11$\bar{1}$) surfaces of InSb which were cleaned by argon ion bombardment and annealing. From the diffraction patterns obtained in both (110) and (11$\bar{2}$) azimuths, a double-spaced structure of surface atoms appears to be present on (111) and (11$\bar{1}$) surfaces. Exposure to oxygen resulted in a gradual decrease in intensity of all beams, indicating that an amorphous layer of oxygen was formed. The sticking coefficient for oxygen on the cleaned surfaces has a maximum value of 10^{-5}, and appears to be similar on both (111) and (11$\bar{1}$) surfaces. The cleaned surface pattern could be regenerated by heating the crystal at about 330°C for approximately one hour. Studies of InSb surfaces heated in vacuum while continuously observed with a microscope showed the formation, above about 400°C, of small flattopped hillocks which migrated over the heated surface. (Author) (See also PB 142 810)

California U., Los Angeles.
STRESS FIELD OF A UNIFORMLY PLASTICALLY DEFORMED CRYSTAL IN AN AGGREGATE, by T. H. Lin and S. Uchiyama. Rept. on Contract AF 49(638)20. Oct 59, 35p. 14 refs. AFOSR-TN-59-1048
Order from LC mi$3.00, ph$6.30 PB 145 867

Contents:
Application of single crystal
Characteristics to polycrystals
Equivalence of plastic strain gradient to body force
Calculation of stress distribution caused by a uniformly slipped region in an elastic medium

Carnegie Inst. of Tech., Pittsburgh, Pa.
ANALYTIC PROPERTIES OF BLOCH WAVES AND WANNIER FUNCTIONS, by W. Kohn Technical rept. no. 7 on Contract Nonr-760(13). 16 Jan 59, 41p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 145 928

The one dimensional Schroedinger equation with a periodic and symmetric potential is considered, under the assumption that the energy bands do not intersect. The Bloch waves, φ_{nk}, and energy bands, E_{nk}, are studied as functions of the complex variable, k. In the complex plane, they are branches of multivalued analytic and periodic functions, φ_k, and E_k, with branch points, k', off the real axis. A simple procedure is described for locating the branch points. Application is made to the power series and Fourier series developments of these functions. The analyticity and periodicity of φ_{nk} has some consequences for the form of the Wannier functions. In particular, it is shown that for each band there exists one and only one Wannier function which is real, symmetric or anti-symmetric under an appropriate reflection, and falling off exponentially with distance. The rate of fall off is determined by the distance of the branch points k' from the real axis. (Author)

General Atomic, San Diego, Calif.
RESEARCH IN RADIATION DAMAGE IN SEMICONDUCTORS, by J. W. Harity, H. Horiye and others. Final rept. on Contract AF 19(604)3899. 10 Feb 60, 162p. 31 refs. GA-1201; AFCRC-TR-60-117.
Order from OTS $3.00 PB 161 673

The purpose of the experimental program was to study the effect of irradiation on semiconducting materials and to apply this knowledge to fabricate a radiation-resistant diode. This program of research was carried out utilizing various facilities at General Atomic. High-energy 25-Mev electron bombardment done with the linear accelerator and neutron bombardment done with the TRIGA reactor were used to study the electrical properties of germanium and silicon as

a function of total irradiation between 78° and 300°K. The electrical properties studied were the conductivity, Hall effect, and carrier lifetime. The carrier removal rate was found to be 4.0 electrons per centimeter of 25-Mev electron path in germanium at 78°K, compared with 0.18 in silicon at 300°K. Two hole-trapping levels were found in germanium with energies above the valence band of 0.15 and 0.27 ev. Evidence of annealing was also observed between 78°K and room temperature in germanium. The result of these studies was the fabrication of a radiation-resistant diode using p-type germanium with a resistivity of about 0.20 ohm-cm as the base material.

Hebrew U. (Israel).
OPTICAL PROPERTIES OF PARAMAGNETIC SOLIDS, by W. Low. Technical note no. 10 on Contract AF 61(052)59. Aug 59, 29p. 36 refs. AFOSR-TN-60-168.
Order from LC mi$2.70, ph$4.80 PB 145 862

The transition groups show absorption and fluorescence spectra characteristic of the particular ion and of the crystal surroundings. Certain regularities are shown to exist in the intensities of the absorption lines and line width of these transition groups.

Institute of Tech., U. of Minnesota, Minneapolis.
STUDY OF NOISE IN SEMICONDUCTORS AND SEMICONDUCTOR DEVICES, by A. van der Ziel. Quarterly rept. no. 3, 1 Dec 58-1 Mar 59, on Contract DA 36-039-sc-78009. [1959] 71p. 6 refs.
Order from LC mi$4.50, ph$12.30 PB 146 028

There have been reports of discrepancies between theory and measurements of noise in silicon transistors. A program of measurement of noise in silicon transistors has been undertaken. Preliminary results of this program are presented in this report. These results indicate that discrepancies do exist; there is a frequency dependent divergence from the theoretical value at very low injection levels; there is a marked increase in noise at high injection levels. An experimental expression for the noise in the mid-current region is presented which fits the experimental curve better than the present theoretical expression. A revised method of measurement is presented. This method of measurement is to be used for the measurements of noise in transistors and should permit a significant increase in the speed and accuracy of collecting data. A theory is presented which demonstrates the correspondences between carrier diffusion and signal propagation on a transmission line. The analogy is used to solve for the spectral density of the fluctuations in the total number of carriers in a one-dimensional semiconductor with surface recombination. It is found that this approach clarifies several points of confusion found in previous treatments. (Author) (See also PB 142 765)

Institute of Tech., U. of Minnesota, Minneapolis.
STUDY OF NOISE IN SEMICONDUCTORS AND SEMICONDUCTOR DEVICES, by A. van der Ziel. Quarterly rept. no. 5, 1 June-1 Sep 59, on Contract DA 36-039-sc-78009. [1959] 122p. 24 refs.
Order from LC mi$6.30, ph$19.80 PB 146 490

The gain, bandwidth and noise figure of wideband transistor amplifiers are discussed. Silicon transistor noise measurements show deviations from theory. The equivalent circuit theory of semiconductor noise is extended. (See also PB 146 028)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
TRANSMISSION LINE FORMULATION FOR SEMICONDUCTORS, by Herbert Kurss. Quarterly rept. no. 10, 1 Oct-31 Dec 58 on Contract DA 36-039-sc-73052. 30 Mar 59, 14p. 1 ref. Rept. R-523.29-59; PIB-453.29; AD-218 108.
Order from LC mi$2.40, ph$3.30 PB 145 825

A "transmission line" analysis of wave propagation in media with a transverse periodicity is given. For a periodically layered crystal the manner in which the network problem must be supplemented by information relating to the third translational symmetry vector is indicated. (See also PB 140 019)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
TRANSMISSION LINE FORMULATION FOR SEMICONDUCTORS, by Herbert Kurss. Quarterly rept. no. 11, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-73052. 15 June 59, 17p. 8 refs. Rept. R-523.32-59; PIB-453.32; AD-225 231.
Order from LC mi$2.40, ph$3.30 PB 145 896

In the neighborhood of the source point, the (scalar) Green's function of a rectangular waveguide with phase shift boundary conditions is shown to be approximately a free space (scalar) Green's function augmented by a finite number of plane waves. These plane waves are then expanded into a series of spherical waves to obtain readily computable formulae for the so-called structure constants. (Author) (See also PB 140 019)

Ohio State U. Research Foundation, Columbus.
SOLID-STATE LOGICAL TRANSDUCERS, by F. E. Battocletti, E. C. Orris and others. Rept. on Research on Physical Phenomena Affecting the Characteristics of Electronic Components, Contract AF 33(616)5923. Feb 60, 39p. 12 refs. WADC Technical rept. 59-686.
Order from OTS $1.00 PB 161 668

Theoretical and experimental investigations of methods of performing complex logical operations with semiconductor devices are described. It is shown that every n-ary connective may be constructed from, at most, two (n-1)-ary connectives and a single-pole double-throw switch. The effects considered for use, either singly or in combination, in fabricating logic circuits include the field effect, punch through, four-layer switch, avalanche breakdown, and the tunnel effect. Experimental techniques that were used in making diffused junctions, oxide masks, and thermal compression bonds are discussed. Only very preliminary results were obtained in experiments on functioning devices. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
GALVANOMAGNETIC EFFECTS AND THE BAND STRUCTURE OF ANTIMONY, by Sandor J. Freedman (Doctoral thesis) and Hellmut J. Juretschke. Technical rept. no. 6 on Contract Nonr-839(06). 15 Apr 59, 87p. 23 refs.
Order from LC mi$4.80, ph$13.80 PB 145 811

The energy band structure of antimony is deduced from room temperature galvanomagnetic measurements and their interpretation in terms of a theoretical model.

Purdue Research Foundation, Lafayette, Ind.
SEMICONDUCTOR RESEARCH. Quarterly rept. no. 9, 1 Aug-31 Oct 58, on Contract DA 36-039-sc-71131. [1958] 36p. 22 refs.
Order from LC mi$3.00, ph$6.30 PB 145 884

Contents:
States associated with vacancies in non-ionic lattices
Technique for measurement of small length increments
Preparation and testing of single crystals
Infrared absorption in neutron irradiated silicon
Impurity photoconductivity in germanium
Paramagnetic resonance in irradiated silicon
Specific heat of silver-manganese
Specific heat of molybdenum-rhodium
Transport properties of germanium at low temperatures
Magnetic susceptibility
Impurity band conduction in silicon
Resistivity of some germanium samples between 0.3 and 4°K
Bulk conductivity at high electric fields
Diffusion of copper in germanium

Purdue Research Foundation, Lafayette, Ind.
SEMICONDUCTOR RESEARCH. Quarterly rept. no. 11, 1 Feb-30 Apr 59, on Contract DA 36-039-sc-71131. [1959] 39p. 32 refs.
Order from LC mi$3.00, ph$6.30 PB 145 883

Contents:
Preparation and analysis of crystals
Gauge transformation in perturbation theory
Thermal capture of electrons by vacancies
Conductivity at high electric fields (Cu-doped Ge)
A note on accuracy of Hall coefficient measurements
The transport properties of semiconductors at low temperatures
Impurity photoconductivity in germanium
Impurity conduction in silicon
Magnetic susceptibility
Contribution of the nucleus to the specific heat of rhenium
Nuclear specific heat of gallium and zinc
Infrared absorption and photoconductivity of irradiated silicon
Spin resonance in neutron irradiated silicon
(See also PB 145 884)

Purdue Research Foundation, Lafayette, Ind.
SEMICONDUCTOR RESEARCH. Quarterly rept. no. 13, 1 Aug-31 Oct 59, on Contract DA 36-039-sc-71131. [1959] 47p. 14 refs. AD-230 348.
Order from LC mi$3.30, ph$7.80 PB 146 497

Contents:
Choice of gauge in perturbation theory
Preparation and analysis of semiconductor single crystals
High perfection silicon crystals
Low temperature mobility in p-type germanium
Non-injecting contacts for n-type germanium
Transport properties of germanium at low temperatures
Impurity conduction in silicon
Resistivity of germanium at very low temperatures
Specific heat of indium
Infrared absorption in irradiated silicon
Fast infra-red detector
Magnetic susceptibility
Spin resonance in neutron irradiated silicon

Purdue Research Foundation, Lafayette, Ind.
SILICON CRYSTAL PERFECTION STUDY, by H. J. Yearian. Quarterly rept. no. 4, 1 Mar-31 May 59, on Contract DA 36-039-sc-77991. [1959] 20p. 6 refs. AD-225 165.
Order from LC mi$2.40, ph$3.30 PB 146 486

High perfection single crystals of Si have been pulled from a quartz crucible heated by a current regulated carbon resistance furnace using a well etch dislocation free seed 0.2mm in diameter. A regulated Lepel RF converter and zone refining jig were modified to permit conventional floating zone crystal growing with 1/2" rods.

Rochester U., N. Y.
ELECTRON-HOLE PAIR PRODUCTION, by D. L. Dexter (RCA Labs.). Rept. on Contract AF 49(638)432. Jan 60, 23p. 13 refs. AFOSR-TN-60-99.
Order from LC mi$2.70, ph$4.80 PB 145 733

We compute for a fairly general band structure the transition probability for across-the-gap impact ionization by a fast particle in a semiconductor, taking into account various possibilities involving tensor masses, non-equivalent energy surfaces, umklapp-processes, etc. Some discussion is given of possible uses of the results. (Author)

Rutgers [State] U., New Brunswick, N. J.
HIGH NEGATIVE NUCLEAR POLARIZATIONS IN SOLUTIONS OF FREE RADICALS, by L. H. Bennett and H. C. Torrey. Doctor's thesis. Rept. on Contract AF 18(603)6. 26 Jan 60, 22p. 24 refs. AFOSR-TN-60-107. AD-232 622.
Order from LC mi$2.70, ph$4.80 PB 145 839

A double magnetic resonance experiment in which negative proton spin polarizations were obtained in liquids containing dissolved paramagnetic material is described in this paper. The present paper, which is an extension of our earlier work, reports negative proton polarizations of up to about 150 in both naphthalene and anthracene free radical solutions.

Uppsala U. (Sweden).
BORIDES OF RHENIUM AND THE PLATINUM METALS. THE CRYSTAL STRUCTURE OF Re_7B_3,

ReB, Rh_7B_3, $RhB_{\sim 1.1}$, $IrB_{\sim 1.1}$, AND PtB, by B. Aronsson, E. Stenberg and J. Aselius. Technical note no. 8 on Contract AF 61(052)40. 15 Dec 59, 20p. 14 refs. AFOSR-TN-59-1138.
Order from LC mi$2.40, ph$3.30 PB 145 866

Re_7B_3 and Rh_7B_3 are isomorphous with Ru_7B_3 (Th_7Fe_3 ($D10_2$)-type). The structure of ReB is closely related to those of Mo_2B_5 and W_2B_5. $RhB_{\sim 1.1}$ and PtB crystallize in the anti-NiAs structure, and a phase with the approximate composition $IrB_{\sim 1.1}$ is isomorphous with $ThSi_2$ (C_c-type).

Uppsala U. (Sweden).
THE CRYSTAL STRUCTURE OF Re_3B, by B. Aronsson, Maggie Bäckman and S. Rundqvist. Technical note no. 11 on Contract AF 61(052)40. 22 Jan 60, 10p. 9 refs. AFOSR-TN-59-1290.
Order from LC mi$1.80, ph$1.80 PB 145 859

The crystal structure of Re_3B has been determined by powder and single crystal methods.

Uppsala U. (Sweden).
X-RAY INVESTIGATION ON RHODIUM PHOSPHIDES. THE CRYSTAL STRUCTURE OF Rh_4P_3, by Stig Rundqvist and Allan Hede. Technical note no. 10 on Contract AF 61(052)40. 9 Jan 60, 18p. 20 refs. AFOSR-TN-59-1270.
Order from LC mi$2.40, ph$3.30 PB 145 860

The rhodium-phosphorus system has been investigated in the range 0-75 atom per cent phosphorus using X-ray and chemical analytical methods. Four intermediate phases have been found, viz. Rh_2P, Rh_4P_3, RhP_2 and RhP_3.

Willow Run Labs., U. of Michigan, Ann Arbor.
PHASE DIAGRAM FOR THE BINARY SYSTEM CdTe-In_2Te_3, by Lars Thomassen and Donald R. Mason. Rept. on Project Michigan, Contract DA 36-039-sc-78801. Apr 60, 27p. 16 refs. 2900-80-R.
Order from LC mi$2.70, ph$4.80 PB 146 869

The phase diagram for the binary system CdTe-In_2Te_3 has been obtained by correlating information from differential thermal analysis measurements, microscopic studies, diffusion couples, and X-ray powder patterns. In establishing the terminal points for this diagram, the melting point for In_2Te_3 was found to be 667 ± 1°C. For CdTe, a melting point of 1098 ± 3°C was indicated. In going across the diagram, three peritectics are apparent. The first (β) is at 785°C and 50 mol % In_2Te_3; the second (γ) is at about 702°C and 74 mol % In_2Te_3; and the third (δ') is at 695°C and about 83 mol % In_2Te_3. There is a large retrograde solubility of $CdIn_2Te_4$ in CdTe. The δ-phase transforms to an ϵ-phase at 625°C and 100% In_2Te_3. The addition of CdTe stabilizes the δ-phase, and it finally disappears to $\gamma + \epsilon$ in a eutectoid reaction at about 360°C and 83 mol % In_2Te_3. Some of the properties of the phases have been measured and are presented. There appear to be qualitatively significant monotonic relationships among the energy gap, the transition temperatures, and the compositions. (Author)

Theoretical Physics

Aeronutronic, Newport Beach, Calif.
THEORETICAL STUDY OF HIGH TEMPERATURE EMISSIVITIES AND ATMOSPHERIC TRANSMISSION, by Gilbert N. Plass and V. Robert Stull. Final rept. on Contract AF 19(604)2166. 30 Jan 60, 88p. 17 refs. Aeronutronic U-784; AFCRC-TR-60-221.
Order from LC mi$4.80, ph$13.80 PB 145 869

A number of different topics have been investigated which are connected with the determination of the high temperature spectral emissivity of molecules and solid particles and with the transmission of infrared radiation through the atmosphere. Basic to all of these calculations was the development of new mathematical models to represent the absorption of an infrared band. These models materially reduce the amount of computation involved without sacrificing accuracy. They were used to calculate the spectral emissivity of carbon dioxide from 1800 to 2500 cm^{-1} and of hydrogen chloride from 1000 to 3400 cm^{-1}. The spectral emissivity of spherical carbon particles was also calculated up to 2400°K. New and more accurate calculations have been made of the atmospheric absorption of infrared radiation in the region of most of the important bands. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A CORNER EFFECT IN PLANE DIFFUSION THEORY, by Harold Levine. Technical rept. no. 83 on Contract Nonr-225 (11). 6 May 59, 34p. 5 refs. AD-216 413.
Order from LC mi$3.00, ph$6.30 PB 146 075

Some aspects of the mathematical technique are discussed with reference to plane problems where the boundaries are defined by straight lines. A different approach to the problem is considered which does not require series development and subsequent summation and is distinguished by a greater adaptability to the study of various aspects of the solution. The method rests on a pair of integral transform relations. A discussion is given of the local flux, or normal derivative, at the boundary with reference to the right angle corner. Its deviation from a constant value, reached at large distances from the corner, is characterized by an inhomogeneous integral equation with semi-infinite domain. The complex Fourier transform of this distribution satisfies a simple type of functional or difference relation, and is obtained by a further application of the same transformation. The normal derivative at the boundary is recalculated to illustrate a technique for employing an integral representation of the spatial function within the corner region.

Astro-Electronic Products Div., Radio Corp. of America, Princeton, N. J.
RESEARCH ON PLASMA ACCELERATION BY ELECTRIC FIELD GRADIENT. Semi-annual technical rept. for 30 June-31 Dec 59 on Contract AF 49(638)658. Dec 59, 74p. 26 refs. [AFOSR-TN-60-211; AD-232 096]
Order from LC mi$4.50, ph$12.30 PB 145 873

Theoretical and experimental studies of plasma acceleration by nonuniform RF fields are presented. Theoretical considerations indicate that a plasma will be accelerated toward the low-field region if the applied frequency is greater than the plasma frequency and toward the high-field region if the frequency is less than the plasma frequency. Pulses of mercury plasma have been generated in a reproducible way, and an RF system has been designed and operated. Phototubes and electron and ion pickup probes have been used for detecting the moving plasma. Oscillograms show a change in plasma velocity as the RF field is applied. (Author)

Avco-Everett Research Lab., Mass.
ON THE FLOW OF A VISCOUS ELECTRICALLY CONDUCTING FLUID, by Harvey P. Greenspan. Rept on Contract AF 49(638)61. Oct 59, 34p. 3 refs. Research rept. 73; AFOSR-TN-59-1221; AD-231 877.
Order from LC mi$3.00, ph$6.30 PB 145 772

Magnetohydrodynamic flow of a viscous incompressible fluid of constant properties past a flat plate is considered. The applied magnetic field is parallel to the free stream direction and the plate is at zero angle of attack. A number of explicit solutions of the linearized theory are presented for the flow past a semi-infinite plate which is either sucking or injecting a conducting fluid into the main stream. The sub-Alfven flow past a long finite impermeable plate is studied in some detail and the magnitude of the viscous wake is compared to the similar type upstream disturbance produced by the forward propagation of Alfven waves.

Brandeis U., Waltham, Mass.
ON A QUANTUM MECHANICAL THEORY OF ABSOLUTE REACTION RATES, by Sidney Golden. Technical rept. no. 6 on Contract Nonr-1677(01). 1 Apr 59, 57p. 22 refs.
Order from LC mi$3.60, ph$9.30 PB 145 810

The criteria employed for classifying a collection of electrons and nuclei as some particular set of chemical species or another are embodied in the form of projection operators, here termed species-classification operators. Logical properties or reproducibility, distinguishability and completeness are imposed upon the several species-classification operators for a system. The effect of different criteria of species classification upon the kinetic equations is discussed in relation to current theories of absolute reaction rates. (See also PB 140 966)

Cornell U., Ithaca, N. Y.
DIFFUSION AND DESORPTION OF METAL IMPURITIES IN PLATINUM, by Richard C. Bradley. Technical rept. no. 13 on Contract AF 18(600)674. 1 Oct 59, 18p. 18 refs. AFOSR-TN-59-1004.
Order from LC mi$2.40, ph$3.30 PB 145 868

Activation energies for the volume diffusion of impurities in polycrystalline platinum samples have been obtained by studying the ions released at temperatures above 1000°C.

Electron Tube and Microwave Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTS ON THE INTERACTION OF A MODULATED ELECTRON BEAM WITH A PLASMA, by Gary D. Boyd. Technical rept. no. 11 on Contract Nonr-220(13). May 59, 111p. 55 refs.
Order from LC mi$6.00, ph$18.30 PB 145 902

New experiments are performed concerning the high frequency interactions of electron beams and plasmas. In the course of verifying plasma density measurements, the excitation of the dipole resonance of a plasma column is considered. Multiple resonances are observed and discussed.

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
EXPERIMENTAL INVESTIGATIONS OF ELECTROMAGNETICALLY INDUCED DETONATIONS. PART I. PARAMETERS AFFECTING THE FORMATION OF THE PINCH, by Thomas Donner and Leonard Aronowitz. Rept. on Contract AF 49(638)552. Nov 59, 35p. 4 refs. PPL rept. no. 122. AFOSR-TN-60-59.
Order from LC mi$3.00, ph$6.30 PB 145 843

A series of tests were conducted with various gases to investigate the conditions needed for the formation of the "pinch discharge". Most tests were conducted at capacitor energies somewhat below those under which pinches had been previously obtained. Some tests were made with mixtures of H_2 and O_2 as a first attempt to obtain pinch induced detonations.

Plasma Propulsion Lab., Republic Aviation Corp., Farmingdale, N. Y.
THEORETICAL STUDIES FOR A PROBLEM IN ELECTROMAGNETICALLY INDUCED DETONATIONS, by W. Chinitz, K. M. Foreman, and L. W. Levin. Rept. on Contract AF 49(638)552. 30 Nov 59, 87p. 15 refs. PPL rept. no. 121; AFOSR-TN-60-85.
Order from LC mi$4.80, ph$13.80 PB 145 842

The aerothermochemistry of electromagnetically driven gaseous detonations is formulated. Next, the revisions necessary to transpose to a moving forced detonation, supported by a magnetic piston, are detailed. The numerical approximation techniques to permit programming for automatic digital computers are discussed. A method of computing enthalpy, heat of formation and equilibrium constant from available data is outlined. Quantities are tabulated for 16 reactions, involving hydrogen, oxygen, nitrogen, and argon, between temperatures of 100° to 24,000°K. The results of a parametric study of standing oxy-hydrogen and air-hydrogen detonations are graphically presented and discussed.

Stevens Inst. of Tech., Hoboken, N. J.
INVESTIGATION ON THE MANY BODY PROBLEM, by Jerome K. Percus. Final rept. on Contract Nonr-263(11). [1959] 14p.
Order from LC mi$2.40, ph$3.30 PB 145 996

Summaries are presented of: "dynamical" Lagrangian; statistical approach to the domain of action of collective co-ordinates; analysis of classical statistical mechanics by means of collective coordinates; role of quantum statistics in the collective approach; collective coordinate analysis of free Einstein-Bose system; the ground state of an Einstein-Bose system; comments on Bohm's new theory of superfluid helium II; some remarks on the role of supplementary variables in the collective treatment of the many body problem; generalized collective coordinates; some new kinds of collective coordinates; normal modes of oscillation at low density; collective modes of oscillation at high density; transverse collective coordinates; generation of action-angle variables; interpolation method; the equation of state for classical statistics; and the semiclassical approach.

Thermodynamics

Air Force Missile Development Center, Holloman AFB, N. Mex.
WIND EXCITED RIGID-BODY VIBRATIONS OF THE HELIOSTAT MIRROR FOR THE PROPOSED DEPARTMENT OF DEFENSE SOLAR FURNACE, by Sigurd Hoyer (Potter Instrument Co.). Jan 60, 54p. 5 refs. AFMDC-TN-60-1.
Order from LC mi$3.60, ph$9.30 PB 145 738

Rigid-body vibrations of the heliostat mirror is the subject of the present report. A minimum requirement is that the mirror be designed to withstand the static load produced by the worst possible wind condition. It is pointed out that the mirror may fail, even if this requirement is satisfied. Such failure may occur if the mirror is excited at one of its natural frequencies, or if the mirror is dynamically unstable in any possible wind condition. Von Kármán vortices may conceivably excite the mirror at one of its natural frequencies. Calculations presented here indicate that this should not prove to be a dangerous source of excitation. It is shown that one must investigate the dynamic stability of the mirror considered as a rigid body. Furthermore, it is shown that in order to do this, one must consider at least three coupled modes of vibration simultaneously.

Avco-[Everett] Research Lab., Mass.
HYPERSONIC GAS DYNAMIC CHARTS FOR EQUILIBRIUM AIR, by Saul Feldman. Rept. on Contract AF 04(645)18. Jan 57, 137p. 6 refs. Research rept. 40
Order from LC mi$6.90, ph$21.30 PB 146 700

A collection of charts is presented for the equilibrium properties of air in several flow situations of interest in hypersonic flow. The cases considered are: (a) flow over bodies in flight at hypersonic speeds: normal and oblique shocks; (b) flow over bodies in shock tubes: this includes moving, standing and reflected normal shocks as well as oblique shocks. A Mollier diagram is also included. (Author)

Avco [Everett] Research Lab., [Mass.]
RELAXATION PHENOMENA IN AIR BETWEEN 3000 AND 8000°K, by M. Camac, J. Keck, and C. Petty. Rept. on Contract AF 04(645)18. 13 Mar 58, 32p. 9 refs. Research rept. 22.
Order from LC mi$3.00, ph$6.30 PB 146 853

Experimental data on the time dependence of the molecular oxygen concentration and the emitted radiation behind moving shock waves in air have been obtained which may be applied directly to practical aerodynamic problems or interpreted to give basic information about reaction kinetics. Since the reaction kinetics of air are not at all well understood at present and are probably quite complicated, extreme caution is urged in extrapolating the information given to conditions which differ markedly from those of the experiments.

General Electric Co. [Schenectady, N. Y.]
TEMPERATURE-ALTITUDE TEST OF MODEL II FIN SERVO AMPLIFIER WITH DOUBLE LAMINATE MOUNTING BOARD, by E. C. Fehner. 16 Oct 52, declassified, 4p. Hermes Heat Transfer memo. no. 55.
Order from LC mi$1.80, ph$1.80 PB 145 916

General Mills, Inc., Minneapolis, Minn.
RESEARCH ON THE EFFECTS OF COLLISIONS OF SMALL PARTICLES WITH BODIES MOVING AT HYPERSONIC SPEED. PART II. EROSION AND HEAT TRANSFER EFFECTS, by G. Whitnah, G. Wehner and others. Rept. for 15 Sep 58-15 July 59 on Contract AF 33(616)5565. Aug 59, 110p. 4 refs. WADC Technical rept. 58-498, Pt. 2.
Order from OTS $2.50 PB 161 657

Results of experimental work in the investigation of heat transfer to smooth and roughened nose cone models are discussed. Heat transfer coefficients for models roughened by sandblasting and by etching are compared with those of smooth models for the two stagnation pressures investigated. Large increases in average heat transfer coefficients were found for the roughened models. Locations of maximum heat transfer were measured for both roughened and smooth models and were found to be considerably closer to the stagnation point for the roughened models than for the smooth model. The experimental apparatus and techniques employed in these investigations are described. Surface pitting or roughening due to the formation of binary and ternary alloys at elevated temperatures has been studied further. Recent data on hypervelocity cratering are discussed. A mathematical analysis of the dispersion of particles by explosive means and as a result of wind shear forces has been made.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
IMPACT PRESSURE AND TOTAL TEMPERATURE INTERPRETATION AT HYPERSONIC MACH NUMBER, by J. C. Graves and N. R. Quiel. Rept. on Hypersonic Research Project, Contract DA 04-495-ORD-19. 26 July 54, 66p. 18 refs. Memo. no. 20.
Order from LC mi$3.90, ph$10.80 PB 146 701

Results are presented of an experimental investigation of impact-pressure and total-temperature interpretation at a nominal Mach number of 5.6. The data indicate that the Rayleigh equation, which assumes non-viscous flow, requires correction at low free-stream Reynolds numbers. These viscous effects are detected at Reynolds numbers (based on impact-probe diameter) as high as 6000, and they continue to increase with decreasing Reynolds numbers. At the low pressure limit of the facilities used in this investigation, the maximum viscous correction is 2.5 per cent for a Reynolds number of 425.

Institute of Engineering Research, U. of California, Berkeley.
HEAT TRANSFER, RECOVERY FACTOR AND PRESSURE DISTRIBUTIONS AROUND A CIRCULAR CYLINDER NORMAL TO A SUPERSONIC RAREFIED AIR STREAM. PART II: COMPARISON OF EXPERIMENT WITH THEORY, by Omar El-Khattab Tewfik. Doctoral thesis. Rept. on Contract Nonr-222(45). 15 May 59, 75p. 18 refs. HE-150-169; Series no. 20, issue no. 128; AD-217 961.
Order from LC mi$4.50, ph$12.30 PB 146 027

Theoretical methods for the prediction of heat transfer, recovery factor and pressure distributions around a circular cylinder normal to a supersonic rarefied gas stream are critically evaluated by comparison with experimental measurements. The results of extensive measurements of heat transfer, recovery factor and pressure distributions obtained in the low pressure wind tunnel of the University of California are reported. Interpretation of these results involved essentially the analysis of heat transfer from a laminar compressible boundary layer with pressure gradient and provides an excellent criterion for a critical study and evaluation of pertinent theory. The modified Newtonian theory was compared with the results of pressure distribution measurements in the Mach number range 3.55 - 5.73, and the Reynolds number range 330 - 4100, using an adiabatic and a cooled model. The free stream was rarefied, with its density corresponding to that of the atmosphere at about a 30-40 mile altitude. (Author) (See also PB 145 090)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A METHOD OF DETERMINING THE THERMAL CONDUCTIVITY, ELECTRICAL RESISTIVITY, AND TOTAL AND SPECTRAL EMISSIVITY OF A CONDUCTING MATERIAL AT HIGH TEMPERATURE FROM ELECTRICAL AND THERMO-OPTICAL MEASUREMENTS ON A HEATED TUBE IN A VACUUM, by Walter B. Powell. Rept. on Contract DA 04-495-ORD-18. 5 July 57, 21p. 1 ref. Progress rept. no. 20-324; AD-151 861.
Order from LC mi$2.70, ph$4.80 PB 146 369

A method of determining the thermal conductivity and electrical resistivity of a conducting material, as functions of temperature, from electrical and thermal measurements on a heated tube is described. This method takes into account linear gradients of these physical properties with temperature. A separate calculation procedure, to be employed when an optical pyrometer is used to observe the tube surfaces, makes it possible to determine the total and spectral emissivity, as well as the true temperature. (Author)

Leyden U. (Netherlands).
ENTROPY AND GAUSSIAN-MARKOFF PROCESSES, by P. Mazur and S. R. de Groot. Technical note on Contract AF 61(052)16. 16 July 59, 17p. 1 ref. AFOSR-TN-59-960; AD-226 408.
Order from LC mi$2.40, ph$3.30 PB 146 020

The model of Gaussian-Markoff processes is used to discuss the time behavior of entropy. The statistical definitions of entropy of Boltzmann and Gibbs are considered. Under macroscopic conditions, the same behavior as expected from non-equilibrium thermodynamics is shown to be obtained in both cases. (Author)

Naval Research Lab., U. of Wisconsin, Madison.
THE INITIAL PRESSURE DEPENDENCE OF THERMAL CONDUCTIVITY AND VISCOSITY, by Daniel E. Stogryn and Joseph O. Hirschfelder. Rept. on Contract N7onr-285(11). 13 Apr 59, 35p. 21 refs. WIS-ONR-36.
Order from LC mi$3.00, ph$6.30 PB 145 889

The initial pressure dependence of thermal conductivity and viscosity of gases is considered to arise from (1) molecular association and (2) collisional transfer. Clusters larger than dimers can be neglected. In the case of thermal conductivity, it is found that at low temperatures molecular association is more important than collisional transfer while at high temperatures collisional transfer predominates. For viscosity, the initial pressure dependence is due primarily to collisional transfer. Detailed equations are given for both of these effects.

Purdue U. Div. of Engineering Sciences, Lafayette, Ind.
IRREVERSIBLE THERMODYNAMICS AND CONTINUUM MECHANICS, by A. Cemal Eringen. Technical rept. no. 14 on Contract Nonr-1100(02). May 59, 33p. 17 refs.
Order from LC mi$3.00, ph$6.30 PB 145 900

Principles of the irreversible thermodynamics are recapitulated. Using the basic conservation principles and the principles of irreversible thermodynamics, the fundamental equations and constitutive relations are obtained for fluids, solids, and visco-elastic media. Equations for the entropy production and heat conduction are derived for various special media and for a general medium having internal constraints. For the latter case, a law generalizing Fourier's law of heat conduction is found. (Author)

Wave Propagation

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDIES OF METEOR-BURST PROPAGATION AT 49 AND 74 MEGACYCLES, by M. L. Meeks,

J. C. James and others. Final rept. for 1 Jan 56-30 June 58 on Contract AF 19(604)1593. [1958] 70p. 11 refs. AFCRC-TR-58-178; AD-160 821.
Order from LC mi$3.90, ph$10.80 PB 137 438

Signals transmitted from Walpole, Massachusetts, on 49.44 mc and 73.82 mc were received at Congaree, South Carolina, (path length 1250 km) and at Smyrna, Georgia, (path length 1480 km). Five-element Yagi antennas were used, and the output power was 5 kw on 49 mc and 3 kw on 74 mc. The duty cycle was found to be 2 or 3 times greater at 49 mc during the night, but during the day - particularly around noon - the duty cycle became about equal because of ionospheric-scatter noise at 49 mc. Diurnal variations in meteor burst rates on both frequencies show good agreement with the theoretical predictions of James and Meeks. Over flat terrain at Congaree there was no significant change in meteor-burst rate with antenna height for heights ranging from 1.65 λ to 6.34 λ. However, strong decorrelations were found between the burst amplitudes observed at markedly different antenna heights. Strong correlation was observed between underdense bursts observed with two antennas at the same height above ground but with various lateral separations extending out to 662 ft at Congaree. Overdense bursts, however, frequently showed decorrelations. Close agreement was found between the burst rates observed simultaneously at Congaree (flat terrain) and at Smyrna (hilly terrain). In the terrain at Smyrna bursts from two antenna at the same height above sea level were well correlated. (Author)

National Bureau of Standards, Boulder, Colo.
REPORT ON THE IGY OBLIQUE-INCIDENCE SPORADIC-E AND F-SCATTER PROGRAM, by J. W. Finney and E. K. Smith, Jr. Final rept. on National Science Foundation Grant no. Y/6.14/120 and Technical rept. no. 1 on NSF Grant no. Y/22.7/328. Mar 60, 101p. 4 refs. Technical note no. 48.
Order from OTS $2.50 PB 151 407

The existence of the longitude effect in the occurrence of sporadic-E propagation suggested by previous data has been affirmed by this experiment, inasmuch as three to five times more sporadic E (depending on the reference level) has been observed on the Poro-to-Onna circuit in the Far East than on the Panama-to-Cuba circuit in the Caribbean. Seasonal variations of the occurrence of sporadic E showed the summer maximum on both circuits, but only the Far East one had a well defined winter peak. Diurnally, sporadic E recorded over the Poro-to-Onna circuit exhibited a double-peaked daytime maximum, with the peaks occurring at 1000 and 1700 hours. The Es data from the Panama-to-Cuba circuit also had the daytime maximum but only one peak in the afternoon. Peculiar evening signal enhancements (referred to as the evening signal anomaly or Far East anomaly) have been observed, particularly around the fall equinox, over the Poro-to-Onna circuit.

National Bureau of Standards, Boulder, Colo.
A SUMMARY OF VHF AND UHF TROPOSPHERIC TRANSMISSION LOSS DATA AND THEIR LONG-TERM VARIABILITY, by D. A. Williamson, V. L. Fuller and others. Mar 60, 183p. 2 refs. Technical note no. 43.
Order from OTS $2.25 PB 151 402

Cumulative distributions of hourly median basic transmission loss are presented for 135 beyond-line-of-sight radio paths in the United States. In order to allow for seasonal trends of transmission loss, the year is divided into a summer period, May through October, and a winter period, November through April. The long-term variability of observed hourly medians is compared with predicted variability based on empirical curves by Rice, Longley and Norton. (PB 151 374). (Author)

Stanford Electronics Lab., Stanford U., Calif.
OBLIQUE ECHOES FROM OVER-DENSE METEOR TRAILS, by L. A. Manning. Technical rept. no. 29 on Contract Nonr-225(24). 28 Feb 58, 23p. 8 refs. AD-157 095.
Order from LC mi$2.70, ph$4.80 PB 138 142

Ray paths are computed for waves refracted by meteor trails having a Gaussian radial distribution of ionization density.

Stanford Research Inst., Menlo Park, Calif.
COMPUTATION OF WHISTLER RAY PATHS, by Irving Yabroff. Final letter rept, pt. 2 on Contract AF 18(603)126. Dec 59, 52p. 3 refs. AFOSR-TN-60-71.
Order from LC mi$3.60, ph$9.30 PB 145 865

This is the second of two reports covering the work done on the theory and application of ray tracing techniques to whistler propagation in the outer ionosphere. The work reported here is an attempt to demonstrate some of the complex phenomena of "magneto-ionic duct" propagation. (See also PB 145 864).

Stanford Research Inst., Menlo Park, Calif.
THE THEORY OF PROPAGATION OF RAYS IN AN INHOMOGENEOUS AND ANISOTROPIC MEDIUM, by J. J. Bandstatter. Final letter rept., pt. 1 on Contract AF 18(603)126. Dec 59, 66p. 7 refs. AFOSR-TN-60-138.
Order from LC mi$3.90, ph$10.80 PB 145 864

This is the first of two reports covering the work done on the theory and application of ray tracing techniques to whistler propagation in the outer ionosphere. This report provides an exposition of the background theory in a more geometric setting.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Army Research Office, Washington, D. C.
ANNUAL RESEARCH TASK SUMMARY, 1960. VOLUME 7. INDEX. 677p.
Order from OTS $3.00 PB 161 139

Contents:
Sect. 1. Project numbers, project titles, and task titles
Sect. 2. Location of work: Army installations, other government installations, roster of contractors doing external work
Sect. 3. Chief investigators
Sect. 4. Scientific fields and sub-fields
Sect. 5. Subject index
(See also PB 161 133-PB 161 138)

Case Inst. of Tech., Cleveland, Ohio.
A NUCLEAR MAGNETIC RESONANCE SPECTROMETER, by Perry R. Longaker. Master's thesis. Technical rept. no. 1 on Contract Nonr-1141(07). May 59, 54p. 11 refs. AD-229 366.
Order from LC mi$3.60, ph$9.30 PB 145 931

The construction of a Pound type nuclear magnetic resonance absorption spectrometer patterned after the Nuclear Magnetics Corporation design is described. Calibration and operation procedures at radio frequency fields of 1 to 30 mc and magnetic fields of about 7500 gauss are discussed, utilizing proton resonance in mineral oil and the lithium resonance in various compounds. (Author)

Ohio State U. Research Foundation, Columbus.
THE EFFECT OF AUDITORY STIMULATION ON THE PRONUNCIATION OF ENGLISH WORDS BY NON-NATIVE SPEAKERS, by Henry M. Moser, Herbert J. Oyer and others. Technical rept. no. 54 on Contract AF 19(604)4575. Sep 59, 21p. 12 refs. AFCRC-TN-59-56.
Order from LC mi$2.70, ph$4.80 PB 146 218

On the basis of experimental evidence presented, it is concluded that: (1) Auditory stimulation improves the intelligibility of the pronunciation of English words by foreign nationals. (2) The most frequent distortions that occurred for the vocabulary under study involved vowel distortions. (3) Auditory stimulation may have an adverse effect upon some words. However, there was no set pattern of distortion in terms of vowel, consonant, or inflectional distortion. Adverse effect is probably due to chance.

Willow Run Labs., U. of Michigan, Ann Arbor.
SURVEY OF AUTOMATA THEORY, by John Holland. Memo. on Proj. Michigan, Contract DA 36-039-sc-78801. Sep 59, 25p. 26 refs. Memo. no. 2900-52-R; AD-226 595.
Order from LC mi$2.70, ph$4.80 PB 145 992

Automata theory draws its methods and data from several disciplines. Major contributions of 4 disciplines, and the way in which these contributions are integrated to form a unified discipline, are surveyed here. The 4 disciplines are : (1) logic and metamathematics, (2) the theory and use of stored-program computing machines, (3) information theory, and (4) neurophysiology and related parts of psychology. From logic and metamathematics come the concepts of a formal system (the axiomatic method and decision procedures), general recursive functions (effective definition), and Turing machines (computability). Study of stored-program computers contributes the concepts of the logical net, programming, and simulation. Information theory provides a means of studying complex systems by statistical methods, giving a measure of the amount of data a system can process or store, and rigorous definitions to concepts such as redundancy and feedback. Finally, neurophysiology and psychology supply data and examples of very complex systems, important questions, and some suggestive outlines of theory. Consideration is given to the way in which these methods and concepts are coordinated to provide abstract deductive theories of complex systems with delayed feedback. (Author)

SOCIAL SCIENCES

Stanford U., Calif.
LOANABLE FUNDS VERSUS LIQUIDITY PREFERENCE THEORIES OF INTEREST, by Takashi Negishi. Technical rept. no. 74 on Contract N6onr-25133. 30 Apr 59, 13p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 145 945

If we introduce money and credit in the general economic equilibrium model, we must decide between two alternative theories of the rate of interest, the Loanable Funds Theory, and the Liquidity Preference Theory. Here we confine ourselves to the merits and demerits of these two theories in relation to the tâtonnement the dynamic adjustment within a Hicksian week, and understand that the Loanable Funds Theory insists that the dynamic movement of the rate of interest is determined by the excess demand which exists in the loan market, while the Liquidity Preference Theory maintains the determination of the dynamic path of the rate of interest by the excess demand which exists in the money market.

Documentation

Armed Services Technical Information Agency, Arlington, Va.
THESAURUS OF ASTIA DESCRIPTORS, FIRST EDITION, by J. Heston Heald, Herbert Rehbock and others. 329p. AD-235 000.
Order from OTS $5.00 PB 161 681

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Patent Office, Washington, D. C.
ADVANCES IN MECHANIZATION OF PATENT SEARCHING; CHEMICAL FIELD, by B. E. Lanham, J. Leibowitz, and H. R. Koller. 11 Apr 56, 11p. 3 refs. Research and Development repts. no. 2.
Order from LC mi$2.40, ph$3.30 PB 146 067

Patent Office, Washington, D. C.
A FIRST APPROACH TO PATENT SEARCHING PROCEDURES ON STANDARDS ELECTRONIC AUTOMATIC COMPUTER (SEAC) by Ethel C. Marden (National Bureau of Standards), Harold Pfeffer, and Herbert R. Koller. 28 Jan 58, 22p. 3 refs. Research and Development repts. no. 10.
Order from LC mi$2.70, ph$4.80 PB 146 073

Patent Office, Washington, D. C.
INTERRELATED LOGIC ACCUMULATING SCANNER (ILAS), by Don D. Andrews. 25 June 57, 17p. 1 ref. Research and Development repts. no. 6.
Order from LC mi$2.40, ph$3.30 PB 146 070

Patent Office, Washington, D. C.
ORGANIZATION OF CHEMICAL DISCLOSURES FOR MECHANIZED RETRIEVAL, by B. E. Lanham, J. Liebowitz and others. 14 June 57, 12p. 2 refs. Research and Development repts. no. 5.
Order from LC mi$2.40, ph$3.30 PB 146 069

Patent Office, Washington, D. C.
A PUNCHED CARD SYSTEM FOR SEARCHING STEROID COMPOUNDS, by Julius Frome and Jacob Leibowitz. 8 July 57, 12p. Research and Development repts. no. 7.
Order from LC mi$2.40, ph$3.30 PB 146 071

Patent Office, Washington, D. C.
RECENT ADVANCES IN PATENT OFFICE SEARCHING: STEROID COMPOUNDS AND ILAS, by Julius Frome, H. R. Koller and others. Rept. of presentation made at Western Reserve University Symposium for Systems on Information Retrieval held in Cleveland, Ohio, April 15-17, 1957. 14p. 1 ref. Research and Development repts. no. 8.
Order from LC mi$2.40, ph$3.30 PB 146 072

Patent Office, Washington, D. C.
STORAGE AND RETRIEVAL OF CONTENTS OF TECHNICAL LITERATURE; NONCHEMICAL INFORMATION, by Don D. Andrews and Simon M. Newman. 15 May 56, 13p. 4 refs. Research and Development repts. no. 1.
Order from LC mi$2.40, ph$3.30 PB 146 066

Patent Office, Washington, D. C.
STORAGE AND RETRIEVAL OF CONTENTS OF TECHNICAL LITERATURE; NONCHEMICAL INFORMATION, by Simon M. Newman. June 57, 15p. 5 refs. Research and Development repts no. 4.
Order from LCmi$2.40, ph$3.30 PB 146 068

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, May 60.
Order from OTS $1.25, $10.00/year PB 161 281

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Articles: 220-
220-Mc propagation in an elevated duct (project trade winds). Wave propagation branch staff
Magnetic compression of plasmas, by A. C. Kolb
An X-ray shield for a 2-Mv Van de Graaf accelerator, L. S. August
Scientific program:
Problems accepted
Problem notes
Applications Research: Formula for computing probability of success in war games and other competitive situations
Astronomy and Astrophysics: New extreme ultraviolet solar spectra
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Radio: Performance of electronic equipment flown in the lightweight, Transosonde meteorological sounding system. Two research tools for use in radar polarization studies: a modified Pincare sphere and a simulator for generating Lissajous patterns
Solid-State Physics: Role of physical defects in the magnetoresistance of copper

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General

Sizes of U. S. Steam-Electric Plants, by R. C. Robertson. Oak Ridge National Lab., Oak Ridge, Tenn. May 59. Contract W-7405-eng-26. 15p. Order from LC. Mi $2.40, ph $3.30. CF-59-5-130

Decontamination of dissolver vent gases at Hanford, by A. G. Blasewitz and others. Hanford Works, Richland, Wash. Feb 51. Decl. July 6, 1959. Contract W-31-109-Eng-52. 17p. Order from LC. Mi $2.40, ph $3.30. HW-20332

Unclassified research and development programs executed for the Division of Reactor Development and the Division of Research, September 1959, by L. H. McEwen, comp. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct 59. Contract AT(45-1)-1350. 42p. Order from LC. Mi $3.30, ph $7.80. HW-62362

A method of calculating boundary-layer thickness in axisymmetric nozzles with laminar hypersonic flow, by A. F. Johnson. Sandia Corporation, Albuquerque, N. Mex. Oct 59. 26p. Order from OTS. 75 cents. SC-4370(RR)

Civilian application releases through 1959. Sandia Corporation Bibliography, by the Technical Information Division. Sandia Corporation, Albuquerque, N. Mex. Jan 60. 87p. Order from OTS. $2.25. SCR-150

Report number series, used by the Technical Information Service in cataloging reports, by F. E. Stratton. Oak Ridge National Laboratory, Technical Information Service Extension, Oak Ridge, Tenn. Mar 60. 116p. Order from OTS. $2.75. TID-85 (2nd Rev.)

Biology and Medicine

Uptake of radioisotopes and their transfer through food chains by marine organisms. Annual report 1958-1959, by S. J. Townsley and others. Univ. of Hawaii. Hawaii Marine Lab., Honolulu, Hawaii. Contract AT(04-3)-56. 47p. Order from LC. Mi $3.30, ph $7.80. AECU-4350

Tunover of labeled amino acids and proteins in cancerous tissues and mammals. Literature search, by M. Comstock. Brookhaven National Lab., Upton, N. Y. Oct 58. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4357

Effect of proton and dueteron irradiation on biolical material. Bibliography, by M. Comstock. Brookhaven National Lab., Upton, N. Y. Sep 58. 2p. Order from LC. Mi $1.80, ph $1.80. AECU-4358

Respiratory pathways in fungi and actinomycetes. Final report for January 1, 1956 to June 30, 1959, by V. W. Cochrane. Wesleyan Univ., Middletown, Conn. Sep 59. Contract AT(30-1)-1813. 29p. Order from LC. Mi $2.70, ph $4.80. AECU-4366

Studies of the effects of ionizing radiation on the ultrastructure of developing nervous tissue as revealed by electron microscopy. Annual report for November 1, 1958, to October 31, 1959, by H. Fernandez-Moran. Massachusetts. General Hospital. Mixter Labs. for Electron Microscopy, Boston, Mass. 1959. Contract AT(30-1)-2278. 36p. Order from LC. Mi $3.00, ph $6.30. AECU-4405

Study of long-term pathologic effects of radioactive isotopes of calcoum and strontium in bone and soft tissues, especially with reference to bone tumor production. Final technical report for

May 16, 1958 to August 31, 1959, by J. F. Kuzma and G. E. Zander-Principati. Marquette Univ., School of Medicine, Milwaukee, Wis. 1959. Contract AT(11-1)-105. 63p. Order from LC. Mi $3.90, ph $10.80. AECU-4409

Final report. Atomic Energy Commission Contract AT(11-1)-194. Chicago Medical School, Chicago, Ill. 1959. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4432

Final report [on effects of radiation on apples and grapes], by C. Pratt. New York State Agricultural Experiment Station, Geneva, N. Y. [1959]. Contract AT(30-1)-1541. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4475

Biological and Medical Research Division semiannual report, January through June, 1958, by L. R. Drapper and others. Argonne National Laboratory, Lemont, Ill. Sep 58. Contract W-31-109-eng-38. 152p. Order from OTS. $3.00. ANL-5916

Structure and function of genetic elements. Brookhaven Symposia in Biology. No. 12, held June 1-3, 1959, by M. Levine and others. Brookhaven National Laboratory, Biology Dept., Upton, N. Y. 1959. 187p. Order from OTS. $2.00. BNL-558 (C-29)

Radiosensitivity of various species of bacteria under different environmental conditions. Final report for the period December 15, 1958 to August 31, 1959, by B. E. Proctor and others. Massachusetts Inst. of Tech., Cambridge, Mass. 1959. Contract AT(30-1)-1719. 22p. Order from LC. Mi $2.70, ph $4.80. NYO-2861

Radiation background in albuquerque, New Mexico, during and after the teapot series, by H. H. Sanders and T. B. Cook, Jr. Sandia Corp., Albuquerque, N. Mex. Sep 55. 12p. Order from LC. Mi $2.40, ph $3.30. SCTM-206-55-(51)

The chemical, physical, and biological properties of human serum phospholipides. Thesis, by G. J. Nelson. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Jan 60. Contract W-7405-eng-48. 76p. Order from OTS. $2.00. UCRL-9040

Biological mixtures, some biophysical problems, and the stable-flow free-boundary method, by H. C. Mel. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Feb 60. Contract W-7405-eng-48. 36p. Order from OTS. $1.00. UCRL-9108

Chemistry—General

Separation factor and transfer coefficients associated with ion exchange separation of enriched as-depleted As, by S. H. Jury. Oak Ridge National Lab., Oak Ridge, Tenn. Aug 52. Decl. December 17, 1958. Contract W-7405-eng-26. 14p. Order from LC. Mi $2.40, ph $3.30. CF-52-8-218

Equilibrium concentrations of several gaseous species (CO, CO_2, CH_4, H_2, H_2O) in equilibrium with graphite at very low hydrogen and oxygen levels, by D. V. Ragone. General Dynamics Corp., Dept. of Chemical and Metallurgical Engineering, Univ. of Michigan, Ann Arbor, Mich. Mar 60. Contract AT(04-3)-187. 15p. Order from OTS. 50 cents. GA-1109

A study of the Miller's fluorinated lubricant - chlorine trifluoride reactions, by G. Stern and R. P. Bell. Goodye r Atomic Corp., Tech. Div., Process Engineering Dept., Portsmouth, Ohio. Jan 60. Contract AT(33-2)-1. 22p. Order from OTS. 75 cents. GAT-290

Infrared spectra of ClO_2, ClO_2F, and ClO_3F, by E. A. Smith and tohers. Goodyear Atomic Corp Portsmouth, Ohio. Oct 59. Contract AT(33-2)-1. 6p. Order from LC. Mi $1.80, ph $1.80. FAT-T-687

The melting points of uranium dioxide, uranium monocarbide, and uranium mononitride, by H. W. Newkirk and J. L. Bates. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Mar 59. 5p. Order from LC. Mi $1.80, ph $1.80. HW-59468

Decontamination studies for HAPO high temperature reactor recirculation systems. Progress report for June 1958 to June 1959, by L. D. Perrigo and R. D. Weed. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 34p. Order from LC. Mi $3.00, ph $6.30. HW-60677

Exchange studies of the uranium-tributyl phosphate reaction, by B. Keisch. Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho. Nov 59. Contract AT(10-1)-205. 23p. Order from LC. Mi $2.40, ph $3.30. IDO-14490

Measurement error - identification and estimation, by F. H. Tingey. Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

Mar 60. Contract AT(10-1)-205. 21p. Order from OTS. 75 cents. IDO-14508

Process of the storage of plutonium hexafluoride, by N. J. Hawkins Knolls Atomic Power Lab., Schenectady, N. Y [1957] Decl. Oct 15, 1959 Contract W-31-109-eng-52. 9p. Order from LC. Mi $1.80, ph $1.80. KAPL-M-NJH-2

The reliability of determining impurity titanium in Zircaloy, by W. S. Horton. Knolls Atomic Power Lab., Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 20p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-WSH-5

Estimated upper bounds to the half-life of thermal decomposition of ammonia, hydrogen, methane, and propane, by D. Herschbach Los Alamos Scientific Lab., N. Mex. Aug 56. Decl. Aug 11, 1959. Contract W-7405-eng-36. 30p. Order from LC. Mi $2.70, ph $4.80. LAMS-1954

Process development of 2, 2-dinitropropyl acrylate, by T. M. Benziger and others. Loa Alamos Scientific Lab., N. Mex. Oct 55. Decl. Sep 25, 1959. Contract W-7405-eng-36. 45p. Order from LC. Mi $3.30, ph $7.80. LAMS-1974

Space groups and atomic parameters in some graphite-alkali metal lamellar compounds, by G. M. Wolten. Atomics Interantional. A Division of North American Aviation, Inc., Canoga Park, Calif. Apr 60. Contract AT(11-1)-GEN-8. 18p. Order from OTS. 75 cents NAA-SR-4545

Solubility of terphenyls at room temperature, by R. T. Keen. Atomics International Division., North American Aviation, Inc., Canoga Park, Calif. Jan 58. 4p. Order from LC. Mi $1.80, ph $1.80. NAA-SR-Memo-2412

Thermo-physical properties of OMRE circulating coolant, by G. Asanovich. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. May 59. 16p. Order from LC. Mi $2.40, ph $3.30. NAA-SR-Memo-3843

Thermodynamic properties of sulfuryl fluoride from 12°K to its boiling point. The entropy from molecular and spectroscopic data, by F. J. Bockhoff and others. Western Reserve Univ., Morley Chemical Lab., Cleveland, Ohio. Sep 59. Contract AT(30-1)-824. 23p. Order from LC. Mi $2.70, ph $4.80. NYO-4885

The system lithium hydride--calcium hydride, by C. E. Messer. Tufts Univ., Medford, Mass. Sep 59. Contract AT(30-1)-1410. 12p. Order from LC. Mi $2.40, ph $3.30. NYO-8026

Calculation of suspension peptization, by F. H. Sweeton. Oak Ridge National Lab., Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 131p. Order from OTS. $2.75. ORNL-2791

Reduction of cupric oxide by hydrogen. 1 Fundamental kinetics, by W. D. Bond and others. Oak Ridge National Lab., Oak Ridge, Tenn. Feb 60. Contract W-7405-eng-26. 26p. Order from OTS. $1.00. ORNL-2815

Purification of Americium chloride solutions by mercury cathode electrolysis, by J. L. Holst and C. W. Barrick. The Dow Chemical Co., Rocky Flats Plant, Denver, Colo. Mar 60. Contract AT(29-1)-1106. 9p. Order from OTS. 50 cents. REP-183

Intermetallic compounds between lithium and lead V. Brillouin polyhedra of the various phases, by W. J. Ramsey and J. O. Jepson. University of California, Lawrence Radiation Lab., Livermore, Calif. Nov 59. Contract W-7405, eng-48. 16p. Order from OTS. 50 cents. UCRL-5801

Chemistry Division semiannual report, June through November 1959. University of California, Lawrence Radiation Laboratory, Livermore, Calif. Feb 60. Contract W-7405-eng-48. 103p. order from OTS. $2.50. UCRL-9093

Longitudinal dispersion in two-phase continuous - flow operations: Solution and tables for concurrent flow, by T. Miyauchi and others. University of California, Lawrence Radiation Lab., Berkeley, Calif. Mar 60. Contract W-7405-eng-48. 24p. Order from OTS. 75 cents. UCRL-9112

The gravimetric determination of hafnium and zirconium in hafnium materials. (Tentative Method), by T. M. Reinhold. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Apr 59. 4p. Order from LC. Mi $1.80, ph $1.80. WAPD-M(GLA)-718

An evaluation of uranium salvage operations - a case study, by A. E. Sands. Union Carbide Nuclear Co. Div. of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Dec 59. Contract W-7405-eng-26. 75p. Order from OTS. $2.00. Y-1279

Chemistry—Radiation and Radiochemistry

Effectsof gamma radiation on the kinetics of chlorination of some aromatic hydrocarbons. Part I. Chlorination of mesitylene and naphthalene. Part II. Chlorination of ethyl benezen Part III. Chlorination of M-xylene and methyl naphthalenes, by J. J. Martin and others. University of Michigan. Engineering Research Inst.; Ann Arbor, Mich. [195?] 69p. Order from LC. Mi $3.90, ph $10.80. AECU-4339

Radiochemical separation of cadmium and the application of vacuum distillation of metals to radiochemical separations, by J. R. DeVoe. University of Michigan, Ann Arbor, Mich. Dec 59. Contract AT(11-1)-70. 91p. Order from OTS. $2.50. AECU-4610

California production in the high flux isotope reactor, by H. C. Claiborne and M. P. Lietzke. Oak Ridge National Lab., Oak Ridge, Tenn. Aug 59. 24p. Order from LC. Mi $2.70, ph $4.80. CF-59-8-125

Removal of iodine from aqueous solutions by sparging, by C. H. Holm. Hanford Works, Richland, Wash. June 51. Decl. with detetions July 7, 1959. Contract W-31-109-Eng-52. 39p. Order from LC. Mi $3.00, ph $6.30. HW-20803(Del.)

The stability of purex solvent to radiation and chemical attack, by J. L. Swanson. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. May 55. Decl. with deletions Aug. 25, 1959. Contract W-31-109-Eng-52. 30p. Order from LC. Mi $2.70, ph $4.80. HW-38263(Del.)

General research quarterly report for January, February, March 1950. Mound Lab., Miamisburg, Ohio. Apr 50. Decl. Nov 24, 1959. Contract AT-33-3-GEN-53. 27p. Order from LC. Mi $2.70, ph $4.80. MLM-443-3

General research report for June 26 to September 18, 1950. (Actinium Volume). Mound Lab., Maimisburg, Ohio. Oct 50. Decl. Nov 24, 1959. Contract AT-33-1-gen-53. 16p. Order from LC. Mi $2.40, ph $3.30. MLM-499

Tentative procedure for the analysis of mixtures containing radium-226, actinium-227, and thorium-228, by H. W. Kirby. Mound Lab., Miamisburg, Ohio. Oct 52. Decl. Nov 24, 1959. Contract AT-33-1-gen-53. 9p. Order from LC. Mi $1.80, ph $1.80. MLM-773(Rev.)

The radiochemistry of cadmium, by J. R. DeVoe. The University of Michigan, Ann Arbor, Mich. Jan 60. 57p. Order from OTS. 75 cents. NAS-NS-3001

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Calculations on the TRX critical assembly, by L. Maki and W. Allen. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. [1959?] 5p. Order from LC. Mi $1.80, ph $1 80. NAA-SR-Memo-3892

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Safety analysis of enriched uranium processing. A study of the possible consequences of nuclear accidents in licensed plants processing unirradiated enriched uranium, by H. T. Williams and others. CONVAIR, A Division of General Dynamics Corp., Fort Worth, Tex. Mar 60. Contract AT(30-1)-2271. 199p. Order from OTS. $3.00. NYO-2980

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Preliminary report on the geology and uranium deposits of Haiwee Ridge, Inyo County, California, by W. R. Power. U. S. Atomic Energy Commission, Grand Junction Operation Office, Production Evaluation Div., Salt Lake Branch, Salt Lake City, Utah. May 58. 39p. Order from OTS. $1.25. RME-2066

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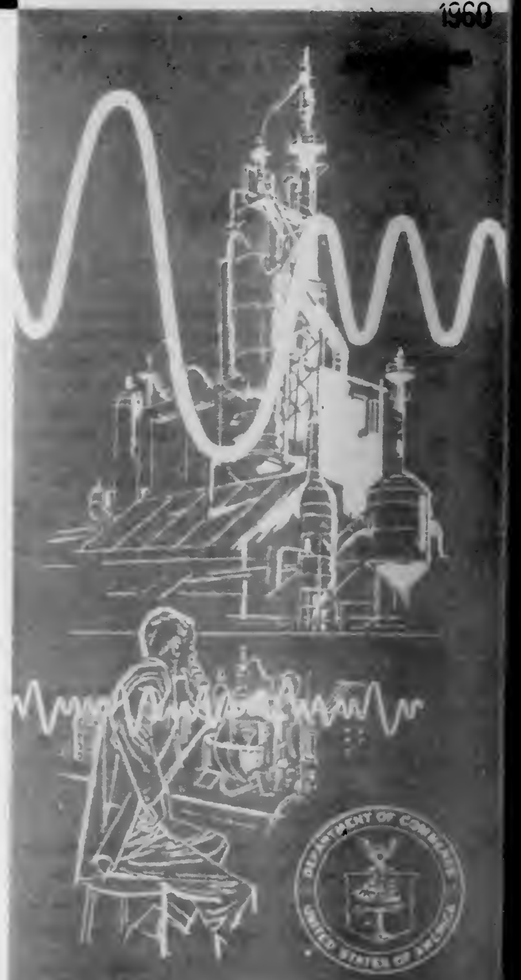

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AGRICULTURE

Pennsylvania State U. [University Park].
ANALYSIS OF METHODS AND EQUIPMENT FOR MEASURING SOIL MOISTURE, by Mark D. Shaw. Rept. on Contract DA 36-039-sc-78125. Jan 60, 64p. AD-232 841.
Order from LC mi$3.90, ph$10.80 PB 146 793

An outline is presented of the textural, structural, and chemical properties of soil as well as a discussion of the following aspects of soil moisture: hygroscopic and capillary moisture, gravitational water, field capacity, permanent wilting point, moisture equivalent, and plastic and liquid limits. Descriptions are included for chemical, electrical, gravimetric, lysimetric, nuclear, penetrometric, tension, thermal, and miscellaneous methods of measuring soil moisture. The literature survey combined with test work indicates that the most promising methods available for measuring soil moisture are those based on nuclear radiation and electrical resistance. The electrical resistance method is the simpler of the two. Additional work needs to be done on the development of sensing units and measuring instruments for accurate and reliable soil moisture measurements under all conditions and at all moisture levels. The appendices include discussions on the (1) effect of fertilizer concentration, temperature, and soil type on electrical resistance soil moisture instruments [from an unpublished manuscript by Shri Mohan Gupta of the Dept. of Electrical Engineering, Univ. of Penna., 1958]; and (2) response of electrical resistance soil moisture instruments at frequencies of 20 to 20,000 c.

ASTRONOMY

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ASTRONOMICAL OBSERVATIONS BY MEANS OF HIGHLY SENSITIVE ELECTRONIC LIGHT INTENSIFICATION, by Lloyd R. Wylie (Wittenberg U.), Radames K. H. Gebel, and Lee Devol. Rept. on Research on the Quantum Nature of Light. Mar 60, 27p. 31 refs. WADC Technical note 59-404.
Order from OTS $2.75 PB 161 729

The advantages of observing and photographing celestial bodies with a light amplifier that employs the closed circuit television principle are explored and treated here. Special pickup tubes were developed to insure optimum performance. The electrical signals from the pickup tube are electronically amplified and modified. The image is reproduced by a cathode ray tube and photographs may be obtained from the screen of this tube. The electronic amplification of the electrical signal permits light intensification of 10^9 times. The modification of the signal makes almost complete suppression of the background possible. It permits astronomical observations during the day and also at night that are not possible with systems in which the background cannot be suppressed. Photographs of celestial bodies taken at the Weaver Observatory of Wittenberg University are included. (Author)

[Radio Corp. of America] Princeton, N. J.
THE LOW LIGHT LEVEL PERFORMANCE OF THE INTENSIFIER ORTHICON, by G. A. Morton and J. E. Ruedy. Rept. on Contracts AF 33(616)2631 and AF 33(616)3946. Mar 60, 19p. WADD Technical note 60-20.
Order from OTS $0.50 PB 161 701

This discussion of basic principles for development of the intensifier orthicon utilizes television techniques combined with preamplification from image converter principles. Fundamental factors influencing the investigation were: ability to obtain necessary gain of additional brightness by amplification of the pickup tube signal with a conventional video amplifier, secure long integration times with background suppression and better contrast, simplicity of multiple viewing and signal measurements. Performance of the tube, related equations, diagrams and photos are included. Quantitative relationships are drawn between contrast, brightness, and image definition for one-stage intensified orthicon and wide-spaced image orthicon. Simulated astronomical objects observed by methods described in this report show the significance of the intensifier orthicon. (Author)

Astrophysics

Army Signal Research and Development Lab., Fort Monmouth, N. J.
RADAR DETERMINATION OF THE SURFACE STRUCTURE OF THE MOON, by Fred B. Daniels. 1 Apr 60, 11p. 4 refs. USASRDL Technical rept. 2110.
Order from LC mi$2.40, ph$3.30 PB 146 937

The theory of radar reflections from a curved surface having random irregularities is developed and the application of this theory to radar echoes from the moon is discussed. The space correlation function measured at the earth's surface is found to have a similar form to that of the lunar surface, but a scale that is larger by a factor of approximately 500. Reasons are advanced for the choice of a Gaussian to represent this function, and the possibility of checking the validity of this assumption by making space diversity tests is discussed. The results of a preliminary experiment are described. (Author)

Center for Radiophysics and Space Research, Cornell U., Ithaca, N. Y.
SCIENTIFIC EXPERIMENTS FOR THE ARECIBO RADIO OBSERVATORY. Scientific rept. no. 2 on Contract AF 19(604)6158. 31 Mar 60, 64p. 29 refs. Research rept. RS 5; AFCRC-TN-60-359.
Order from LC mi$3.90, ph$10.80 PB 147 053

The feasibility of experiments inactive and passive radio astronomy is discussed. A priority list of experiments for the Arecibo Radio Observatory emerges, and the scheduling of these experiments is then discussed. Supporting theoretical and laboratory research is discussed.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
BIBLIOGRAPHY OF EXTRATERRESTRIAL RADIO NOISE. FIFTH QUARTERLY LIST OF RECENT PUBLICATIONS, by Martha Stahr Carpenter. Rept. on Contract Nonr-401(22) and NSF Grant G5964. 15 Sep 58, 21p. 177 refs. Research rept. EE 414; AD-230 622.
Order from LC mi$2.70, ph$4.80 PB 146 094

This "Fifth Quarterly List" presents references to publications dealing wholly or in part with extraterrestrial radio noise. Most of the references pertain to material received at Cornell University between June 1, 1958 and September 1, 1958. Also included are certain references to earlier publications that were not mentioned in previous "Quarterly Lists," and a few revised statements of previously listed references about which further information is now available. The types of references included and the methods of finding them have been described in the preceding reports of this series. The list of journals that are thoroughly scanned in the search for pertinent publications has recently been greatly expanded.

Cruft Lab., Harvard U., Cambridge, Mass.
EMPIRICAL BASES FOR STATIONARY TIME SERIES, I, by W. C. Kellogg. Scientific rept. no. 2 on Contract AF 19(604)4979. 5 Oct 59, 18p. 2 refs. AFCRC TN-60-214; AD-232 539.
Order from LC mi$2.40, ph$3.30 PB 146 088

A brief review is presented of some properties of orthogonal function expansions, and a method is proposed for obtaining minimal sets of basis functions for the representation of sets of signals. The design of electronic equipment that will obtain basis functions and measure expansion coefficients by an analogue computing technique is discussed. An account is given of a numerical application of the technique of obtaining basis functions to time series consisting of daily sunspot counts. (Author)

Cruft Lab., Harvard U., Cambridge, Mass.
EMPIRICAL BASES FOR STATIONARY TIME SERIES, II, by W. C. Kellogg. Scientific rept. no. 3 on Contract AF 19(604)4979. 20 Nov 59, 15p. 2 refs. AFCRC TN-60-215; AD-232 540.
Order from LC mi$2.40, ph$3.30 PB 146 089

The procedure described (PB 146 088) for constructing as basis for a set of signals from samples of the signal set is studied for the case of a single continuous signal. It is found to be applicable provided the signal is a solution of an ordinary linear homogeneous differential equation with constant coefficients. When such a signal is represented in terms of a basis of functions derived from samples of the signal, the expansion coefficients depend upon the initial times of the samples and of the section of the signal being represented, and upon the frequencies and damping factors of the signal, but not upon the amplitudes and phases of the terms containing the various frequencies. (Author)

Manchester U. (Gt. Brit.)
STUDIES IN LUNAR TOPOGRAPHY. III. ERRORS INVOLVED IN THE PHOTOGRAPHIC DETERMINATION OF HEIGHTS AND A PRELIMINARY STUDY OF THE REGION OF PTOLEMAEUS AND ALPHONSUS, by Geoffrey Turner. Technical scientific note no. 3 on Contract AF 61(052)168. June 59, 35p. 10 refs. AFCRC-TN-59-612. AD-232 271.
Order from LC mi$3.00, ph$6.30 PB 146 133

A brief recapitulation of the cine photographic method is given and the errors arising from photographic and

seeing effects together with the measuring technique are discussed. The limitations, imposed by our present inadequate knowledge of basic selenographic coordinates are described and the need for further positional measures stressed. Heights are given for the eastern ramparts of the crater Ptolemaeus and the eastern ramparts and central mountain of the crater Alphonsus. (Author) (See also PB 146 132)

Visibility Lab., U. of California, San Diego.
THEORY OF ATTENUATION MEASUREMENTS IN PLANETARY ATMOSPHERES, by Rudolph W. Preisendorfer. Rept. on Contract NObs-72092. 8 8 Dec 58, 36p. 2 refs. SIO Reference 58-81; AD-212 699.
Order from LC mi$3.00, ph$6.30 PB 147 599

Two general methods are proposed for the determination of the volume attenuation function α in arbitrarily inhomogeneous spherical atmospheres. Each method is deduced directly from the equation of transfer of general radiative transfer theory, and is designed to take into explicit account the effects of the sphericity of the earth's atmosphere on radiometric measurements at high altitudes in the atmosphere.

BEHAVIORAL SCIENCES

Human Engineering

Dunlap and Associates, Inc., [Stamford, Conn.]
TRACKING TRAINING III: TRANSFER OF TRAINING, by Charles R. Kelley, Hugh M. Bowen and others. Rept. on Contract Nonr-1908(00). 25 Jan 60, 73p. 4 refs. Technical rept. NAVTRADEVCEN 1908-00-3.
Order from LC mi$4.50, ph$12.30 PB 146 878

Field studies indicate that there is a general carryover of training from one aircraft to another which, however, does not extend to the details of control skill. Present trainers can teach procedural and instrument skills but fail to teach particular control skills. These are usually learned by actual flying. Pilot studies indicate the following: (a) Transfer between different vehicular systems is high when instruments and controls are similar. Very stable high-order tracking systems seem to the operator to respond like lower order systems. (b) Stability seems to be the most important single variable in developing tracking skill. (c) In transferring from one- to two-dimensional control, there is a high positive transfer with a stable system, and some positive transfer with an unstable system. (d) The use of a predictor display is highly effective for principles training. Laboratory experiments indicated the following: (a) Six tracking conditions varying in stability and number of control dimensions were all effective in tracking training. The most effective condition employed variable stability while the poorest condition was the criterion system which was the most unstable. (b) General tracking training produces significant increases in skill in the control of systems having widely different dynamic characteristics.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE AMOUNT OF INFORMATION IN THE ABSOLUTE JUDGMENT OF MUNSELL HUES, by Donald W. Conover. Doctoral thesis. Rept. on Contract AF 33(616)3612, continuation of Contract AF 33(616)43. June 59, 56p. 49 refs. WADC Technical note 58-262.
Order from OTS $1.50 PB 161 699

Using surface colors provided by the Munsell 50-hue series of colored papers, the author developed a preliminary equal-discriminability scale for the absolute recognition of colors. Based on these data 16 colors were selected that represented an equally spaced series. This scale was validated with a second group of subjects. The results indicated that no adjacent pair of colors was confused with much greater frequency than any other pair. Both the initial and validating data indicate that the average color-normal individual can identify, on an absolute basis, nine surface colors. For practical coding purposes these results indicate that a maximum of somewhere between five and eight colors can be used, the exact number depending on how unfavorable the viewing conditions are expected to be and how large a proportion of the population must read the code without error. Theoretical and practical aspects of the results are reviewed. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus, Ohio.
A SUMMARY OF RESEARCH METHODS, OPERATOR CHARACTERISTICS, AND SYSTEM DESIGN SPECIFICATIONS BASED ON THE STUDY OF A SIMULATED RADAR AIR TRAFFIC CONTROL SYSTEM, by J. S. Kidd. Rept. on Contract AF 33(616)3612; continuation of AF 33(616)43. July 59, 33p. 25 refs. WADC Technical rept. 59-236.
Order from OTS $1.00 PB 161 741

This report summarizes fourteen laboratory studies of human engineering aspects of radar air traffic control systems. It includes a review of methodological developments and empirical findings. Human operator characteristics consistently observed in the task setting employed are presented, along with recommendations for system design and system management based on the experimental findings. Comments regarding the future potential of this type of research in dealing with significant human factor problems are also included. (Author)

Naval Medical Research Lab., New London, Conn.
THE SHAPE OF THE NORMAL WORK AREA, by Paul C. Squires. Rept. on Project NM 002 014.08.10. 23 July 56, 7p. 3 refs. Rept. no. 275.
Order from LC mi$1.80, ph$1.80 PB 147 033

The 'normal' work area, as represented by two intersecting semicircles, found in standard texts and human engineering manuals, is incorrect. A species of epicycloid curve is proposed as the correct and desirable contour for the normal work area; the parametric equations of this curve are given, based on anthropometric data. The epicycloid contour recommended would be useful in situations where instruments and visual displays must be arranged compactly and operator movement is relatively restricted. The proposed work area contour is natural and comfortable for the operator. (Author)

Pennsylvania State U., University Park.
HUMAN ENGINEERING INVESTIGATION OF AIRCRAFT COCKPIT VISUAL DISPLAYS. THE EFFECTS OF CONTRAST COLOR, AND VIEWING ILLUMINATION ON SCALE READING, by J. Lazo, E. Hendler and others. Rept. on Contract N156s-32041. 7 Feb 57; 36p. 2 refs. TED NAM AE-7047, Pt. 16; NAMC-ACEL-324; AD-129 108.
Order from LC mi$3.00, ph$6.30 PB 146 507

The research in this report concerns the effects on the time and accuracy of scale reading of (1) the contrast of dial marks with background; (2) the color of dial marks, white vs. red on black; and (3) the level of illumination under which scale readings are made, specifically, day vs. night levels. Legibility is described as accuracy of reading in time following the definition of Fitts. Another aspect of the research is that it is based on a large number of judgments with a small number of highly practiced subjects. (See also PB 136 724)

Pennsylvania State U., University Park.
HUMAN ENGINEERING INVESTIGATION OF AIRCRAFT COCKPIT VISUAL DISPLAYS. THE EFFECTS OF CONTRAST, COLOR, AND VIEWING ILLUMINATION ON THE LEGIBILITY OF LETTERS AND NUMERALS, by Alec J. Slivinske and Lloyd M. Crumley. Rept. on Contract N156s-32041. 27 Feb 57, 15p. 3 refs. TED NAM AE-7047, Pt. 16a; NAMC-ACEL-329; AD-129 107.
Order from LC mi$2.40, ph$3.30 PB 146 505

This experiment was conducted to investigate the effects of contrast, color, and viewing illumination on the legibility of printed letters and numerals. A previous study (PB 146 507) was made of the effects of the same variables on dial-scale reading. Taken together, the two studies provide some initial data on the effectiveness of interior color and lighting of cockpits on the legibility of dials and panel displays. (See also PB 146 507)

Personnel and Training

Adjutant General's Office, Washington, D. C.
RELATIONSHIP OF AFQT TO RATED BASIC TRAINING PERFORMANCE, by A. G. Bayroff, Leonard C. Seeley, and Alan A. Anderson. Feb 60, 14p. 1 ref. PRB Technical research note 106.
Order from LC mi$2.40, ph$3.30 PB 147 055

To evaluate the effectiveness of the Armed Forces Qualification Test (AFQT) in determining mental qualification for military service and to determine its usability for screening men on differential aptitude requirements of the Army, AFQT whole and part scores of 498 enlisted men in the 8th week of basic combat training were correlated with quality of performance as rated by fellow squad members and cadre. Total AFQT score correlated .44 with mean 7-point criterion rating. Validity coefficients of AFQT subtests had a range of .30 to .40, not appreciably different from that of Army Classification Battery tests used as reference variables for this study. No basic change in AFQT content was indicated. (Author)

Applied Psychology Panel, Office of Scientific Research and Development.
HUMAN FACTORS IN MILITARY EFFICIENCY; APTITUDE AND CLASSIFICATION. Summary technical rept. vol. 1, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 306p. 195 refs.
Order from LC mi$11.10, ph$47.10 PB 139 780

Contents:
Selection of military specialists
Classification of military personnel
Psychological principles in the development and evaluation of classification methods and devices.

Human Resources Research Office, George Washington U., Washington, D. C.
WHAT HUMRRO IS DOING, JULY 1948-JUNE 1959. Apr 60, 67p. 33 refs. Research Bulletin 7.
Order from LC mi$3.90, ph$10.80 PB 147 429

Using the methods of scientific research to improve the soldier's training, motivation, and leadership has been the mission of the Human Resources Research Office. The focus continues to be upon the human element amid increasingly complex instruments of war. This sixth issue of What HumRRO Is Doing reviews some of the work completed or under way during the 1959 fiscal year. It describes ways in which principles of learning have been applied to the practical problems of Army instruction, and in which experimental research techniques have contributed toward raising the soldier's proficiency and lowering the costs of his training in time and materiel. It also shows the dynamic manner in which factual data gathered during research programs may sometimes be applied successfully to practical situations while studies are still in progress.

Office of Naval Research, Washington, D. C.
TRI-SERVICE CONFERENCE ON JOB QUALIFICATIONS ANALYSIS, WASHINGTON, D. C., MAY 27-28, 1959. PROCEEDINGS. [1959] 74p. 12 refs. ONR Symposium rept. ACR-41, AD-233 145.
Order from LC mi$4.50, ph$12.30 PB 142 894

Contents:
Navy
- Naval organization for job qualifications research
- Enlisted job qualifications research
- Officer job qualifications research
- Qualifications analysis - the man side
- Job qualifications research on weapons systems not yet operational

Air Force
- Job qualifications analysis in the USAF
- The use of aptitude tests in the initial classification of Air Force military personnel

Army
- Army presentation on qualifications analysis
- Enlisted qualifications analysis
- Officer qualifications analysis
- Qualification analysis of aptitudes for Army jobs
- Qualifications analysis for training

Psychology

Applied Mathematics and Statistics Labs., Stanford U., Calif.
BEHAVIORISTIC FOUNDATIONS OF UTILITY, by Patrick Suppes. Technical rept. no. 23 on Contract Nonr-225(17). 27 July 59, 29p. 18 refs. AD-225 157.
Order from LC mi$2.70, ph$4.80 PB 147 096

The extent to which behavioristic foundations can be supplied for utility is discussed. The fundamental assumptions are given of the stimulus sampling learning theory in terms of the concepts of stimulus, response, and reinforcement. This theory is then used to derive a utility function for various simple choice situations. This derived utility function is for stochastic choice behavior. The results are then related to the concept of entropy of Shannon (The Mathematical Theory of Communications. Univ. of Ill. Press, Urbana, 1949) and to the choice axiom of Luce (Individual Choice Behavior, Wiley, N. Y., 1959).

Applied Psychology Research Unit, Cambridge (Gt. Brit.).
RESEARCH ON REVERSIBLE PERCEPTION OF SPEECH SOUNDS, by Richard M. Warren. Final rept. on Contract AF 61(052)184. 30 Sep 59, 26p. 3 refs. AFOSR-TR-59-148; AD-232 057.
Order from LC mi$2.70, ph$4.80 PB 146 098

The principal findings are: (1) Verbal transformations were obtained with all the repeating experimental stimuli, varying in complexity from 2 speech sounds to complete sentences. (2) Repeating speech made indistinct by masking noise produced fewer transitions and fewer different forms than the same recording heard clearly. (3) When loudness of speech was sufficient to insure clarity, further increase in loudness seemed to have little effect on verbal transformations. (4) Repeating unfamiliar words tended to be distorted in the first (and subsequent) forms into familiar words. (5) The combined data for all words show that the rate at which words were called out was the same for each minute of the 3 min. test period. (7) Previous stimulation by a word of closely related phonetic structure was followed (even after a few days) by responses related to the previous word. Other experimental findings are reported, and the phonetic and semantic characteristics of verbal transformations are discussed. A hypothesis is suggested which considers that verbal transformations result from the application of mechanisms underlying normal speech perception to the special conditions of repeating words.

Army Medical Research Lab., Fort Knox, Ky.
BIBLIOGRAPHY OF RESEARCH REPORTS IN PSYCHOPHYSIOLOGICAL STUDIES, 1955-1958, by Philip I. Sterling. 16 Mar 59, 17p. 143 refs. Rept. no. 359.
Order from LC mi$2.40, ph$3.30 PB 147 456

This report consolidates the research information provided under the support from the U. S. Army Medical Service from 1955 through July 1958. (Author)

California U., Los Angeles.
A FURTHER STUDY OF METHODS OF TRAINING FREE ASSOCIATION ORIGINALITY AND UNUSUAL USES, by Irving Maltzman, David Raskin, and Seymore Simon. Technical rept. no. 2 on Contract Nonr-233(50). Apr 59, 11p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 146 051

The purpose was to further explore possible relevant variables and alternative methods for facilitating originality. In the first experiment an attempt was made to determine whether two different methods of presenting uncommon associations to Ss would also facilitate the originality of their subsequent responses The second experiment is concerned with the effects of varying amounts of training, and was conducted as a result of some of the findings obtained in the first experiment.

Cognitive Operations Lab., Bethany Coll., [W. Va.]
CONCEPT IDENTIFICATION AS A FUNCTION OF NUMBER OF RELEVANT DIMENSIONS, by Wilbert S. Ray. Technical rept. no. 3 on Contract Nonr-2315(00). July 59, 19p. 13 refs. AD-220 051.
Order from LC mi$2.40, ph$3.30 PB 147 078

Several studies of concept formation have dealt with difficulty of acquisition as a function of the number of elements in the concept. Archer, Bourne and Brown (1955) find that difficulty increases with the number of irrelevant dimensions. Other experiments, such as those of Bruner, Goodnow and Austin (1956) and of Hovland and Weiss (1953), suggest that difficulty increases with the number of relevant dimensions, but none of these investigations has held constant the number of irrelevant dimensions. In the work reported here the number of irrelevant dimensions was held constant at zero.

Cognitive Operations Lab., Bethany Coll., [W. Va.]
ON THE INFLUENCE OF "CONGRUITY" ON THE SEARCH MECHANISM IN PROBLEM SOLVING, by Wilbert S. Ray. Technical rept. no. 2 on Contract Nonr-2315(00). July 59, 21p. 14 refs. AD-219 081.
Order from LC mi$2.70, ph$4.80 PB 147 080

The relationships which are the object of problem solving hold between 2 or more elements. Those elements which the problem solver considers first may be called congruous. Several conditions making for congruity are suggested, and 3 experiments investigating those conditions are described. The first experiment showed effects of cultural habits and of a bias produced by instructions, but failed to show any effect of visible similarity, or of familiarity with elements as occurring in pairs. The latter 2 variables appeared in a second experiment, but the first 2 disappeared. The third experiment attempted to make nonsense syllables similar by giving them similar meanings, and then transferred these syllables to an apparatus task to see whether the meanings would affect the order in which Ss used the switches of the apparatus. They did not do so. (Author)

Illinois U., Urbana.
INTERPERSONAL PRECEPTION AND INTERPERSONAL RELATIONSHIPS IN THERAPEUTIC COUNSELING, by J. McV. Hunt. Annual rept. no. 1 on Contract Nonr-1834(11). 15 Nov 57, 50p. 14 refs. AD-150 620.
Order from LC mi$3.30, ph$7.80 PB 137 981

The first section describes an analysis of the interpersonal preception scores obtained from the clients and counselors in the program of research on therapeutic counseling at the University of Illinois and an initial attempt to relate them to various measures of outcome in a test of their promise for use in further investigation. The second section describes the results of the factor analysis of the items of the Ewing Personal Rating Form. The third section is a working paper which outlines the results of this test of the independence of interpersonal perception scores of the content of descriptive items. It also presents a mathematical break-down of one of these scores, and tests the meaning of the components on a highly exploratory basis with two factors in 10 cases.

Institute for Research in Social Science, U. of North Carolina, Chapel Hill.
ANNUAL TECHNICAL REPORT. Rept. on Contract Nonr-855(04). Nov 57, 19p. 12 refs. AD-147 203.
Order from LC mi$2.40, ph$3.30 PB 146 046

Studies which are directed toward further understanding the determinants of various interpersonal behaviors are summarized.

Maryland U., College Park.
AN ASSOCIATIVE FACTOR IN THE CONSTRUCTION OF SENTENCES, by Charles N. Cofer. Technical rept. no. 25 on Learning, Retention and Recovery of Meaningful Material, Contract Nonr-595(04). July 59, 8p. 4 refs. AD-220 521.
Order from LC mi$1.80, ph$1.80 PB 147 071

Subjects were asked to choose one of two words to go with another word (A-word) in a sentence. It was hypothesized that choice would favor the one of the two words which was a higher associate, according to free association norms, of the A-word. The over-all results did not conform to this expectation. Analyses of items whose results did fit this expectation and of items which did not was carried out. Among the positive items, the high-frequency response to the A-word was also found (in the norms) to elicit the A-word as a frequent associate. In the negative instances, either both of the A-word associates or its less frequent associate elicited the A-word as an associate, according to the norms. Although the associative data are too scarce to permit a confident generalization, these findings suggest the significance of bidirectional associations in a choice situation of this kind. It was also pointed out that paradigmatic and syntamatic relations among the words are probably factors in choice. (Author)

Maryland U., College Park.
AN EXPLORATION OF CLUSTERING IN THE RECALL OF NOUNS EMBEDDED DURING PRESENTATION IN SENTENCES, by Charles N. Cofer and Erwin Segal. Technical rept. no. 27 on Learning, Retention and Recovery of Meaningful Materials, Contract Nonr-595(04). July 59, 7p. 6 refs. AD-220 523.
Order from LC mi$1.80, ph$1.80 PB 147 074

A procedure is described for studying the effect of a sentence context on clustering in nouns. Twenty-four nouns were selected, 6 from each of 4 categories: occupations, articles of clothing, articles of furniture, and 4-footed animals. The six nouns for each category were selected from those which, according to the norms of Cohen, Bousfield, and Whitmarsh (Psychol. Rep. 4:39-44, 1958), were frequent associates to the category names. Six sentences were made up, all having very similar structures, and each sentence contained one noun from each of the 4 categories. The sentences were to the subjects of the experimental group. In order to provide control data for the recall of the nouns from the sentences, the 24 nouns were formed into 2 lists. In one the sequence of nouns was random, and in the other it was the same as it was in the sentences. An experiment was conducted to try this method. Findings indicated that recall of words is significantly impaired in the sentence condition at both immediate and delayed recalls. (See also AD-220 521, AD-220 522)

Maryland U., College Park.
CERTAIN MODIFIER EFFECTS WITH NOUNS VARYING IN DEGREE OF CLUSTERING TENDENCY by Charles N. Cofer and Erwin Segal. Technical rept. no. 29 on Learning, Retention and Recovery of Meaningful Materials, Contract Nonr-595(04). July 59, 8p. 6 refs. AD-220 525.
Order from LC mi$1.80, ph$1.80 PB 147 072

Two experiments are described. The purpose of the first experiment was to determine whether inappropriate modification would affect the recall and clustering of strongly clustering nouns to an extent greater than it would effect these measures in weakly clustering nouns. The second experiment also examined the effects on strongly and weakly clustering nouns of a variable found in previous studies to reduce recall and clustering. This variable is the specificity with which adjectives modify their nouns. Results indicated that the specificity adjectives, like the inappropriate ones, tend to reduce clustering and recall in strongly clustering nouns, although the effects are not as great as expected. The weakly clustering nouns were affected less by the specificity effect than were the strongly clustering nouns. The effects of inappropriate modification were greatest in the strongly clustering words, which was contrary to expectations.

Maryland U., College Park.
INAPPROPRIATE MODIFICATION OF NOUNS IN A FACILITATION DESIGN, by C. N. Cofer and Erwin Segal. Technical rept. no. 28 on Learning, Retention and Recovery of Meaningful Materials, Contract Nonr-595(04). July 59, 6p. 6 refs. AD-220 524.
Order from LC mi$1.80, ph$1.80 PB 147 073

The present study investigates the possibility that the effects of inappropriate modification might be offset to some extent if inappropriate modification could be accomplished in the facilitation design.

Michigan U., Ann Arbor.
ATTITUDE CHANGE PROJECT. Annual rept. for 15 Nov 57-31 Jan 58 on Contract Nonr-1224(10). 1 Feb 58, 6p.
Order from LC mi$1.80, ph$1.80 PB 137 804

A theory on the relation of structure to perception has been sketched; experimental studies of opposites structure have been continued; and an investigation of attitude change and the generalization of that change within a structure based on associative linkages has been carried out.

[Northwestern U., Evanston, Ill.]
FACTORS INFLUENCING THE LEARNING AND RETENTION OF VERBAL MATERIALS, by Benton J. Underwood. Final rept. on Contract N7onr-450(08). 6 July 59, 3p. 26 refs.
Order from LC mi$1.80, ph$1.80 PB 147 081

The results of studies dealing with the effect of intertrial interval and interacting variables have been published as a series in the Journal of Experimental Psychology. Work on distributed practice led to problems not directly associated with the role of distribution. Publications are listed which represent efforts on these problems.

Psychological Research Associates, Arlington, Va.
PREDICTION OF ADVANCED LEVELS OF PROFICIENCY IN A COMPLEX TRACKING TASK, by James F. Parker, Jr. and Edwin A. Fleishman (Yale U.). Rept. on Human Factors in the Design of Training Equipment, Contract AF 41(657)64. Dec 59, 63p. 23 refs. WADC Technical rept. 59-255.
Order from OTS $1.75 PB 161 734

Two hundred three Air Force ROTC subjects were administered a large battery of printed and apparatus psychomotor reference tests from which 50 scores were taken. Following administration of the reference tests, subjects devoted 17 sessions distributed over a six-week period to practice on a complex tracking task. The matrix of intercorrelations among these scores was factor analyzed and 15 ability factors identified. An analysis then was conducted of the extent to which variation in performance in tracking at the different stages of practice could be accounted for in terms of the identified ability factors. The ability factors accounted for in terms of the identified ability factors. The ability factors accounted for only a small portion of the variance in tracking performance. Hypotheses are offered concerning the selection of a different set of reference measures which might be more effective. The analyses of these data do indicate, however, that the prediction of terminal tracking proficiency is better accomplished through a set of external measures than through initial scores taken directly from the tracking task. Early proficiency on the task itself was unrelated to terminal proficiency. (Author)

Research Center for Human Relations, New York U., N. Y.
GROUP EFFECTS ON TENSION PATTERNS AND MOTIVATION, by Murray Horwitz. Technical rept. no. 1 on Contract Nonr-285(28). Apr 59, 18p. 2 refs. AD-218 364.
Order from LC mi$2.40, ph$3.30 PB 146 049

The experiment described here is designed (a) to engage S in unpleasant tasks, (b) to induce social pressures upon S to deny his aversive feelings, (c) to examine effects upon muscle tensions. The results are reported in two parts: (a) evidence as to how well the experimental manipulations "took"; (b) effects on tensional activity.

Rutgers State U., New Brunswick, N. J.
HOMEOSTASIS THEORY OF SMALL GROUPS, by F. K. Berrien and William H. Angoff. Technical rept. on Contract Nonr-404(10). Dec 57, 26p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 137 996

The purpose of this research program is to test the usefulness of the concepts of homeostasis and equilibrium as they may be applied to small group phenomena. A detailed statement of the theory and pertinent literature bearing upon it is summarized. (See also PB 142 092)

Washington U., Seattle.
THE PREDICTION OF COLLEGE SUCCESS FROM BIOGRAPHICAL DATA AND SELF-RATINGS, by Wolf-Ulrich J. Hebenstreit. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3) July 59, 40p. 16 refs. AD-220 239.
Order from LC mi$3.00, ph$6.30 PB 147 098

An attempt was made to determine whether items from the Personality Data Inventory (PDI) would correlate with the obtained Grade Point Average (GPA), and to determine the effect on scale validity of adding items of progressively decreasing item validity. Results indicated that 10 of the 33 items selected by the judges as probably predictive of GPA were found to be significantly correlated with GPA. The addition of less valid items did not have the expected effect; i.e., there was no evidence that the original validity coefficients has been spuriously high because of capitalizing on chance differences in the original sample.

Washington U., Seattle.
PRELIMINARY STEPS IN THE CONSTRUCTION OF FACTOR SCALES FOR THE MMPI, by Hayden LeRoy Mees. Rept. on Contracts Nonr-477(08) and Public Health Research Grant M-743(C3). July 59, 120p. 19 refs. AD-219 936.
Order from LC mi$6.00, ph$18.30 PB 147 090

A study is presented of the problems considered preliminary to the construction of factor scales for the Minnesota Multiphasic Personality Inventory (MMPI). These problems are: (1) finding the dimensionality of a selected set of MMPI items, (2) determining the degree to which these dimensions are similar when the items are used with 2 different populations of subjects, and (3) investigating the relationship between the items

and the dimensions. The results are cited as evidence for the relative invariance and psychological meaningfulness of these 3 factors: (1) a general complaint factor described in terms of serious psychopathology and denoting socially undesirable characteristics, (2) a regressive factor which measures denial of aggressiveness, and (3) factors related to feminine interest patterns. The similarity to results of factor analyses affirms the usefulness and adequacy of the methods used. The approach also provides information about the MMPI items which are directly applicable to the construction of the factor scales.

Willow Run Labs., U. of Michigan, Ann Arbor.
A STUDY OF DECISION MAKING UNDER RISK, by C. H. Coombs and D. G. Pruitt. Rept. on Project Michigan, Contract DA 36-039-sc-78801. Apr 60, 31p. 12 refs. 2900-33-T.
Order from LC mi$3.00, ph$6.30 PB 147 001

The importance of the human being in man-machine systems has made it necessary to study man as he functions in these systems, particularly to determine whether individuals possess any characteristic attitudes that would influence their decisions in risky situations. The present experiment has produced a theory which revises the theory of maximization of expected utility--i.e., that someone faced with alternative gambles will make the choice yielding the maximum average payoff. The revision of this theory suggests that, while he will always prefer more expectation (other things being equal), an individual may have a utility for risk which will exhibit itself as a preference for certain amounts of variance and skewness. The results of this experiment show that for the best results the desirable risk-taking characteristics of an individual should be known and squared with the system in which he operates. If a computer is designed to replace an individual in a decision-making role, the desired risk-taking characteristics must be built into its decision-making component. (Author)

BIOLOGICAL SCIENCES

Army Chemical Corps, Fort Detrick, Md.
USE OF ULTRAVIOLET RADIATION IN MICROBIOLOGICAL LABORATORIES, by G. Briggs Phillips and Everett Hanel, Jr. Nov 59, 391p. 328 refs.
Order from LC mi$11.10, ph$60.60 PB 147 043

The investigational program which is reported here was established because it was desirable first to survey the literature concerning the action and use of UV radiation, and second, to determine experimentally the susceptibility of various types of microorganisms when exposed to radiation under conditions that might be found in the infectious disease laboratory. Finally it was planned to use the assembled data as a guide in developing, designing and testing suitable UV installations for use in the infectious disease laboratory. Germicidal UV radiation is used in industry for protection of personnel and protection of the product. Its uses in this report have been directed primarily toward protection of personnel and test animals.

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. Monthly rept. May 60, 46p. 40 refs. Vol. 1, no. 2.
Order from OTS $0.50, $3.00/6 mos. PB 161 371-1

Contents:
Sect. 1. Milk
Sect. 2. Air
Sect. 3. Water
Sect. 4. Other data
Sect. 5. Abstracts
(See also PB 161 371-1)

Anatomy and Physiology

Air Reduction Co., Inc., Murray Hill, N. J.
CLOSED CIRCUIT RESPIRATION/VENTILATION SYSTEM: PHASE 1. Rept. on Contract AF 33(616)3856. Jan 60, 111p. 61 refs. WADD Technical rept. 60-33.
Order from OTS $2.50 PB 161 747

A literature survey was conducted to determine the physiological requirements of a man supported in an artificial atmosphere. Concurrently, a study was made of the environmental considerations which, combined with the physiological requirements, defined the desired characteristics of a closed circuit respiration/ventilation system. A closed circuit respiration/ventilation system was designed to support a man on a hypothetical twelve hour mission. The design, fabrication, and testing of each component are treated separately and limited results of tests of the assembled system are included. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
CHANGES IN TESTICULAR CHOLESTEROL IN THE SEMICRYPTORCHID AND SEMICASTRATE RAT, by Roger A. Hoffman, Mar 60, 11p. 7 refs. CWLR-2379.
Order from LC mi$2.40, ph$3.30 PB 147 331

Following unilateral cryptorchidism, cholesterol concentration and total amount in the testes undergo rapid changes. After 16 days the scrotal testis maintains normal levels while the abdominal testis shows a gradual decline. No difference was found in the scrotal testis and the remaining testis of the partially castrated rat, suggesting that these two conditions are comparable in so far as gonad cholesterol is concerned. The data suggest that rapid changes in FSH secretion occur following cryptorchidism and that the presence and functional integrity of the advanced germinal elements of the testicular tubules act to regulate pituitary gonadotrophin secretion. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
EFFECT OF 2-PAM ON RETENTION OF P^{32} OF LABELED VE OR VX IN BLOOD AND TISSUES OF THE CAT, by J. H. Wills, A. M. Kunkel and others. Dec 59, 15p. 5 refs. CWLR-2345; AD-231 236.
Order from LC mi$2.40, ph$3.30 PB 146 865

Geiger-Mueller counting of various tissues and urine from anesthetized cats injected intravenously with VE or VX labeled with P^{32} showed that liver, kidney, and lung are especially active in taking up the isotopic label. Administration of either atropine, 1-methyl-2-formylpyridinium iodide oxime (2-PAM), or a combination of atropine and 2-PAM had about the same effects on retention or urinary excretion of P^{32} given as VX. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE EFFECT OF OXYGEN DEPRIVATION ON THE X-WAVE AND B-WAVE OF THE HUMAN ELECTRORETINOGRAM, by J. H. Hill. Rept. no. 13 on Task MR005.13-6002.1. 29 Mar 60, 77p. 40 refs. NADC-MA-6008.
Order from LC mi$4.50, ph$12.30 PB 146 899

The object of this investigation was to determine the effects of oxygen deprivation on the X-wave and the B-wave of the human electroretinogram. The electroretinograms were elicited by ten-second bursts of four-per-second flashes or three-second bursts of twenty-per second flashes of dark red, light red, green, or blue light at three levels of intensity. A burst of flashes was presented at one-minute intervals while the observer breathed air for 12 minutes, a nine per cent oxygen gas mixture for thirty minutes and then air again for twenty minutes. In all, electroretinograms were elicited and recorded in 18 such experimental sessions with two observers. Records obtained from the two observers showed that the amplitude of the X-waves elicited by dark red, light red, green, or blue light at four flashes per second and at twenty flashes per second was reduced when the observer breathed the oxygen-poor gas mixture. The reduction in X-wave amplitude was not found to vary with the spectral composition of the stimulus, but was found to be proportional to the amplitude of the waveform elicited in the initial air-breathing period. The amplitude of the B-wave elicited by the stimuli at four flashes per second was reduced to a lesser extent than the X-wave. When the losses in photopic and scotopic visual sensitivities were estimated from losses in amplitude of the X-wave and the B-wave respectively, the difference between the estimates was found to be insignificant. The relation of these finds to those of previous investigations is discussed. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE EFFECTS OF MODERATE AND LOW LUMINANCES AND VARIOUS DURATIONS OF PRE-EXPOSURE ON DARK ADAPTATION, by Dorothy E. Fletcher. Rept. no. 3 on Project NM 001 110 300. 2 May 57, 36p. 10 refs. NADC-MA-5706; AD-134 621.
Order from LC mi$3.00, ph$6.30 PB 147 585

Monocular dark adaptation data for two observers were obtained with the Hecht-Shlaer adaptometer, fitted with a 2-mm diameter artificial pupil, as absolute thresholds taken by ascending series of the method of limits. After 30 minutes in the dark, the pre-exposure was presented at a luminance of from 0.000608 to 971 millilamberts (mL) and at a duration of from 0.01 to 20 minutes. The white+pre-exposure field was 35° in diameter, centered 10° nasally. The test field was green, 1° in diameter, 10° nasal in retinal location, and 0.02 second in duration. Single-limbed curves described data taken after pre-exposures of from -1.15 to 2.69 log mL-min for one observer and from -1.92 to 2.99 log mL-min for the other. As the product of pre-exposure luminance and duration increased over this range, the dark adaptation curves decreased in acceleration and increased in extent on the time axis and on the log threshold luminance axis. Similar but less extensive and less reliable effects were produced by increasing pre-exposure duration. (Author)

Aviation Medical Acceleration Laboratory, Naval Air Development Center, Johnsville, Pa.
PRELIMINARY STUDY OF DAMPING OF THE OTOLITH ORGAN SYSTEM BY EPICYCLIC ROTATION, by R. F. Gray and D. M. Morway. Rept. no. 10 on Task MR 005.13-6002-1, formerly NM 17 01 12.1. 28 Dec 59, 9p. TED ADC AE-1412; NADC-MA-5919; AD-231 600.
Order from LC mi$1.80, ph$1.80 PB 146 203

An attempt was made to determine the basic validity of the concept that the effects of gravity on the otolith organs can be eliminated by tumbling humans around a horizontal axis through the head. The method of testing this concept was to generate oculogravic illusions in subjects on the centrifuge by letting the direction of the resultant of centrifugal acceleration and gravity change in direction through the man so that his perceived vertical would change. Four subjects were tumbled in the plane of rotation of the centrifuge around a true vertical axis. Results indicated that tumbling does reduce the apparent tilt of the oculogravic illusion generated on a centrifuge. The rate of 30 rpm was not sufficiently high to completely eliminate these illusions. The few seconds at 30 rpm noted as being without oculogravic illusions suggested that a higher tumbling frequency may eliminate these illusions.

George Washington U. School of Medicine, Washington, D. C.
EFFECT OF LIPOTROPIC FACTORS ON COLD PHYSIOLOGY. III. KETONE BODY LEVELS IN THE COLD, by Carleton R. Treadwell. Rept. on Contract AF 18(600)463. Sep 57, 18p. 4 refs. Technical note AAL-TN-57-25; AD-230 835.
Order from LC mi$2.40, ph$3.30 PB 146 241

The effects of protein, fat, and carbohydrate contents of the diet on fat metabolism and especially on the development of ketosis in the cold, including the relation of age, sex, previous diet, and duration of exposure to cold, were investigated. Results indicated that cold is an effective lipotropic agent. No demonstrable requirements were found for lipotropic factors in the cold in rats receiving diets containing up to 40% fat. The principal effect of cold on the lipids of the liver, blood, adrenals, and kidneys was to produce a marked decrease (to normal levels) in the neutral fat fraction. Cold, over a 3-wk period, did not lower the

free or ester cholesterol content of the adrenals, indicating a later adjustment of the animals to the immediate stress of cold. Animals in the cold on high-fat diets can utilize large amounts of fat without a metabolic ketosis. In changing from a low-fat diet to a high-fat diet an immediate response of an increase in the blood lipid fractions was observed both at 25° and at 10°C. During the 3-wk period there is a gradual return to control levels at both temperatures. Animals at 10°C metabolize large amounts of fat without an increase in blood lipids over the levels of comparable animals at 25°C. The data on ketosis in the cold suggests that previous reports of metabolic ketosis were caused by an actual or relative deficiency of calories. (See also PB 146 243)

Medical Research Council (Gt. Brit.)
ADVANCED STUDIES ON THE CORRELATION OF ELECTRICAL RESPONSES OF THE CEREBRAL CORTEX, by R. Efron. Quarterly technical status rept. no. 3 for 1 Nov 59-31 Jan 60 on Contract DA 91-591-EUC-1139, OI-1421-59. Feb 60, 20p.
Order from LC mi$2.40, ph$3.30 PB 147 002

Contents:
Observations on the initially positive extracellularly recorded spike
Observations on the membrane potential of cortical units during induced seizures
Observations on single cortical units following application of strychnine and penicillin

Minnesota U., Minneapolis.
DEVELOPMENT OF A TECHNIQUE TO MEASURE CARBON DIOXIDE OUTPUT BY USE OF DOUBLY LABELED WATER, by Nathan Lifson. Final rept. for 1 Sep 54-31 Aug 57 on Contract Nonr-710(12). 9 Jan 58, 6p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 137 960

Naval Research Lab., Washington, D. C.
SOME METHODOLOGICAL CONSIDERATIONS IN MEASURING VISUAL THRESHOLDS FOR VELOCITY, by R. H. Brown. Interim rept. 21 Apr 60, 14p. 49 refs. NRL rept. 5477.
Order from LC mi$2.40, ph$3.30 PB 145 719

Theoretical analysis and review of literature data indicated the utility of three assumptions: first, that the distribution of responses reported in different experiments as a function of speed involved the effects of random variables; second, that the distribution function of speed in logarithmic units is normal, which assumption was supported by an analysis involving the Bunsen-Roscoe law of photochemistry and by plotting the frequency of velocity discriminations on log probability paper; and third, that the logarithmic-normal distribution function of speed provides for homogeneity of variance when an additional variable is introduced. The third assumption was supported by the conclusion from a review of a group of experiments involving different bivariate distributions of velocity discrimination as a function of field dimensions, luminance, speed during comparative judgments, and mode of observation that the standard deviation is proportioned to the mean of the distributions in speed. (Author)

North American Aviation, Inc., Los Angeles, Calif.
INSTRUMENTATION PACKAGE FOR INFLIGHT PHYSIOLOGICAL STUDIES, by M. N. Goldberg, R. A. Mills, and W. V. Blockley. Final rept. on Physiology of Flight, Contract AF 33(616)5866. Feb 60, 73p. WADD Technical rept. 60-83.
Order from OTS $2.00 PB 161 712

An instrumentation package has been developed for the monitoring of pilot physiological status during flights in the X-15. Data recorded include electrocardiograph signals, respiratory flow rates, skin and deep body temperatures, and helmet-suit and suit-cockpit pressure differentials. Environmental and flight tests were performed to determine the characteristics of the package and to survey subject response during stress. The package is capable of driving a pulse duration modulation (PDM) system for telemetering pressure data. Descriptions of the components and method of use are included. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
CHANGES IN FOOT VOLUME AND CAPILLARY FRAGILITY DURING CONTINUOUS COLD EXPOSURE AND STARVATION, by Paul S. Norman, Marlin B. Kreider, and P. F. Iampietro. Apr 60, 11p. 13 refs. Technical rept. EP-132.
Order from LC mi$2.40, ph$3.30 PB 146 905

The effects of continuous cold exposure (2 weeks at 60°F) and starvation on foot volume and capillary fragility were studied in 6 men. The experimental period was preceded and followed by 2-week periods (Control and Recovery) at 80°F and a caloric intake of 2,400 calories. Foot volumes decreased 6.1 percent in the first 5 hours of cold exposure and remained constant for the remainder of the experimental period. Foot volume was also measured after 3 minutes of elevation of the foot and occlusion of the blood supply. This volume decreased less during the experimental than the preceding or following periods. Capillary fragility decreased slowly during the experimental period and increased in the recovery period. On the third day of recovery, foot volumes were larger than at any other time. For the remainder of recovery, foot volume was the same as the control volume, but there was a greater decrease in volume with foot elevation. The results suggest that there was a constriction of all types of blood vessels during the experimental period, while in the recovery period there was apparently a simultaneous dilatation of large blood vessels and a constriction of small ones. One subject had a greatly increased volume of one foot, associated with pain and redness during early recovery days. These changes may be indicative of early trench foot or capillary damage. Starvation per se appeared to have no effect on foot volume. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
EFFECTS OF HIGH AND LOW HUMIDITY ON HEAT EXCHANGES OF LIGHTLY CLOTHED MEN, by P. F. Iampietro, E. R. Buskirk, and J. A. Vaughan. Apr 60. 10p. 4 refs. Technical rept. EP-131.
Order from LC mi$1.80, ph$1.80 PB 146 904

Six healthy young men were exposed, lightly clothed, to various combinations of wind (<1 and 10 mph), temperature (40 and 50°F) and relative humidity (30 and 100%). Skin and rectal temperatures and oxygen consumption were recorded. The results show that relative humidity had no effect on the physiological responses measured, whereas wind and dry bulb temperature had marked effects. This follows the pattern seen when men were exposed without clothing, and indicates that, under chamber conditions, there is little interaction between clothing and humidity that could account for cold-wet "chill". The importance of considering radiation in any comparison of cold-wet and cold-dry environments is discussed. (Author)

Systems Research Labs., Inc., Dayton, Ohio.
MODEL 16 AUTOMATIC BLOOD PRESSURE MEASURING INSTRUMENT, by Richard A. Johnson. Rept. on Physiology of Flight, Contract AF 33(616)5829. Dec 59, 51p. Research rept. 16-4F; WADC Technical rept. 59-429.
Order from OTS $1.50 PB 161 707

An Automatic Blood Pressure Measuring System for detecting and measuring the arterial diastolic and systolic pressures of a human has been developed. The purpose of this system is to provide physiological information about an individual while he is being subjected to varying conditions of environment and stress. The system is unique in that it uses transistor logic for performing the program functions. It is housed in a compact, portable case and is equipped with a carrying handle. The range of operation is from 100 to 200 mm. of mercury, and the measurement can be automatically repeated at intervals varying from 1 to 15 minutes. (Author)

Tufts [U.] Medford, Mass.
RELATIVE MERITS OF SLOW VERSUS RAPID REWARMING AND INTERNAL VERSUS EXTERNAL REWARMING FOLLOWING ACUTE GENERAL AND LOCAL HYPOTHERMIA. II, by Benjamin G. Covino and Henry E. D'Amato (Arctic Aeromedical Lab.). Rept. on Contract AF 41(657)183. Oct 58, 18p. 3 refs. Technical note AAL-TN-59-4.
Order from LC mi$2.40, ph$3.30 PB 147 286

Research was carried out to determine the physiological response of local body surfaces, e.g. limbs, to subzero air temperatures and to evaluate the relative merits of various rewarming techniques in ameliorating the effects of frostbite. Studies were also made to ascertain the cardiovascular changes which occur during the cooling and rewarming phases of general hypothermia and to evaluate the relative merits of various rewarming techniques. (See also PB 146 238)

Tufts U. School of Medicine, Boston, Mass.
THE EFFECT OF ADRENALECTOMY ON ALBUMIN-PALMITATE-1-C^{14} OXIDATION, by E. J. Masoro, M. D. Valentine, and J. M. Felts. Rept. on Contract AF 41(657)145 and Public Health Research Grant RG 4989. June 58, 11p. 17 refs. Technical note AAL-TN-58-6.
Order from LC mi$2.40, ph$3.30 PB 147 291

The oxidation of albumin-palmitate-1-C^{14} (NEFA) to $C^{14}O_2$ was studied in sham-operated and adrenalectomized rats fasted for 12-18 hours. The $C^{14}O_2$ yield was approximately the same in both animal groups. The conclusion is drawn that the ability of the rat tissues to oxidize long-chain fatty acids is not affected by adrenalectomy. It was found that the $C^{14}O_2$ production from the albumin-palmitate complex is not related either to the size of the animal or to the endogenous metabolism, as shown by the total CO_2 production. (Author)

University of Southern California, Los Angeles.
COMPARATIVE HISTOLOGICAL STUDIES OF THE DIGESTIVE TRACT OF WARM AND ACTIVE AND HIBERNATING ARCTIC GROUND SQUIRRELS, by Sol Bernick and William V. Mayer (Arctic Aeromedical Lab.). Rept. on Contract AF 18(600)843. Sep 58, 13p. 7 refs. Technical note AAL-TN-58-28.
Order from LC mi$2.40, ph$3.30 PB 147 287

As hibernation progresses there is a decrease in both number and activity of the parietal and chief cells of the stomach. During hibernation mitoses in the crypts of Lieberkühn of the small intestine are reduced and are not demonstrable after 3 weeks of hibernation. During this same period the staining property of the Paneth cells is likewise reduced. The colon exhibits a reduction in the mucous of the goblet cells during hibernation. All regions of the digestive tract investigated were essentially normal 24 hours after awakening from hibernation.

Biochemistry

Cincinnati General Hospital, Ohio.
ENZYME ACTIVITY IN HUMAN LIVER, by Leon Schiff and James F. O'Donnell. Rept. for 1 Mar 58-15 Feb 59 on Contract DA 49-007-MD-882. 20 Feb 59, 9p. 10 refs. AD-211 137.
Order from LC mi$1.80, ph$1.80 PB 146 010

Human liver tissue specimens have been obtained at surgery or in some instances at autopsy as soon after death as possible. The acid-soluble fractions of 16 of these liver specimens have been prepared and column chromatography carried out to analyze for the nucleotide components. It has been found that characteristically the triphosphorylated nucleotides are diminished in patients with hepatitis and cirrhosis and in some cases of carcinoma of the liver. Levels of the enzyme ATPase are also being determined on liver specimens and from the five cases studied to date there appears to be increased activity in patients with liver disease. These data fit well with the theory that in liver disease uncoupling of oxidative phosphorylation results in increased levels of ATPase and consequent lowering of the ATP content of liver. (Author)

George washington U. School of Medicine, Washington, D. C.
EFFECT OF LIPOTROPIC FACTORS ON COLD PHYSIOLOGY. I. PRELIMINARY EXPERIMENTS, by Carleton R. Treadwell. Rept. on Contract AF 18(600)463. Sep 57, 19p. 6 refs. Technical note AAL-TN-57-23.
Order from LC mi$2.40, ph$3.30 PB 147 290

Johnson Research Foundation, U. of Pennsylvania, Philadelphia.
PROPERTIES OF ENZYMATIC SYSTEMS, A THEORETICAL AND EXPERIMENTAL STUDY, by Britton Chance. Annual rept. on Contract Nonr-551(15). [1959] 3p.
Order from LC mi$1.80, ph$1.80 PB 145 048

The purpose of this research program is to obtain precise mathematical formulation of mechanisms representing enzyme reactions and to compare these with the results of direct experiments on the same system. This report emphasizes the use of the digital computer.

School of Aviation Medicine, Brooks AFB, Tex.
EFFECTS OF CORTICOTROPIN ON EXCRETION RESPONSES OF RATS ACCLIMATED TO VARIOUS ENVIRONMENTS, by Henry B. Hale and Roy B. Mefferd, Jr. Aug 59, 27p. 18 refs. Rept. 59-81; AD-229 895.
Order from LC mi$2.70, ph$4.80 PB 146 148

The effects of corticotropin (ACTH) in low dosage on metabolic responses of male rats acclimated to cold, neutral, or hot environments or to low barometric pressure were determined. Determinations included urinary Na, K, Ca, P, Mg, urea, uric acid, creatinine; creatine, taurine, β-alanine, glycine, α-alanine, valine, methionine, serine, threonine, tyrosine, glutamic acid, aspartic acid, lysine, arginine, histidine, glucose, glucuronic acid, phenolic acids, and coproporphyrin. Fecal determinations were made for coproporphyrin, protoporphyrin, and deuteroporphyrin. The metabolic responses studied were those which occurred when the differently acclimated groups of rats were exposed to adverse conditions other than those to which they were acclimated. ACTH augmented certain responses and diminished others. There were some metabolic responses which which were unaffected by ACTH. Environmentally nonspecific effects were identified among these results, and a comparison was made between two strains of rats. (Author)

School of Aviation Medicine, Brooks, AFB, Tex.
INFLUENCE OF SODIUM CHLORIDE ON FAT FORMATION BY ESCHERICHIA COLI AND CERTAIN OTHER GRAM-NEGATIVE BACTERIA, by Walter Sellers, Roland B. Mitchell, and Harry M. Hughes. Jan 60, 5p. 6 refs. Rept. 60-24.
Order from LC mi$1.80, ph$1.80 PB 146 146

Under a variety of experimental conditions, formation of free fat by Esch. coli was increased by added NaCl. However, addition of NaCl was devoid of effect on fat formation by Ps. aeruginosa, and resulted in decreased fat formation by A. faecalis.

Tulane U., New Orleans, La.
STRUCTURE AND FUNCTION OF CHYLOMICRONS, by Roy H. Turner. Rept. for 1 Sep 50-28 Feb 59 on Contract DA 49-007-md-79. [1958] 23p. 6 refs. AD-212 296.
Order from LC mi$2.70, ph$4.80 PB 146 825

This report summarizes studies of serum lipids, with particular reference to several physiological and pathological influences which modify lipids in the ultracentrifugal fraction of minimum density, (FMD), with respect to its quantity and quality, as described by statistical methods. The results of the studies reported support the hypothesis that large concentrations of triglyceride in postabsorptive serum of humans may reflect one of the metabolic peculiarities which predispose individuals to development of atherosclerosis, and that the predisposition is greater when the fat is carried by beta lipoprotein then when carried by alpha,

General Biology

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
THE ELECTRICAL CONDUCTANCE AND DIELECTRIC CONSTANT OF THE INTERIOR OF ERYTHROCYTES, by H. Pauly and H. P. Schwan. Technical rept. no. 28 on Contract Nonr-551(05). [1958] 84p. 56 refs. AD-219 122.
Order from LC mi$4.80, ph$13.80 PB 147 059

The impedance of erythrocytes of man, beef, sheep, dog, cat, rabbit, and chicken was measured in the range from 0.5 to 250 Mc. The electrical conductance of the interior of the red blood cells was measured between 70 and 100 Mc. The values differ from species to species within the rather limited range from 4.4 to 5.3 mMho/cm. The theoretical value, calculated on the basis of the salt content of the cell, its ion mobility and the volume concentration of hemoglobin, is roughly twice as large as the measured value. As yet there is no quantitative explanation for this discrepancy. This discrepancy is not a typical property of the living red blood cell. After removal of the cell interior into a highly concentrated hemoglobin solution, the conductivity is practically unchanged. This leads to the conclusion that the cell interior behaves -- from an electrical point of view -- like a highly concentrated hemoglobin solution. (Author)

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
THE ELECTRICAL PROPERTIES OF THE MITOCHONDRIAL MEMBRANE, by Helmut Pauly, Lester Packer, and H. P. Schwan. Technical rept. no. 29 on Contract Nonr-551(05) and Public Health Service USPH-1253(C6). [1959] 43p. 31 refs.
Order from LC mi$3.30, ph$7.80 PB 147 060

The electrical capacity of the membrane of rat liver mitochondria is 0.5 to 0.6 μ farad/cm^2. This membrane capacity is obtained from the analysis of the frequency dependence of the admittance of a suspension of swollen mitochondria. In potassium chloride media the mitochondrial membrane capacity does not depend on the ion concentration. The internal conductance of the mitochondria was approximately two times lower than that of the external medium; the same applies if the mitochondria are equilibrated in a medium with a 10-fold difference in potassium chloride concentration. Hence the swollen mitochondria investigated here appear to be able to adjust their internal ion concentration in proportion with that of the external phase. The similarity of the membrane capacity of isolated mitochondria with the range of values

known for other membranes suggests a common molecular structure. The analysis of experimental data suggests an unisotropic electrical behavior of the interior of mitochondria. This unisotropy is readily explained by the existence of internal membranes. (Author)

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
THE RELATIONSHIP OF INTERNAL CONDUCTANCE AND MEMBRANE CAPACITY TO MITOCHONDRIAL VOLUME, by Helmut Pauly and Lester Packer. Technical rept. no. 30 on Contracts Nonr-551(05) and USPH-1253(C6). [1959] 37p. 31 refs.
Order from LC mi$3.00, ph$6.30 PB 147 061

A study was made of the effect of mitochondrial size on the electrical properties of the membrane and the internal conductivity of mitochondria. The dielectric constant and electrical conductivity of suspensions of guinea pig heart mitochondria were examined in the frequency range 5×10^5 to 2.5×10^8 cps. Membrane capacity was calculated to be 1.1 - 1.3 μ Farad/cm^2 and was virtually the same in mitochondria whose surface area was made to vary by a factor of 4 by osmotic means. This finding suggested that some mechanism must exist for the transfer of mitochondrial material into membrane structure during fluctuations in mitochondrial size. The electrical capacity of the membrane was unaffected by a 33-fold change in potassium chloride concentration. The internal conductance of swollen mitochondria was 2-3 times lower than that of the external medium. In contracted mitochondria the internal conductance was virtually independent of the conductivity of the external medium. These results were discussed in relation to current concepts of mitochondrial structure. (Author)

Medical Specialties and Equipment

Army Prosthetics Research Lab., Washington, D. C.
POROUS METAL MOLDS. PART I, by M. J. Fletcher and Fred Whisenhunt. 26 Mar 58, 9p. Technical rept. 5807; AD-160 649.
Order from LC mi$1.80, ph$1.80 PB 145 965

In line with current efforts to obtain a durable, efficient, porous mold for casting latex films, the first attempt has been made to produce a porous metal mold. In general, porous metals have been attained by three means: Powder metallurgy, leaching and plating. This first study has been conducted with brass plating for the leaching operation.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
DESIGN AND CONSTRUCTION OF PHYSIOLOGICAL ELECTRONIC SYSTEMS USING OPERATIONAL AMPLIFIERS, by Freeman W. Cope. Rept. no. 9 on Task MR005.15-0002.7. 7 Apr 60, 9p. 4 refs. Proj. TED ADC AE RS-7045; NADC-MA-6010.
Order from LC mi$1.80, ph$1.80 PB 146 898

The use of operational amplifiers allows the construction of a great variety of physiological electronic systems at minimum cost and with a minimum knowledge of electronics design and with minimum expenditure of time. An operational amplifier in conjunction with 2 or 3 external plug-in resistors or capacitances may be used as a D. C. amplifier, an integrator, or a differentiator. Many more complicated physiological electronics systems may be designed and constructed with comparable ease and at modest cost using operational amplifiers. (Author)

Pathology

Army Chemical Warfare Labs., Army Chemical Center, Md.
STUDIES IN WOUND BALLISTICS: TEMPORARY CAVITIES AND PERMANENT TRACTS PRODUCED BY HIGH-VELOCITY PROJECTILES IN GELATIN, by Mas Krauss and John F. Miller. Feb 60, 30p. 11 refs. CWLR-2340; AD-233 840
Order from LC mi$2.70, ph$4.80 PB 146 863

In the present experiments, caliber .30 and caliber .22 bullets, caliber .30 fragment simulators, and 1/4-in. steel spheres were fired into cylinders of 20% gelatin, some of which were confined in rigid plasticized fiberglass casings. A simple method for approximating the cross-sectional dimensions of the temporary cavity from the cross-sectional dimensions of the permanent missile path in 20% gelatin is described. Experiments with confined gelatin cylinders showed that the temporary cavity can be almost completely suppressed by external constraint of the gelatin. It was shown that energy absorption and momentum transfer in 20% gelatin are independent of temporary-cavity formation. Implications of these findings are discussed. (Author)

University of Southern California, Los Angeles,
THE EFFECTS OF STAGNANT ANOXIA ON THE CAPILLARY CIRCULATION, by Chester Hyman, Sheldon Rosenfeld and others. Rept. on Contract W33-038-ac-19062. Oct 49, 32p. 9 refs. AF Technical rept. no. 5974; ATI-69 292.
Order from LC mi$3.00, ph$6.30 PB 147 385

Based on the present studies, as well as a review of the literature, there is reason to believe that the blood vessels in mammalian muscle and skin are capable of enduring periods of stagnant anoxia in excess of one hour with minimal residual damage. The present studies call attention to the transient alteration in normal fluid equilibrium which occurs during the period of reactive hyperemia, and which results in a limited amount of edema formation. (Author)

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
AEROSOL IMPACTION ON SMALL DIAMETER COLLECTORS, by Donald O. Egner and Donald Campbell. Feb 60, 23p. 4 refs. CWLR-2352.
Order from LC mi$2.70, ph$4.80 PB 146 867

Information is reported pertaining to the collection efficiency of given size droplets on ribbon-like and cylindrical sampling devices having diameters of 1/10 to 1 inch. Methods of determining droplet-size distributions and wind velocities by mass measurements are also discussed. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
EFFECT OF ENVIRONMENTAL TEMPERATURE ON TOXICITY OF GB INTRAVENOUSLY ADMINISTERED, by Harry M. Frankel and William V. Blevins. Jan 60, 9p. 5 refs. CWLR-2348; AD-231 374.
Order from LC mi$1.80, ph$1.80 PB 146 866

Relative lethality of intravenously injected GB at high and low environmental temperatures was compared to room temperature. Results indicated that (1) acute exposure of rats at 4°C decreases the LD50 dose of injected GB; (2) acclimation of rats at 4°C increases the LD50 dose of injected GB; (3) exposure of the rat to 4°C only after injection of GB is more deleterious than exposure only before injection; and (4) neither acute exposure nor acclimation to 34°C alters the LD50 dose for GB from that determined at room temperature. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE RELATIONSHIP OF THE LD50 AND RBC-ChE50 IN GUINEA PIGS EXPOSED TO GB BY THE INHALATION AND INTRAVENOUS ROUTES, by William S. Koon, James W. Crook and other. Feb 60, 27p. 11 refs. CWLR-2342.
Order from LC mi$2.70, ph$4.80 PB 146 864

GB was administered to guinea pigs to determine the inhalation and intravenous LD50 and RBC-ChE50 values. The LD50 value is approximately three times the RBC-ChE50 value for both the inhalation and intravenous routes of administration. The inhalation LD50 and RBC-ChE50 values are approximately twice as large as the corresponding intravenous values. (Author)

Southern Research Inst., Birmingham, Ala.
EVALUATION OF SOME DECONTAMINATION PROCEDURES, by C. E. Feazel. Rept. no. 5 (Final) for 29 Jan 56-28 Feb 57 to Army [Chemical] Warfare Labs. 28 Feb 57, 5p. 4 refs. Rept. no. 3048-740-V; AD-124 736.
Order from LC mi$1.80, ph$1.80 PB 138 234

This final report briefly summarizes the work done during the period January 29, 1956, through February 28, 1957.

Wisconsin U. [Madison.]
ROLE OF SOLVENTS IN PENETRATION OF SKIN BY CHEMICAL AGENTS. I. METHOD OF COLLECTION AND CHARACTERIZATION OF HUMAN SKIN LIPIDS, by James E. Tingstad, Dale E. Wurster, and Takeru Higuchi. Rept. on Contract DA 18-108-CML-5753. [1956] 67p. 63 refs. CWL Technical Memo. 27-8.
Order from LC mi$3.90, ph$10.80 PB 146 830

A procedure has been developed to collect and characterize skin lipids on a substantial scale. Chemical data obtained on the material collected indicate that the nature of the lipids was relatively insensitive to the exact collection method but appeared to vary markedly from donor to donor and quite significantly with season. Evidence is presented which indicate that the collected material actually represent the products of the sebaceous glands and may constitute the major barrier towards skin penetration. A countercurrent distribution study has led to isolation of crystalline components which are at least in part responsible for the observed variation. (Author)

Wisconsin U. School of Pharmacy, Madison.
FINAL REPORT, by Louis W. Busse. Rept. for 24 May 55-30 June 58 on Contract DA 18-108-cml-5753; continuation of Contract DA 18-108-cml-2576. [1958] 264p. 108 refs. AD-235 602.
Order from LC mi$11.10, ph$41.10 PB 146 756

Contents:
Permeation of mechanical barriers by chemical agents (MLCR-32)
Permeation of mechanical barriers by true diffusion (MLCR-56)
Adsorption characteristics of GB from solution (MLCR-58)
The influence of active fillers on the permeability of semi-solids (CWLR-2009)
Theories and relationships dealing with diffusional movement of chemical agents
A new relationship for the dielectric properties of two-phase mixtures (Pub. in Jnl. of Physical Chemistry 62:649-653, 1958)
The thermodynamic activity of sarin in solution (CWL SP-2-16, PB 142 248)
A thermometric method for thermodynamic studies and molecular weight determination in solutions

CHEMISTRY

Analytical Chemistry

Rock Island Arsenal Lab., Ill.
COMPOSITION OF ZINC PHOSPHATE COATINGS, by Jodie Doss. 28 Oct 57, 21p. 9 refs. Rept. no. 57-2612.
Order from LC mi$2.70, ph$4.80 PB 147 432

Determinations were made for phosphate (PO_4), zinc (Zn) and iron (Fe) in zinc phosphate coatings formed in four different solutions after various processing times. The percent of phosphate (PO_4), zinc (Zn) and iron (Fe), found in zinc phosphate coatings remains approximately the same regardless of the processing time, the accelerator used, or the operating condition of the phosphating solution. The coatings were found to contain approximately 40.8 percent phosphate (PO_4), 12.3 percent iron (Fe), and 32.3 percent zinc (Zn). The sum of the above percentages was found to be approximately 85.4 percent. The remaining 14.6 percent of the coating was presumed to be water. (Author)

Tennessee U., Knoxville.
FLAME PHOTOMETRIC STUDY OF BORON [AND] FLAME PHOTOMETRIC DETERMINATION OF ELEMENTS ASSOCIATED WITH BORON IN BORON CONTAINING COMPOUNDS. PART I: COPPER, by John A. Dean, Morton Salkind, and Clarice Thompson. Final proj. rept. on Subcontract [NOa(s) 52-1023]. June 54, 53p. 16 refs. MCC-1023-TR-59.
Order from LC mi$3.60, ph$9.30 PB 147 017

This investigation describes the application of the flame photometer to the rapid, routine determination of boron. The method should be of particular interest to those laboratories that are concerned with borohydrides and other boron containing compounds. The flame photometric procedure offers a rapid instrumental means of determining boron compared to conventional distillation methods and is particularly applicable to the processing of a large number of samples. Determinations of boron by means of the green flame coloration are discussed by Stahl and applied to agricultural materials by McHargue, McHargue and Calfee, Calfee and McHargue, and Weber and Jacobson. These workers used either visual methods or photographic recording in conjunction with a spectrograph.

Inorganic Chemistry

Office of Technical Services, Dept. of Commerce, Washington, D. C.
RARE EARTH ELEMENTS (1940-1960). Mar 60, 20p. 533 refs. OTS Selective Bibliography 404.
Order from OTS $0.10 OTS SB-404

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed include research on light and heavy rare earth elements, their metals, alloys, and compounds, as well as the hazards involved in handling.

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by W. C. Schumb and C. N. Satterfield. Quarterly periodic status rept. on Contract Nonr-1841(11). 31 Mar 59, 25p. AD-214 607.
Order from LC mi$2.70, ph$4.80 PB 146 034

Covers the following:
Stability studies
Heterogeneous catalysis in liquid hydrogen peroxide
Burning velocities of the H_2O_2 decomposition flame at low pressures
Stability of hydrogen peroxide to radiation
Hydrogen peroxide from the partial oxidation of propane in a porous-walled reactor
(See also PB 143 934)

Organic Chemistry

Aerojet-General Corp., Azusa, Calif.
CHAIN-TRANSFER OF NITRO COMPOUNDS IN POLYMERIZATION REACTIONS, by T. R. Fukuto and J. P. Kispersky. Rept. on Contract N7onr-462, T.O. 1. 25 May 53, declassified 20 Apr 60, 38p. 47 refs. Rept. no. 700 (Special).
Order from LC mi$3.00, ph$6.30 PB 147 271

The chain transfer constants for 12 aliphatic nitro compounds and a nitrate ester with methyl methacrylate were found to vary from $< 10^{-4}$ to 1. Several possible mechanisms for the transfer reaction are discussed. The inhibition of methyl methacrylate polymerization is reported. The reason for the inhibition is believed to be the formation of NO_2. Attempts to determine the chain-transfer constants of the nitro compounds with styrene and vinyl acetate were unsuccessful. The polymerization of 2,2,2-trinitroethyl methacrylate using various initiator concentrations gave a polymer with a constant molecular weight, corresponding to a $\overline{P}_n$ of about 12.

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
EFFECT OF CIS-TRANS ISOMERISM ON THE UREA INCLUSION COMPOUND FORMING-ABILITY OF A MOLECULE: A STUDY OF THE MALEATE-FUMARATE SYSTEM, by Jack Radell, Joseph W. Connolly, and William R. Cosgrove, Jr. Feb 60, 13p. 9 refs. WADC Technical note 59-407.
Order from OTS $0.50 PB 161 730

Several maleates and fumarates were investigated to determine their ability to form urea inclusion compounds. Olefinic esters of both acids will form inclusion compounds. However, the shortest chain required to stabilize a particular ester was related to the over-all cross-sectional diameter of the ester. The fumarates, having the more slender conformation form complexes more readily than the maleates. (Author)

Brussells Free U. (Belgium).
THE MECHANISM OF THE PHOTOCHLORINATION OF SIMPLE CHLORINATED HYDROCARBONS, by S. Dusoleil, P. Goldfinger and others. Final technical rept. on Contract DA 91-591-EUC-994. Dec 59, 78p. 36 refs.
Order from LC mi$4.50, ph$12.30 PB 147 435

The number of parameters measured in the reaction system Cl_2, C_2Cl_4, C_2HCl_5 leading to a unique set of elementary rate constants seems to settle definitely the mechanism of this reaction between room temperature and 500°K. It leads to a general outlook on the mechanism of the photochlorination of more or less chlorinated simple hydrocarbons. (Author)

Carbon Research Lab., U. of Buffalo, N. Y.
INVESTIGATION OF ELASTIC AND THERMAL PROPERTIES OF CARBON-BASE BODIES, by S. Mrozowski, J. F. Andrew and others. Rept. for May 58-June 59 on Ceramic and Cermet Materials, Contract AF 33(616)5186. Mar 60, 93p. 21 refs. WADC Technical rept. 58-360, Pt. 2.
Order from OTS $2.25 PB 161 733

In continuation of the work four basic types of carbon were prepared from (1) soft filler and soft binder, (2) soft filler and hard binder, (3) hard filler and soft

binder, (4) hard filler and hard binder. Elastic moduli, permanent set, shrinkage and density; electric resistivity and thermal expansion coefficient were investigated in dependence on heat treatment temperature and also the variation of the heat conductivity and electrical resistivity on ambient temperature in the range 1200-3000°C. An apparatus for direct determination of the heat diffusivity in the temperature range 100-700°C was set up and reasonably good data for the diffusivity coefficient obtained. Studies of ultra-attenuation show that the decay in intensity of transmitted waves is due to: (1) energy losses due to hysteresis effect present for all wavelengths, (2) scatter of waves by pores, observable only when the wavelength becomes shorter than 10 particle diameters. A discussion of the merits of various types of carbons closes the report. (Author)

Cornell U., Ithaca, N. Y.
NONIONIC DETERGENTS IN NONAQUEOUS SOLVENTS 1: THE BEHAVIOR OF α-MONOGLYCERIDES (Cont'd), by P. Debye and H. Coll. Technical rept. no. 2 on Contract Nonr-401(17). 15 May 59, 45p. 28 refs.
Order from LC mi$3.30, ph$7.80 PB 146 513

The behavior of α-monoglycerides (α-monoesters of glycerin and fatty acids with chains from 10 to 18 carbon atoms) has previously been studied in this laboratory, and the results have been communicated. These results formed the basis for the present investigation. Most important was the conclusion that light scattering showed the formation of clusters containing 20 to 70 monomers of monoglycerides in benzene, and that hydrogen bonds are effective in this association. In the presence of certain impurities, other than water, the clusters appeared to expand, as evidenced by higher intensities of scattered light. Likewise, the clusters appeared to be smaller in chlorobenzene, and also smaller in the case of esters with longer fatty acid chains.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
INVESTIGATION OF SYNTHETIC METHODS FOR PREPARING THE FLUORO DERIVATIVES OF SYMMETRICAL TRINITROBENZENE, by Victor L. Siele and Harold J. Matsuguma. Apr 60, 20p. 19 refs. Technical rept. 2682.
Order from LC mi$2.40, ph$3.30 PB 145 510

Three synthetic reaction schemes leading toward the preparation of fluoro-2, 4, 6-trinitrobenzene, 1, 3-difluoro-2, 4, 6-trinitrobenzene, and 1, 3, 5-trifluoro-2, 4, 6-trinitrobenzene have been investigated. The methods employed involved: (a) the nitration of fluorobenzene, 1, 3-difluorobenzene, and 1, 3, 5-trifluorobenzene; (b) the replacement of chlorine in chloro-2, 4, 6-trinitrobenzene, 1, 3-dichloro-2, 4, 6-trinitrobenzene, and 1, 3, 5-trichloro-2, 4, 6-trinitrobenzene with fluorine by indirect fluorination; and (c) the replacement of the hydroxyl groups in picric acid, styphnic acid, and trinitrophloroglucinol with fluorine, using phosphoryl fluoride as the fluorinating agent. Attempts to prepare these compounds have been unsuccessful. It has been shown conclusively that the fluoro derivatives of trinitrobenzene cannot be prepared by the nitration or phosphoryl fluoride approaches. The halogen exchange method deserves further consideration, since in a few isolated experiments exchange was apparent. A more active potassium fluoride, namely potassium fluorosulfinate, will be investigated as a possible exchange reagent. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
SINGLE-POINT DETERMINATION OF INTRINSIC VISCOSITY, by Marie C. Orsini, Richard J. Valles, and David W. Levi. May 60, 4p. 11 refs. Technical rept. 2687.
Order from LC mi$3.30, ph$7.80 PB 146 400

Intrinsic viscosities of stereoregular polybutene-1 fractions were determined in decalin at 115°C. Use of the Hart rearrangement of the Schulz-Blaschke equation at specific viscosities below 1 made it possible to calculate intrinsic viscosities from single-point determinations after estimation of N in the equation from complete intrinsic viscosity data on three or more fractions. The single-point procedure for low specific viscosities was applied to data previously obtained for a series of alkyl methacrylate polymers in good and in poor solvents. In every case the agreement between experimental and calculated values was found to be reasonably good, generally falling within the range of the experimental error. At higher specific viscosities N appeared to depend on η_{sp} as observed by Hart, although the data was somewhat limited. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
THERMOANALYTICAL CHARACTERIZATION OF SEVERAL QUINOL CLATHRATE COMPOUNDS, by Martin Gilford and Saul Gordon. Mar 60, 27p. 13 refs. Technical notes no. 41.
Order from LC mi$2.70, ph$4.80 PB 145 517

Quinol host clathrates of sulfur dioxide, carbon dioxide, and methanol have been prepared following methods appearing in the literature. The stoichiometry of the prepared complexes has been established. The techniques of differential thermal analysis (DTA) and thermogravimetry (TGA), under ambient and reduced pressures, have been applied in a study of their thermally induced decomposition. Endothermal behavior has been found to attend the breakdown of the clathrate complex with escape of the included guest species. This decomposition occurs at temperatures 10 to 86 degrees below the melting point of the quinol host, which is 173.5°C. The pressure dependency of this breakdown has been established by both DTA and TGA techniques. Application of hot-stage microscopy has given evidence of the temperature range over which decomposition occurs. (Author)

Massachusetts U., Amherst.
O-ACYLHYDROXYLAMINES. I. SYNTHESIS OF O-BENZOYLHYDROXYLAMINE, by Louis A. Carpino, Chester A. Giza, and Barbara A. Pepe. Rept. on Contract AF 18(603)114. 16 Sep 58, 14p. 15 refs. AFOSR-TN-58-759; AD-201 857.
Order from LC mi$2.40, ph$3.30 PB 137 691

O-Benzoylhydroxylamine has been synthesized by taking advantage of the ease of cleavage of the carbo-t-butoxy group. The hydrochloride was obtained analytically pure whereas the free base was found to be an unstable oil which suffered O- to N rearrangement of the benzoyl group. (Author)

Shell Development Co., Emeryville, Calif.
POTENTIAL CW AGENTS. TASK 3. ANALOGS OF TETRAHYDROCANNABINOL, by D. E. Winkler and R. R. Whetstone. Final rept. on Contract [DA 18-108-]cml-4564. 30 Apr 54, declassified 5 Feb 58, 11p. 5 refs. S-13589; AD-201 570.
Order from LC mi$2.40, ph$3.30 PB 147 365

Analogs of tetrahydrocannabinol in which the 3-alkyl group, the 5-oxygen or the 1-hydroxyl were varied were prepared for evaluation as psychochemical agents. Of particular interest chemically was the extension of the synthesis of such compounds by reaction of pulegone with a m-difunctional benzene to the sulfur and nitrogen heterocyclics. (Author)

Technical U., Trondheim (Norway).
THEORETICAL INVESTIGATIONS USING ELECTRON DIFFRACTION METHODS, by Otto Bastiansen. Annual technical rept. for 1 Apr 58-30 June 59 on Contract AF 61(052)72. 24 July 59, 48p. 10 refs. AFOSR-TN-59-905.
Order from LC mi$3.30, ph$7.80 PB 146 183

Contents:
An electron diffraction investigation of the molecular structure of allene, by Almenningen, O. Bastiansen and M. Traetteberg
Electron diffraction studies of the molecular structure of naphthalene and coronene in the vapour state, by Almenningen, O. Bastiansen and F. Dyvik
Preliminary electron diffraction studies of butatriene, by Almenningen, O. Bastiansen and M. Traetteberg

Physical Chemistry

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
ON SOME UNSTEADY FREE MOLECULAR SOLUTIONS TO THE BOLTZMANN EQUATION, by E. Kornowski. Rept. on Contract AF 04(647)269. Nov 59, 22p. 4 refs. Technical Information Series R59SD463.
Order from LC mi$2.70, ph$4.80 PB 146 820

The unsteady free molecular solutions to the Boltzmann equation are found for the filling of regions whose configurations are a channel, cylinder, and sphere. The density profiles, as a function of space and time, are presented. It is shown that the density profiles obtained for the filling of the cylinder can be applied toward obtaining the density profiles aft of a sphere moving through a rarefied gas.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
INVESTIGATION OF THE HYDROGEN-OXYGEN FUEL CELL, by H. Hunger. 15 Dec 58, 56p. 36 refs. USASRDL Technical rept. 2001; AD 219 732.
Order from LC mi$3.60, ph$9.30 PB 147 388

Results are presented to advance the general knowledge of fuel cells and to provide a basis for the construction of a practical hydrogen-oxygen fuel cell. New information, offered as a result of this investigation, includes the importance of a preliminary CO_2 gas activation on the current carrying ability of the hydrogen electrodes, the theoretical conclusions concerning gas transportation to the reaction zone, and the influence of the wet-proofing treatment on this transportation. These theoretical considerations, amply supported by experiments, present new concepts regarding the choice of electrode carriers and surface qualities of the pores. (Author)

Bryn Mawr Coll., Pa.
FUNDAMENTAL ASPECTS OF THE DIELS-ALDER REACTION, by Harold Kwart, Isabel Burchuk, and Christel Kappes. Technical rept. on Contract [Nonr-018(00)]. 15 June 51, 31p. 29 refs.
Order from LC mi$3.00, ph$6.30 PB 147 129

Various aspects of the theories advanced to depict the mechanism of the Diels-Alder reaction are discussed. Various quantitative measurements are in progress which may permit a decision between alternative suggestions offered in explanation of retrodiene decomposition. Factors that determine the ease of formation and stability of an adduct are being studied. Several observations are reported which point up precise lines of experimentation. A very versatile Diels-Alder system has been prepared and identified and its properties reported for the first time here. The design and construction of a special spectrophotometer is reported, which will enable us to make rapid and accurate measurements of the quantities sought.

Carnegie Inst. of Tech., Pittsburgh, Pa.
THE SPECIFIC HEATS OF $NiCl_2 \cdot 6H_2O$ AND $CoCl_2 \cdot 6H_2O$ BETWEEN 1.4° AND 20°K, by W. K. Robinson and S. A. Friedberg. Technical rept. no. 5 on Contract Nonr-760(05). 20 July 59, 29p. 27 refs. AD-219 870.
Order from LC mi$2.70, ph$4.80 PB 147 088

The specific heats of $NiCl_2 \cdot 6H_2O$ and $CoCl_2 \cdot 6H_2O$ have been measured from 1.4° to 20°K. Lambda-type anomalies were observed at 5.34°K and 2.29°K for $NiCl_2 \cdot 6H_2O$ and $CoCl_2 \cdot 6H_2O$, respectively, associated presumably with antiferromagnetic-paramagnetic transitions. It has been possible in each case to separate out the magnetic contribution to the specific heat and thus to compute the total magnetic entropy gained in the transition from the fully ordered to completely disordered condition. This quantity was found to be given accurately by R ln $(2S + 1)$ with $S = 1/2$ for Co^{++} and $S = 1$ for Ni^{++}. Short range order is particularly pronounced in these substances, the fraction of the total magnetic entropy gained above the Néel point being 0.52 for $CoCl_2 \cdot 6H_2O$ and for 0.40 for $NiCl_2 \cdot 6H_2O$. Other features of the anomalies are discussed. (Author)

City Coll. of the City of New York.
CATHODIC FORMATION OF METAL HYDRIDES, by Bernard Goldschmidt and Hugh W. Salzberg. Technical rept. no. 2 on Arsine Evolution at Arsenic Cathodes, Contract Nonr-1597(02). 9 Jan 58, 15p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 137 956

The overall purpose is the study of hydrogen evolution in acid solutions at low current densities, using chemical methods. The arsenic-arsine system was selected for study since arsine is known to form at low current densities and furthermore, methods for determination of microgram quantities of arsine have been worked out.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
GRAPHICAL COMPUTATION OF SHOCK AND DETONATION WAVES IN REAL GASES, by George H. Markstein. Rept. on Project Squid, Contract Nonr-1858(25). May 59, 16p. 5 refs. Technical rept. CAL-78-P.
Order from LC mi$2.40, ph$3.30 PB 146 447

The conservation relations across a shock or detonation wave are represented in the form of a graph applicable to real gases of arbitrary composition. Computation of shock waves reflected from a closed end is performed by means of another universally applicable graph. (Author)

Cryogenic Lab., Ohio State U. Research Foundation, Columbus.
THERMAL, STRUCTURAL, ELECTRICAL, MAGNETIC AND OTHER PHYSICAL PROPERTIES OF THE GROUP V ELEMENTS: TANTALUM, NIOBIUM (COLUMBIUM) AND VANADIUM, by Esther Richert, C. W. Beckett, and H. L. Johnston. Rept. on Contract W33-038-ac-17721. 1 Dec 49, 64p. 29 refs. ATI-81 819; 102-AC49/11-100.
Order from LC mi$3.90, ph$10.80 PB 147 562

The data on the physical properties of the metals, tantalum, niobium (columbium), and vanadium which have been published in the scientific literature during the period between 1917 and 1948 are summarized in this report. Emphasis has been given to the thermal properties. Thermal functions were calculated for these metals. Other physical properties discussed in this report are melting and boiling points, atomic weight and isotopic constitution, crystal structure, compressibility, thermal expansion, spectral emissivity and electrical properties. (Author)

Fairchild Engine Div., Deer Park, N. Y.
EXPLORATORY STUDIES OF COMBUSTION IN SUPERSONIC FLOW, III. CHEMICAL REACTIONS IN A SUPERSONIC BOUNDARY LAYER. IV. SUPERSONIC FLAME STABILIZATION, by Walter Chinitz and Robert A. Gross. Rept. on Project Squid, Contract Nonr-1858(25). June 59, 26p. 6 refs. Technical rept. FED-1-R-P.
Order from LC mi$2.70, ph$4.80 PB 146 517

This report discusses experiments in the stabilization of flames in supersonic flow and chemical reactions in the boundary layer of a flat plate immersed in a supersonic stream. This research was carried out in the steady-state supersonic tunnel.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EFFECTS OF X-RAY AND GAMMA RAY IRRADIATION ON THERMAL DECOMPOSITION OF SOLID AMMONIUM PERCHLORATE, by Eli S. Freeman and David A. Anderson. Apr 60, 29p. 8 refs. Technical rept. 2673.
Order from LC mi$2.70, ph$4.80 PB 144 527

The low-temperature solid state thermal decomposition of ammonium perchlorate was appreciably enhanced by pre-irradiation with X-ray and gamma ray radiation. This increase in chemical reactivity occurred in three stages, (a) before and during crystalline transition from 200° to 260°C, (b) over the temperature range of 260° to 310°C, and (c) over the temperature range of 310° to 385°C. These results were obtained by differential thermal analysis and thermogravimetric experiments carried out under ambient and reduced pressures at the nominal heating rate of 5°C per minute. The sensitivity of the various stages of reaction to exposure dose, as shown by the relative variation in the parameters of the differential thermal analysis reaction bands, indicates the possibility of using the solid state decomposition of ammonium perchlorate for dosimetry. The decomposition spectrum of samples of sublimed ammonium perchlorate was found to be similar to that of irradiated samples. The effects of impurities formed during irradiation; doping with silver, cupric, and iodide ions; recrystallation; and partial decomposition were also investigated. From microscopic observations, it appeared that there were preferential sites of reaction in the interior of the irradiated crystals. The increased chemical reactivity of irradiated ammonium perchlorate is attributed to positive holes and other defects formed during irradiation which favor the electron transfer mechanism of decomposition. (Author)

Florida U. Engineering and Industrial Experiment Station, Gainesville.
FLUOROCARBON NF COMPOUNDS, by J. A. Young and R. D. Dresdner. Quarterly technical rept. no. 2, 1 Oct-31 Dec 59, on Contract DA 01-009-ORD-772. [1959] 18p. 5 refs. AD-231 426.
Order from LC mi$2.40, ph$3.30 PB 145 716

The electrochemical fluorination of pyridine is described. At a lower voltage than reported heretofore, a much larger yield of the coupled product, dipiperidyl, was obtained. A convenient and efficient method for the production of N_2F_4 has been found, which consists of bubbling NF_3 through heated mercury in a steel reactor. At a temperature of 323°C and a contact time of the order of 30-60 seconds, N_2F_4 was obtained in yields of 60-100% and conversions per pass as high as 60%, on 10 gram runs. Spectral evidence indicated that N_2F_2 was also formed in small quantity. The addition of N_2F_4 to $CF_3CF{=}CF_2$ in a flow system over a CsF surface is under study. Preliminary results show that reaction occurs at 250°, but the products have not yet been identified. Although efforts to prepare $(CF_3CO)_2NBr$ for addition to fluorinated olefins have so far been unsuccessful, it has been found that N-alkyl amides can be added directly to olefins, and a 52% yield of adduct was obtained from $CF_3CF{=}CF_2$ and $CF_3CONHCH_3$. The reaction is currently being extended to the imides $(R_FCO)_2NH$. Indirect fluorination of imides with AgF_2 leads to cleavage of the amide linkage. $(CF_3CO)_2NH$ gave CF_3COF and $CF_3N{=}C{=}O$, while $CF_2(CF_2CO)_2NH$ gave only a solid product, possibly the silver salt of the imide. A possible mechanism for the reaction is described. (Author)
(See also PB 144 131)

Florida U. Engineering and Industrial Experiment Station, Gainesville.
FLUOROCARBON NF COMPOUNDS, by J. A. Young and R. D. Dresdner. Quarterly technical rept. no. 3, 1 Jan-31 Mar 60, on Contract DA 01-009-ORD-772. [1960] 16p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 147 006

Contents:
A laboratory scale preparation of N_2F_4
The reaction of perfluoropiperidine (PPP) with perfluoropropene
Fluorocarbon acyl radical reactions
Indirect fluorination of fluorocarbon nitrogen compounds
Replacement of acyl groups on N_2 by F_2
(See also PB 145 716)

Illinois U., Urbana.
ON THE DETERMINATION OF DIFFUSION COEFFICIENTS IN CHEMICAL DIFFUSION, by R. W. Balluffi. Rept. on Contract AF 18(603)106. 11 Feb 60, 11p. 10 refs. AFOSR-TN-60-239.
Order from LC mi$2.40, ph$3.30 PB 146 444

The equations describing chemical diffusion in the general case where the partial molal volumes of the diffusing components may differ and may vary with composition are reviewed and discussed. The results should replace the standard Darken equations and Boltzmann-Matano analysis.

Illinois U. Engineering Experiment Station, Urbana.
PREPARATION AND PROPERTIES OF PHOSPHIDES AND SILICIDES AND SOME ELECTROCHEMICAL STUDIES, by S. S. Hsu, P. N. Yocom and others. Final rept. for 1 July 53-31 Dec 58 on Contract N6ori-071(50). [1959] 6p. 7 refs. AD-218 784.
Order from LC mi$1.80, ph$1.80 PB 147 079

Attempts were made to develop anodes suitable for electrochemical use. The following phosphides were prepared in a pure state by fused salt electrolysis: Ni_3P, Ni_7P_3, Ni_2P, Co_2P, and Mo_3P. MoP, MnP, W_3P, and WP were also prepared. A cast of Ni_2P was prepared and subjected to metallographic examination. Attempts to cast the Fe_2P-Ni_2P and Co_2P-Ni_2P systems were successful. Cast samples, particularly the mixed phosphides, were generally more resistant to corrosion in all solutions than powders. A cast Ni_2P microelectrode was found which was more suitable as an anode than one of sintered CrP. A correlation of the corrosion efficiencies of microanodes of single phosphides indicated that FeP was most resistant in acid and Ni_2P in alkali. Precision lattice constants of Ni_3P (tetragonal), Ni_2P (hexagonal), Fe_2P (hexagonal), Co_2P (orthorhombic), and W_3P (tetragonal) were found from powder X-ray diffraction patterns by the least squares method. Investigations were made of the compositions of the baths and the course of the electrolysis. Direct combination of the elements was found to be more satisfactory than fused salt electrolysis for the preparation of silicides of Fe, Co and Ni. A study of the electrolysis of pure sodium metaphosphate at 900°C was conducted. Attempts were made to prepare and study the behavior of silicides as anodes with a study of an Fe-P-Si system.

Instituto di Metallurgia e Metallografia, Universita' degli Studi di Roma (Italy).
STUDY ON THE BEHAVIOUR OF DEFECT METALLIC SURFACES OF SINGLE-CRYSTALS IN OXIDATION EXPERIMENTS UNDER CONTROLLED ATMOSPHERE, by Felice de Carli. Final technical rept. for 1 Nov 59-30 Jan 60 on Contract DA 91-591-EUC-1022-01-1175-59. [1960] 16p. 37 refs.
Order from LC mi$2.40, ph$3.30 PB 145 954

1. Development of a thermal-etching method to visualize point defects on cleavage surfaces of zinc single-crystals. 2. Effects of X-rays on the oxidation in a controlled atmosphere of cleavage surfaces of zinc single-crystals. 3. Oxidation of cleavage surfaces of zinc single-crystals previously plastically deformed. 4. Effects of ultrasounds on the oxidation of cleavage surfaces of zinc single-crystals.

James Forrestal Research Center, Princeton U., N. J.
BURNING RATES OF SOLID PROPELLANTS, by Gerald Rosen. Rept. on Contract Nonr-1858(25). July 59, 23p. 8 refs. Proj. Squid Technical rept. PR-95-P.
Order from LC mi$2.70, ph$4.80 PB 147 068

The burning mechanism of a solid propellant is described in terms of a pyrolysis law, a premixed laminar flame, and nothing more. A quantitatively accurate burning rate formula is derived from the theory. The predicted burning rate pressure dependence agrees with the experimental results for ammonium perchlorate propellants. (Author)

James Forrestal Research Center, Princeton U., N. J.
GENERALIZATION OF THE LAMINAR FLAME ACTION PRINCIPLE FOR ARRHENIUS-TYPE RATE FUNCTIONS, by Gerald Rosen. Rept. on Contract Nonr-1858(25). July 59, 7p. 2 refs. Proj. Squid Technical rept. PR-94-P.
Order from LC mi$1.80, ph$1.80 PB 147 067

The action principle for the laminar flame can be extended to include reaction rate functions which do not vanish at the cold boundary. The generalization leads to an unambiguous approximation procedure for determining the burning velocity and temperature distribution associated with arbitrarily specified rate functions. (Author)

Linfield Research Inst., McMinnville, Oreg.
RESEARCH ON ELECTROLYTIC MICROMACHINING TECHNIQUES OF REFRACTORY METALS FOR USE IN FIELD EMISSION DEVICES: I. THE PROPERTIES OF ANODICALLY FORMED OXIDE FILMS ON TUNGSTEN, by H. W. Pitman and D. C. Hamby. Final rept. for 15 July 58-15 Sep 59 on Contract DA 36-039-sc-78191. [1959] 95p. 33 refs. AD-230 953.
Order from LC mi$5.40, ph$15.30 PB 146 794

The properties of anodically formed oxide films on tungsten have been investigated in the ionic current density range from 0.037 to 8.6 ma/cm^2. The validity of the exponential law $i_+ = \alpha \exp \beta F$ has been established for the anodic oxidation of tungsten in 0.1 N

sulfuric acid at 25.0°C. Expressions relating the field F in the film during anodization have been deduced. Agreement between the coulometric and optical measurements is about 4 percent, the chief source of difference being in the relatively low accuracy of the density determination, required in the interpretation of the coulometric data. The constants found for the exponential law are $\log_{10} \alpha = -12.45 \pm 0.3$, α being expressed in ma/cm^2; $\beta = (5.22 \pm 0.08) \times 10^6$ cm/volt. (See also PB 146 496)

Little, Arthur D., Inc., Cambridge, Mass.
A NEW INSTRUMENT FOR THE DETERMINATION OF MOLECULAR WEIGHT BY DIFFERENTIAL VAPOR PRESSURE, by Norman M. Wiederhorn, Jay H. Vreeland, and Ruby H. Thomson. Rept. for Oct 58-Oct 59 on Experimental Techniques for Materials Research, Contract AF 33(616)5483. Feb 60, 16p. WADC Technical rept. 59-724.
Order from OTS $0.50 PB 161 711

The differential vapor pressure molecular weight instrument developed previously was subjected to use and further evaluated with regard to sensitivity, reproducibility, and accuracy. To do this, a number of materials having molecular weight in the range 300 to 20,000 were used. The device is capable of measuring number average molecular weights up to 2000 at solution concentrations of 0.1% (gms/100cc). In order to extend the range of the instrument to molecular weights of 20,000, it is necessary to work with at least 1% solutions. At these concentrations, the instrument is accurate to approximately ± 5%. A glass valve assembly and metal-coated Mylar sensing foils have been developed for use with the instrument. These facilitate the manipulations when making measurements and minimize maintenance problems. (Author) (See also PB 151 832)

New York State Coll. of Ceramics, Alfred U.
CHEMICAL-PHYSICS OF CATALYST SURFACES, by T. J. Gray. Rept. on Contract AF 49(638)288. [1959] 17p. 15 refs. AFOSR-TN-60-413.
Order from LC mi$2.40, ph$3.30 PB 147 495

A model is presented representing the electronic constitution of the surface of a catalyst based on the band theory of solids. It follows implicitly that there will be a direct correlation with any process involving a variation of the electron cloud distribution as occurs during chemisorption and reaction processes. Measurements of the electronic properties of the surface region of catalysts under dynamic conditions afford valuable indirect methods for determining the kinetics of adsorption, reaction and desorption processes in great detail. The model leads to the possibility of qualitative prediction of the action of certain promoters and suggests possible ways of modifying selectivity. The model is general in applicability and covers photocatalytic processes which are demonstrated to make possible the applicational use of high efficiency photochemical processes. Direct correlation is suggested with the photocatalytic syntheses in biochemical reactions. (Author)

Noyes Chemical Lab., U. of Illinois, Urbana.
ELECTRON SPIN RESONANCE STUDIES OF SEMIQUINONES AND THE C-F BOND, by D. H. Anderson Peter J. Frank, and H. S. Gutowsky. Technical rept. no. 19 on Contract Nonr-1834(13). 26 May 59, 30p. 41 refs. AD-219 834.
Order from LC mi$2.70, ph$4.80 PB 146 448

The electron spin resonance spectrum has been observed for a solution of tetrafluoro p-benzosemiquinone and a value, $a_F = 4.14 \pm 0.08$ gauss, obtained for the fluorine hyperfine splitting. It is concluded that this splitting is caused by the σ-π configuration interaction proposed for protons attached to an aromatic free radical. The results show that the fluorine orbital in the C-F bond contains about 5% s-character. The electron spin density, ρ_C, at a carbon atom in an aromatic free radical is related to a_F, for a fluorine bonded to the carbon, by the approximate relation $a_F = 39\rho_C$. Data are presented which can be explained by assuming the semiquinone free radicals produced by air oxidation of hydroquinones in alcoholic KOH dimerize or otherwise react in concentrated solution to give radicals with oxygen linkages, while dibenzosemiquinone radicals are produced from quinones under reducing conditions. A brief description is given of the X-band spectrometer which was used, and also the details of an electronic device to sweep the field of the electromagnet. (Author)

Oxford U. (Gt. Brit.)
A STUDY OF DIFFUSION IN A REACTING SYSTEM, by P. G. Dickens, D. Schofield, and J. Walsh. Rept. on Contract AF 61(514)1117. Feb 60, 18p. 9 refs. AFOSR-TN-59-868.
Order from LC mi$2.40, ph$3.30 PB 147 106

The purpose of the present work was to derive and solve numerically the diffusion equation in the general case. The results are compared with the solutions obtained by the earlier approximate treatments, thus enabling the range of validity of such treatments to be properly assessed.

Polytechnic Inst. of Brooklyn, N. Y.
A THEORY OF ELECTRON TRANSFER PROCESSES AT ELECTRODES, by R. A. Marcus. Technical rept. no. 2 on Contract Nonr839(22). 1 July 59, 16p. 5 refs. AD-218 735.
Order from LC mi$2.40, ph$3.30 PB 147 076

The foundations of a quantitative theory of electron transfer processes at electrodes are described. A weak electronic interaction was assumed between the electrochemically active ion and the electrode. The quantum mechanical consequences of this assumption were investigated. The results indicated that the atomic coordinates of the activated complex are those which lie on a many-dimensional surface lying at the intersection of 2 potential energy surfaces. The surfaces are those which are obtained for each of the 2 redox states of the ion-electrode system in the hypothetical case of zero electronic interaction. A method was outlined for determining the free energy of formation of the activated complex. This calculation

permits the computation of the current and its dependence on activation over potential. Depending on the extent of electronic interaction, electron transfer was shown to proceed adiabatically or nonadiabatically. Applications of the Franck-Condon principle in qualitative discussions of electron transfers in solution and at electrodes and their relation to the theory outlined above were examined. Some conclusions based on the behavior of the one-dimensional potential energy curves were questioned since the important part played by the rearrangement of the atomic configuration of the entire system in an electron transfer was not recognized.

Princeton U., N. J.
CONSIDERATION OF HYDRAZINE DECOMPOSITION, by I. J. Eberstein and I. Glassman. Technical rept. on Contract AF 18(600)1527. 11 Dec 59, 24p. 23 refs. Aeronautical Engineering Lab. rept. no. 490; AFOSR-TN-60-352.
Order from LC mi$2.70, ph$4.80 PB 146 901

A brief investigation of the molecular structure of hydrazine is presented. Catalysis of hydrazine decomposition on metal surfaces is discussed. It was found that metals having incomplete d-subshells act as strong catalysts for hydrazine decomposition, whereas metals having no d-subshells, or complete d-subshells act as non-catalysts. Initial steps for hydrazine decomposition under various conditions are proposed and inhibitors for such decomposition are suggested. Inhibitors may be ammonia, aniline, toluene, and xylidene or toluidene.

Queen Mary Coll., U. of London (Gt. Brit.)
THE STUDY OF FREE-RADICAL INTERMEDIATES FORMED DURING THE OXIDATION OF ORGANIC MESOMERIC COMPOUNDS BY METAL IONS IN SOLUTION BY MEANS OF ELECTRON SPIN RESONANCE SPECTROSCOPY. Annual technical rept. for 1 Oct 58-30 Sep 59 on Contract DA 91-591-EUC-945. [1959] 9p. AD-233 210.
Order from LC mi$1.80, ph$1.80 PB 146 832

It was proposed to investigate the oxidation of organic compounds by compounds of the transition metals. In these reactions free-radicals are often postulated as intermediates and a sensitive electron-spin resonance spectrometer for the detection of such radicals has been constructed. The spectrometer has been used to study the oxidation of 2:6-ditertiarybutylphenol. (Author)

Stanford Research Inst., Menlo Park, Calif.
THE DEPTH OF THE SURFACE ZONE OF A LIQUID, by J. C. Henniker and J. W. McBain. Technical rept. no. 5 on Properties of Surfaces, Contract N6ori-154, T.O. 2. 31 Mar 48, 44p. 175 refs. ATI-63 755.
Order from LC mi$3.00, ph$7.80 PB 146 951

Data from widely scattered sources indicate that the molecules of many liquids are highly oriented in the neighborhood of surfaces. A group of 175 references is presented in the order of the degree of certainty with which they demonstrate deep surface orientation.

Stanford Research Inst., Menlo Park, Calif.
IONIZATION IN FLAMES: THE ROLE OF COMPLEX HYDROCARBONS AND THE IONIZATION OF MIXTURES, by Felix T. Smith. Technical rept. 1 on Contract AF 04(645)66. May 57, 43p. 38 refs. WDD Doc. no. 7-5190; AD-216 841.
Order from LC mi$3.30, ph$7.80 PB 147 022

Research on flame ionization led to several equilibrium considerations. A survey of the experimental and theoretical information on ionization potentials of organic compounds showed that many of them, which may be present in flames (in small quantities individually, but in a noticeable amount in the aggregate), can be very readily ionized. Expressions that can be used in calculating the equilibrium ionization to be expected from mixtures of such species and other materials are developed. With regard to nonequilibrium processes, a possible role is suggested for large organic molecules and small carbon particles. They may accumulate energy from small excited molecules, and become hot enough to ionize, giving up this energy only rather slowly to the translational and rotational motion of the gas. The evaluation of this and other possible nonequilibrium processes requires study of time-dependent processes such as the growth, reactions, decay, and mechanisms of energy transfer of large molecules in flames.

Ultrasonic and Electrochemistry Research Lab., Western Reserve U., Cleveland, Ohio.
THE STUDY OF THE KINETICS OF THE HYDROGEN, OXYGEN, AND RELATED ELECTRODES, by Ernest Yeager, Harry Dietrick, and Frank Hovorka. Technical rept. no. 1 on Contract Nonr-581(00). 15 Dec 51, 43p. ATI-170 028.
Order from LC mi$3.30, ph$7.80 PB 147 809

The problems associated with the use of oxygen gas and hydrogen gas as anode and cathode materials in primary cells are discussed in terms of kinetics of these electrodes. The electronic instrumentation to be used for the polarization measurements is described with respect to design and operation. Emphasis is placed upon the determination of the rate of decay and build-up of the polarization at individual electrodes.

Washington U. [Seattle]
THE REACTION OF PEROXYDISULFURYL DIFLUORIDE WITH SULFUR DIOXIDE AND WITH FLUORINE, by George H. Cady and John E. Roberts (Massachusetts U). Technical rept. no. 22 on Contract Nonr-477(16). 1959, 7p. 6 refs.
Order from LC mi$1.80, ph$1.80 PB 147 070

Peroxydisulfuryl difluoride reacts with fluorine to give fluorine fluorosulfonate and with sulfur dioxide to give a compound of empirical formula $S_3O_8F_2$. The latter has been characterized. (Author)

EARTH SCIENCES

British Columbia U. (Canada).
THE MORPHOLOGY OF GEOMAGNETIC MICROPULSATIONS, Pc, by J. A. Jacobs and K. Sinno.

Scientific rept. no. 1 on Contract AF 19(604)4068. 19 June 59, 18p. 9 refs. AFCRC-TN-59-468.
Order from LC mi$2.40, ph$3.30 PB 146 152

An analysis of the occurrence frequency of geomagnetic micro-pulsations Pc has been carried out using data obtained during the IGY from a world-wide network of stations.

Massachusetts U., Amherst.
OBSERVATIONS ON PHOTO INTERPRETATION OF CAROLINA "BAYS" AND ASSOCIATED FEATURES, by David Jon Hagar (U. of Maine). Technical rept. no. 2-A on Contract Nonr-2242(00). July 59, 41p. 7 refs. AD-220 753.
Order from LC mi$3.30, ph$7.80 PB 147 095

In order to provide a basis of comparison for photo interpreters dealing with the Carolina "bays" or with comparable features in regions having similar climatic characteristics, the report endeavors to correlate the expression of selected bays as seen on air photos with actual conditions on the ground as determined by field observations. For each of seven areas covered, the following are discussed: location; setting; topography; drainage; surficial material; vegetation; and passability. Generalized conclusions concerning the areas discussed were outlined.

Climatology and Meteorology

Air Weather Service, Scott AFB, Ill.
AWS TERMINAL FORECAST (TFAWS CODE). 1 Apr 57, 14p. AWSM 105-25 and AWSM-105-25A, 11 Feb 59; supersedes AWSM 105-25, 1 July 54; AWSM 105-25A, 1 Nov 54; AWSM 105-25B, 1 Feb 55; and AWSM 105-25C, 15 Feb 56.
Order from LC mi$2.40, ph$3.30 PB 146 947

Air Weather Service Terminal Forecast Code (TFAWS) groups are appended to surface observations to set forth forecast cloud height or ceiling, visibility and weather at terminals during a definite period of time. The TFAWS code groups are intended as an aid to pilots and the briefing forecaster. Because of limited teletypewriter time and the relatively few code groups transmitted, it is impossible to give a complete picture of the terminal weather using TFAWS code groups. The TAFOR code (FM 51.A) is a more complete terminal forecast code.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
DOUBLE-DIRECTION-FINDING ROCKET METEOROLOGICAL SENSING SYSTEM, by D. E. Cline. 15 July 58, 29p. USASRDL Technical rept. 1981.
Order from LC mi$2.70, ph$4.80 PB 146 932

A proposal is presented for a meteorological rocket system for sounding the winds to approximately 200,000 feet, with an inherent capability for telemetering other meteorological parameters. The system would be composed of a Loki rocket, 1680-mc transmitter with special antenna, wafer-cell battery, suitable switching for the transmitter, parachute, and means for ejecting the instrumentation at the peak of the missile's trajectory. The geometry of the problem is similar to the determination of winds aloft utilizing two theodolites on a known baseline. It is concluded that a High-Altitude Double-Direction-Finding System possesses many advantages over presently devised systems, and that with a modest expenditure of time, money, and manpower, a working system could be evolved which would serve as both a research tool and an operation item for use at rocket proving grounds. (Author)

California U., Los Angeles.
THE INFLUENCE OF TERRAIN AND THERMAL STRATIFICATION ON FLOW IN THE SURFACE AND PLANETARY BOUNDARY LAYERS, by James G. Edinger and Shih-Kung Kao. Final rept. on Contract AF 19(604)2424. 30 Sep 59, 39p. 31 refs. AFCRC-TR-59-401.
Order from LC mi$3.00, ph$6.30 PB 146 931

Contents:
Wind structure in lowest 5km over Santa Monica, California
Stationary flow in the planetary boundary layer with an inversion layer and a sea-breeze
Turbulent transfer in the boundary layer of a stratified fluid

Imperial Coll., London (Gt. Brit.)
CALIBRATION OF A WEATHER RADAR USING A STANDARD TARGET, by D. Atlas and S. C. Mossop. Technical (Scientific) note no. 1 on Contract AF 61(052)254. Sep 59, 19p. 6 refs. AFCRC-TN-59-477; AD-231 806.
Order from LC mi$2.40, ph$3.30 PB 146 818

A simple method is described for calibrating a weather radar by means of a standard spherical target, thus permitting the radar to be used for quantitative measurements of storm reflectivity. The technique involves determination of that storm reflectivity which provides an echo equivalent to that from the known target. The sphere, suspended from a balloon, is tracked as it leaves the radar site. Its echo is "measured" by reducing the receiver gain control to the threshold of visibility. The threshold gain setting is thereby calibrated and subsequently provides an accurate measure of storm reflectivity. There is no need for any other test equipment such as a microwave signal generator. Absolute accuracy is greater than that attainable with a signal generator since no reliance need be placed on the generator calibration or upon the specified antenna gain. (Author)

Laboratory of Climatology, Centerton, N. J.
MICROCLIMATIC INVESTIGATIONS AT POINT BARROW, ALASKA, 1956, by J. R. Mather and C. W. Thornthwaite. Technical rept. no. 1 [on Contracts N7onr-367(01) and Nonr-1138(01)] 1956, 47p. 4 refs. Publications in Climatology vol. 9, no. 1.
Order from LC mi$3.30, ph$7.80 PB 137 849

This report provides an evaluation of the current program of microclimatic observations in the Arctic. Because of the fact that climatic observations can be

accumulated only slowly, it is clear that it will be necessary to continue the program of observations at Point Barrow for a number of years before the expected results can be obtained from the research study.

Little, Arthur D., Inc., Cambridge, Mass.
OBSERVATIONS OF THUNDERSTORMS IN NEW MEXICO, by C. B. Moore, B. Vonnegut, and A. G. Emslie. Rept. on Contract Nonr-1684(00). 15 June 59, 117p. 46 refs. AD-220 039.
Order from LC mi$6.00, ph$18.30 PB 146 826

Contents:
Description of observatory
Potential-gradient changes during thunderstorms
Point-discharge currents and the electrical charge on rain
Relation of point discharge to rain currents
Computation of raindrop charging
Rain gushes following lightning
Raindrop collection efficiencies
Rapid appearance of rain from clouds in New Mexico
Computation of raindrop collection efficiencies in electrified clouds.
Effects of electric field on colliding water drops
Formation of rain by coalescence

Massachusetts Inst. of Tech., Cambridge.
FINAL REPORT, by Pauline M. Austin. Rept. for 1 Mar 56-30 Nov 57 on Weather Radar Research, Contract DA 36-039-sc-71136. 31 Dec 57, 27p. AD-153 903.
Order from LC mi$2.70, ph$4.80 PB 147 387

The basic purpose of this project is to conduct a program of experimental and theoretical research in the field of weather radar. This program includes evaluating the radar as a meteorological instrument, devising and testing additional instrumentation for meteorological observations, and taking observations and using them in meteorological research. Major aspects of the research are, therefore, instrumentation, observation, analysis of data and pursuance of related theoretical studies.

New York U. Coll. of Engineering, N. Y.
ON THE VERTICAL PROPAGATION OF A DISTURBANCE THROUGH THE MESOSPHERE, by Katsuyuki Ooyama. Scientific rept. no. 6 on Contract AF 19(604)1738. Sep 58, 77p. 14 refs. AFCRC-TN-58-499.
Order from LC mi$4.50, ph$12.30 PB 137 835

The vertical propagation of a hydrodynamical disturbance, in which the latitudinal variation of the Coriolis parameter is the only cause of wave propagation, is studied in connection with possible solar-weather relationships. The effect of a vertically variable stratification in the mesosphere on the vertical transmission of the disturbance is first examined. Then, the three-dimensional Green's function of the Rossby wave equation with constant coefficients is derived by making use of the method of stationary phase, and the energy propagation is discussed. Relative accumulation of the energy along the forerunner of disturbance, which proceeds in all directions from the initial point source of the disturbance with the maximum group velocities for the respective directions, is shown to take place. However, within several weeks after the initial disturbance, the forerunner does not become well developed; and the energy density propagated with the maximum group velocity is insignificant when compared with that propagated more slowly, if the size of the initial disturbance is within the range considered here. The speed of the maximum disturbance is found to depend to a great extent on the initial size. The estimate of possible magnitudes of such a disturbance, which might be induced by a corpuscular stream in the high atmosphere and propagated downward, is given in terms of the vertical velocity. (Author)

Operations Research, Inc., Silver Spring, Md.
THE SCATTERING OF THERMAL RADIATION BY CLOUDS, by Donald A. Melnick and J. K. Bragg. Scientific rept. no. 2 on Contract AF 19(604)1422. 4 Dec 57, 25p. 4 refs. Technical paper no. 6.
Order from LC mi$2.70, ph$4.80 PB 137 560

This paper is a summary of certain theoretical results on the transmission of thermal radiation. In the first part, a solution to the problem of transmission of thermal radiation through a layer of scattering particles is derived by two approximation methods. The result is given as a function of angle of incidence, and a scattering parameter of the medium. Although approximate, this solution is more accurate than the precision of measurements which can usually be made in the field or in the laboratory. The second part contains certain practical but less exact approximations necessary to apply these results to the problem of scattering of radiation by clouds. (Author)

Radiobiological Lab., U. of Texas, Austin.
A CORRELATION ANALYSIS OF THE RELATIONSHIP BETWEEN WEATHER VARIABLES AND ATMOSPHERIC RADIOACTIVITY, by J. A. Davis, Loren C. Logie (School of Aviation Medicine) and others. Feb 60, 8p. 8 refs. AFSAM rept. 60-35.
Order from LC mi$1.80, ph$1.80 PB 147 457

Correlation analysis between various surface weather parameters and samples of atmospherically borne radioactive material has been performed. The material collected was primarily of natural origin (i.e., radon and thoron). The analysis suggests that the natural radioactive material is transported into the Austin area within the turbulence associated with a cold frontal passage and concentrated in the lower air layers by the ensuing elevated temperature inversion.

Technical Operations, Inc., Burlington, Mass.
ANALYSIS OF THE PERFORMANCE OF THE AVIATION WEATHER SYSTEM. VOLUME I. SUMMARY, CONCLUSIONS, RECOMMENDATIONS, by Roger F. Willis, Donald Schimelfenyg, and Theodore W. Schwenke. Final rept. on Contract FAA/BRD-39. 30 Dec 59, 71p.
Order from OTS $2.00 PB 161 751-1

The conclusions and recommendations are based on a time analysis of the aviation weather system and a study of the effect of age on the credibility of weather information. The aviation weather system, as studied, includes the weather services provided by the U.S. Weather Bureau, the Air Force, the Navy, and the airlines, with emphasis on aviation operations over the continental United States. The conclusions and recommendations are based on the information presently available on such variables as the number of forecast centers in the system, the number and types of airports and air bases, the weather information traffic load, and the configuration of the teletype networks.

Technical Operations, Inc., Burlington, Mass.
ANALYSIS OF THE PERFORMANCE OF THE AVIATION WEATHER SYSTEM. VOLUME II. DISTRIBUTION OF WEATHER INFORMATION; AGE ANALYSIS OF WEATHER INFORMATION; OBSERVATION PROCESS AND INSTRUMENTS; COMMUNICATION SYSTEMS; [and] CREDIBILITY OF WEATHER INFORMATION, by Roger F. Willis, Donald Schimelfenyg, and Theodore W. Schwenke. Final rept. on Contract FAA/BRD-39. 31 Jan 60, 283p. 98 refs.
Order from OTS $4.00 PB 161 751-2

This volume contains details supporting the conclusions and recommendations of volume 1 (PB 161 751-1)

Frost Science

Army Snow, Ice, and Permafrost Research Establishment, Wilmette, Ill.
AIRFIELDS ON FLOATING ICE SHEETS FOR ROUTINE AND EMERGENCY OPERATIONS, by Andrew Assur. Preliminary edition, Jan 56, 25p. SIPRE rept. 36.
Order from LC mi$2.70, ph$4.80 PB 147 184

The recommendations, covering only practical field aspects, are based on theoretical work, field experiments, and practical experience of personnel of the Snow Ice and Permafrost Research Establishment. They follow chronologically the procedures necessary for the establishment and maintenance of airfields on ice.

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
ICE FABRICS AND THE UNIVERSAL STAGE, by Chester C. Langway, Jr. Aug 58, 21p. 35 refs. Technical rept. 62; AD-206 681.
Order from LC mi$2.70, ph$4.80 PB 147 185

A universal stage for laboratory and field use [J. Geol. 49:590-598, 1951] is described, and the techniques of ice-fabric studies are reviewed. The new stage is based on the same principle as that of Fedorow for use on a polarizing petrographic microscope and has 4 axes of rotation. Three of the axes are graduated, one serving as an azimuth control, the other 2 for recording the angle of inclination. The 4th axis allows the entire stage to be rotated on a vertical axis without disturbing the oriented specimen. The stage is mounted between 6-in. disk polaroids and can accommodate a thin section up to 5 in. in diam. The plastic cover plate is etched with a 1-cm grid for direct grain-size measurements and is equipped with a small copper indicator for obtaining azimuth positions. (Author)

Goethe U., Frankfurt (West Germany).
RESEARCH ON RELATIONS BETWEEN ICE NUCLEI AND ATMOSPHERIC AEROSOLS, by Hans-Walter Georgii. Technical (Final) rept. on Contract AF 61(514)927. May 59, 116p. 75 refs. AFCRC-TR-59-288; AD-232 257.
Order from LC mi$6.00, ph$18.30 PB 146 299

Contents:
Survey on recent research on ice formation in the atmosphere
Problems treated in present investigation
Description of instrumental equipment for research on freezing nuclei
  Determination of the number of ice particles in the cold chamber
  Check of counting process with the method after BIGG
Results of measurements
  Measurements at continental locations
  Relations between size and number of condensation nuclei and the concentration and activity of freezing nuclei
On the properties of the maritime aerosols for the freezing process in supercooled clouds
Demonstration of the ice-nucleation activity of the atmospheric aerosols by direct methods

Geology

Cornell U., Ithaca, N. Y.
HYDROTHERMAL GEOCHEMISTRY OF IRON, by William T. Holser and Cecil J. Schneer. Final rept. on Contract Nonr-401(07). 15 Aug 57, 62p. 86 refs.
Order from LC mi$3.90, ph$10.80 PB 147 802

The solubility of magnetite was measured in dilute aqueous solutions of HCl at high temperature and pressure. At 390 C, 440 bars, in 0.0002 M HCl, 300 ppm ferrous iron are dissolved. Solubility decreases with acid concentration; in pure water at the same conditions solubility is less than 0.02 ppm. Magnetite was synthesized by reaction of acidic iron chloride solutions with calcite at high temperature and pressure.

Iowa Engineering Experiment Station, Ames.
GEOLOGIC AND ENGINEERING PROPERTIES OF SILTS NEAR BIG DELTA AND FAIRBANKS, ALASKA, by G. F. Lindholm, L. A. Thomas and others. Final rept. 1 on Contract Nonr-530(04). 1 Dec 57, 37 refs.
Order from LC mi$6.90, ph$21.30 PB 137 978

This report is presented in two parts. (1) Study of silts in Big Delta region (2) Study of silts in Fairbanks region.

Physics of the Atmosphere

Free U. of Berlin (Germany).
COLLECTION OF STATISTICAL DATA FOR METEOROLOGICAL STUDIES OF THE UPPER ATMOSPHERE, by P. Beelitz, J. Clauss, and W. Fett. Technical (scientific) note no. 1 on Contract AF 61(052)156. 31 July 59, 44p. 19 refs. AFCRC-TN-59-610; AD-231 784.
Order from LC mi$3.30, ph$7.80 PB 146 817

Nocturnal radiosonde ascents were collected, checked and supplemented for the winter months January, February and March 1955 through 1958 from 56 selected aerological stations in Europe and adjacent areas. As the result, data of pressure height, temperature and wind for the standard pressure levels 700, 500, 300, 200, and 100 mb. as well as the surface data and sea-level pressure are given in a complete form on punched cards, lists and microfilms. The methods and means employed are described. Besides comments on the sources of data and the description of working operations, the synoptic-aerological criticism of the data and the developed scientific-technical resources are given in more detail. The experiences with the individual radiosonde networks are pointed out. A selection of scientifically and methodically interesting printing samples illustrates the methods used. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
FINAL REPORT FOR 1 JANUARY 1955 TO 31 AUGUST 1958, by A. H. Waynick. Rept. on Ionospheric Research, Contract AF 19(604)1304. 30 Sep 58, 56p. 242 refs. AFCRC-TN-58-247.
Order from LC mi$3.60, ph$9.30 PB 137 685

Research included theoretical and experimental investigations on the physics, dynamics and general properties of the ionic layers of the earth's atmosphere. The problems outlined fit under the broad categories of recording programs, electromagnetic studies, solar and high atmosphere physics, ionospheric phenomena and equipment development. Brief descriptions of related work supported by other agencies are included in this portion of the report. Four investigations completed or modified prior to June 1957 complete this material.

Michigan U. [Research Inst.] Ann Arbor.
A RADIOACTIVE-IONIZATION-GAGE PRESSURE-MEASUREMENT SYSTEM, by N. W. Spencer, R. L. Boggess and others. Scientific rept. ES-1 on Contracts AF 19(604) (545, 1511, 1948) and National Science Foundation Grant Y/10.20/249. May 58, 66p. 6 refs. 2597-3-S; AFCRC-TN-58-422; AD-152 590.
Order from LC mi$3.90, ph$10.80 PB 146 501

An air-pressure-measurement system employing a radioactive ionization gage has been developed for use in rockets for the determination of surface pressures which can be interpreted in terms of the ambient pressure, density, and temperature of the atmosphere. The system has proven useful for the measurement of pressures from atmospheric to at least 10^{-3} mb. (Author)

Upper Air Research Labs., U. of Utah, Salt Lake City.
IMPROVEMENTS IN THE FALLING SPHERE INSTRUMENTATION, by Obed C. Haycock. Final rept. on Contract AF 19(604)4956. 10 Feb 60, 28p. 4 refs. AFCRC-TR-60-233.
Order from LC mi$2.70, ph$4.80 PB 147 297

Investigations have been made to improve the circuitry and performance of the falling sphere experiment. A study has been made of the operation of the sphere and conversion from mechanical timing and electronic tubes to solid state devices insofar as the state of the art will permit. The results of a study of the antenna operation at 400 and at 730 mc are also included. (Author)

Oceanography

Martin Co., Baltimore, Md.
A RESEARCH PROGRAM FOR MARINE GROWTH PREVENTION BY ULTRASONICS, by C. W. Waldvogel and J. W. Pieczynski. Rept. for Nov 58-Mar 59 on Contract NOa(s) 56-910-C. May 59, 51p. ER 10764; AD-219 982.
Order from LC mi$3.60, ph$9.30 PB 147 155

A test program was conducted to determine the effectivity of ultrasonics on marine growth. This program utilized ultrasonic vibrations on two 14-ft aluminum hulls in conjunction with two similar boats as controls. For each test, two boats were used, one hull was ultrasonically vibrated, and the other used as a means to determine the amount of growth without vibration. The cleanliness of the ultrasonically vibrated boat hull on all four tests indicates that ultrasonic vibration is effective against marine growth.

Narragansett Marine Lab., U. of Rhode Island, Kingston.
BIOLOGICAL PRODUCTIVITY PROJECT, by David M. Pratt and Harold Berkowitz. Annual progress rept. for 1 Jan-31 Dec 57 on Contract Nonr-396(03). Jan 58, 9p. Reference no. 58-2.
Order from LC mi$1.80, ph$1.80 PB 138 283

Growth rates of the quahog, Venus mercenaria L., in Narragansett Bay have been studied over a three-year period in relation to various environmental factors.

ENGINEERING

Ordnance Tank-Automotive Command [Center Line, Mich.]
PROCEEDINGS OF THE CONFERENCE ON EDUCATIONAL ASPECTS OF LAND LOCOMOTION HELD AT THE UNIVERSITY OF MICHIGAN, ANN ARBOR JANUARY 27 AND 28, 1958, by B. A. Unlendorf, ed. July 58, 33p.
Order from LC mi$3.00, ph$6.30 PB 146 775

Contents:
Interest of ordnance in an educational and research program in land locomotion
Adaptation of curricula to modern needs
New curriculum in automotive engineering
Research and land locomotion
Research in automotive problems
Educational needs in mobility and trafficability
Expanding fields of automotive problems
From components to the vehicle as a whole
Interest of industry in the studies of soils considered as a medium of operation for tools and vehicles

Aeronautical Engineering

Air Crew Equipment Lab., Naval Air Material Center, Philadelphia, Pa.
NEW INHALATION VALVE FOR USE WITH A-13A OXYGEN MASK, TEST AND EVALUATION OF, by E. L. Michel. Final rept. 6 June 56, 13p. TED NAM AE-5166; NAmC-ACEL-286; AD-117 563.
Order from LC mi$2.40, ph$3.30 PB 146 508

The inhalation valves presently incorporated in the A-13A oxygen mask have been cause for considerable concern because of their extreme sensitivity to dirt or other foreign material. This condition which could render oxygen masks inoperable during flight poses a definite hazard to pilots. A new design inhalation valve has been developed by Ensigns R. K. Sutz and L. S. Schonberger, which endeavors to eliminate any mask failures which could be caused by this condition. Results of tests conducted indicate that the subject valves do operationally comply with the requirements specified in specifications MIL-V-7553(ASG).

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A PHOTOMETEORONIC METHOD FOR BOMB BALLISTICS AND FOR MEASUREMENTS OF THE FLIGHT PERFORMANCE OF AIRCRAFT, by R. S. Zug. 26 Sep 42, 94p. Rept. no. 279.
Order from LC mi$5.40, ph$15.30 PB 146 948

The Photometeoronic method utilizes two vertical cameras mounted at opposite ends of a suitable base line. An airplane carrying a flashing light flies by night (or by day, with special equipment) at any desired altitude and between the two cameras each of which records the successive images of the flashing light on a photographic plate. Coincident with each flash a radio signal from the airplane is received and recorded at a ground station, for timing purposes. In range bombing the instant of bomb release is signified by a special flash and radio signal. The data from the photographs and time records yields the course and speed of the plane with high percision, as a function of time.

Boeing Airplane Co. [Seattle, Wash.]
WATER VAPOR PUMP STUDY, by John R. Malcolm. Rept. on Contract AF 33(616)5724. Feb 60, 136p. 10 refs. WADC Technical rept. 59-254.
Order from OTS $2.75 PB 161 705

This report presents the results of a study to determine the feasibility of utilizing a water vapor pump to lower the vapor pressure of a water heat sink to obtain water boiling temperatures in the 40° - 70°F and the 120° - 160°F range, for application in aircraft covering the speed range from Mach 1.5 to 12 and altitude range from sea level to 150,000 feet. The criteria of feasibility was: (a) Can water vapor pumps be built in the size range of interest? (b) What penalty results to the vehicle and how does this penalty compare with alternate methods of absorbing the heat load? The pump types considered are the rotary positive displacement, centrifugal, axial flow and ejectors. Centrifugal compressors, both alone and in combination with an expendable ammonia system, and ejectors combined with an ammonia system are feasible for producing 40° - 70°F boiling on bombers with a flight time in excess of 3 hours. No vapor pumps studied are competitive with alternate schemes for providing a heat sink with 120° - 160°F boiling. (Author)

Chicago Midway Labs., U. of Chicago, Ill.
DETERMINATION OF FACTORS GOVERNING SELECTION AND APPLICATION OF MATERIALS FOR ABLATION COOLING OF HYPERVELOCITY VEHICLES, by John H. Bonin, Channon F. Price, and Henry Halle. Rept. on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5436. Feb 60, 162p. WADC Technical rept. 59-87, pt. 3.
Order from OTS $3.00 PB 161 702

The results obtained from tests of samples of fifty-two different materials are presented. The samples were exposed to the high-temperature plasma discharge produced in an air-stabilized electric arc. The sample shape, test conditions and test procedure, and the material behavior are reported upon. (Author)
(See also PB 161 049)

David Taylor Model Basin, Washington, D. C.
ANALYZING THE STEPLESS PLANING BOAT, by Eugene P. Clement. Nov 56, 42p. 8 refs. Research and development rept. 1093.
Order from LC mi$3.30, ph$7.80 PB 147 036

This report gives methods of presenting and using information on the hull forms and model performance of planing boats to guide the design of future boats. The effects on performance of variations in some of the primary planing boat parameters are illustrated and discussed. A design method is proposed, and data are presented to assist in making correct design decisions. (Author)

Douglas Aircraft Co., Inc., Long Beach, Calif.
COOLING METHODS AND EQUIPMENT FOR SUPERSONIC AIRCRAFT, by G. B. Werth, H. K. McCluer, and B. T. Fitchett. Rept. for 15 May 56-15 Nov 57 on Contract AF 33(616)3723. Feb 60, 159p. 152 refs. WADC Technical rept. 57-619; AD-151 141.
Order from OTS $3.00 PB 161 731

Methods of cooling the cabin and equipment that were considered include (1) air cycle, vapor cycle and absorption cycle refrigeration, (2) rejection of heat to expendable coolants, and (3) relatively unexplored

methods such as vortex tubes, thermoelectric cooling and endothermic reactions. Twenty-eight cooling systems were conceived and analyzed, all of which are classified as storage systems. Six of the more promising systems were evaluated to determine the drag horsepower attributable to each. Further, the design and development problems associated with these systems were evaluated. Storage cooling systems using fuel and water as heat sinks were found to to be the most promising systems investigated.

Flight Control Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
INVESTIGATION OF A TECHNIQUE FOR IMPROVING AIRCRAFT RESPONSE USING A COMPLEMENTARY OPTIMUM-RESPONSE MODEL, by Raymond R. Rath. Sep 56, 81p. 3 refs. WADC Technical note 56-475; AD-110 518.
Order from LC mi$4.80, ph$13.80 PB 147 591

The pitch response of an F-89 aircraft to a command input is investigated using the two-degree of freedom short period mode approximation. The command input is fed into both the airframe-hydraulic servo combination and a black box represented by an "ideal" transfer function of the same order as the airframe transfer function. The two outputs are compared and some function of the difference is fed back to the input of only the airframe-servo system. Several feedback configurations are investigated by means of root-locus techniques. The response of the system with a particular feedback function is determined analytically for seven different flight conditions covering the flight regime of the F-89. A computer solution is then obtained for these seven conditions and the "best" fixed gain for all conditions is determined. The results show that the response of the airframe to a command input remains very close to the response of the "ideal" transfer function. (Author)

General Applied Science Labs., Inc., Westbury, N. Y.
NOTE ON THE BROAD SPECTRUM NOISE OF A JET AND ITS SILENCER, by Sin-I Cheng. Rept. on Contract AF 49(638)194. Nov 59, 24p. 9 refs. GASL Technical rept. no. 149; AFOSR-TN-59-1309.
Order from LC mi$2.70, ph$4.80 PB 147 320

In this note, it is intended to amplify some of the implications of the model for analyzing the broad spectrum noise of a jet as was presented in a previous report when applied to practical systems. Experimental results on the noise reduction by the C. F. 100 Orenda IIR diffuser silencer and by the UTIA Model Ground Muffler are discussed from the points of view of both the Lighthill's model and the present model. Based upon Lighthill's model, it appears necessary to assume a very large increase of the turbulence intensity accompanying the diffusion of the jet velocity. According to the present model, where the change of the turbulence intensity is neglected, the observed noise reduction or increase is explained by the change of the relative thickness of the shear layer that appears to be of reasonable magnitudes. (Author)

Heat Transfer Lab., U. of Minnesota, Minneapolis.
EXPERIMENTAL STUDIES FOR DETERMINING HEAT TRANSFER ON THE RIBBONS OF FIST TYPE PARACHUTES, by P. A. Schoeck, J. N. Hool, and E. R. G. Eckert. Rept. on Contract AF 33(616)3755. Feb 60, 103p. 13 refs. WADC Technical note 59-345.
Order from OTS $2.50 PB 161 745

Experimental heat transfer studies were conducted on models representing the ribbons of Fist type parachutes. The measurements were made in the Reynolds number ranges from $.03 \times 10^5$ to $.6 \times 10^5$ and from 2.5×10^5 to 5×10^5 where the Reynolds number is based on ribbon width and on the average velocity and properties in the slots between the ribbons. Low ratios of the pressures upstream and downstream of the models were connected with the small Reynolds number tests and high pressure ratios with the large Reynolds number experiments. The effect of ribbon spacing (porosity) upon the heat transfer was investigated. The data are presented in dimensionless form. The data can be used for the prediction of convective heat transfer rates on Fist type parachutes during descent. (Author)

Hiller Aircraft Corp., Palo Alto, Calif.
DUCTED PROPELLERS: A CRITICAL REVIEW OF THE STATE OF THE ART, by A. H. Sacks and J. A. Burnell. Rept. on Contract Nonr-2677(00). 26 June 59, 74p. 124 refs. Rept. no. ARD-232.
Order from LC mi$4.50, ph$12.30 PB 146 404

A critical survey is made of the state of the art of ducted propellers. The survey is divided generally into theoretical and experimental research, and a comprehensive table of the latter is presented showing the type and extent of experimental investigations carried out. Specific reports are discussed where appropriate, and various aspects of the ducted propeller problem are considered in some detail. A summary of the state of the art is presented along with some recommendations for future research. (Author)

Human Sciences Research, Inc., Arlington, Va.
AIRPORT MARKING AND LIGHTING SYSTEMS: A SUMMARY OF OPERATIONAL TESTS AND HUMAN FACTORS, by William A. Lybrand, W. S. Vaughan, Jr., and John P. Robinson. Final rept. on Contract FAA/BRD-13. May 59, 230p. 20 refs. HSR-RR-59/1-MK.
Order from OTS $3.50 PB 161 750-1

Contents:
Chap. 1. Introduction
Chap. 2. Operational test results from Arcata to Dow
Chap. 3. Flight mode analysis of AML functions
Chap. 4. Outline of recommended research and development
Technical note 1. AML as system design and research and development problems
Technical note 2. The nature of the pilot's task
Technical note 3. Information requirements derived from analysis of the pilot's task
Technical note 4. The information required for the

visual control of aircraft landings
Technical note 5. Implications of accident and pilot reaction time data for AML design
Technical note 6. Determinants of intensity and positioning of approach and runway lighting
(For a condensed version directed to the general non-technical reader see PB 161 750-3)

Human Sciences Research, Inc., Arlington, Va.
AIRPORT MARKING AND LIGHTING SYSTEMS: A SUMMARY OF OPERATIONAL TESTS AND HUMAN FACTORS, by William A. Lybrand, W. S. Vaughan, Jr., and John P. Robinson. Final rept. appendix (with selected annotations and bibliography) on Contract FAA/BRD-13. May 59, 415p. 653 refs. HSR-RR-59/1-MK.
Order from OTS $6.00 PB 161 750-2

This volume contains summaries and references of published reports on airport marking and lighting and related topics. It can be used as a catalog of information about airport marking and lighting to aid airport design engineers and FAA research personnel in identifying and locating reports. (See also PB 161 750-1)

Human Sciences Research, Inc., Arlington, Va.
AIRPORT MARKING AND LIGHTING SYSTEMS; A SUMMARY OF OPERATIONAL TESTS AND HUMAN FACTORS, by William A. Lybrand, W. S. Vaughan, Jr. and John P. Robinson. Condensed rept. on Contract FAA/BRD-13. May 59, 31p. 13 refs. HSR-RR-59/6-MK.
Order from OTS $1.00 PB 161 750-3

This report is a condensed version of HSR-RR-59/1-MK (PB 161 750-1). It is intended for non-technical readers in management or supervisory positions in the aviation industry, and in pertinent government agencies and departments. It describes, within a few minutes reading time, what is known now and what needs to be learned and developed in operational airport marking and lighting.

Flight Control Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
A SUMMARY OF TRIM SYSTEM PROBLEMS, INVESTIGATIONS, CONSIDERATIONS, AND CORRECTIVE ACTIONS, by Richard Hollingsworth. Aug 58, 46p. WADC Technical rept. 58-439; AD-155 802.
Order from LC mi$3.30, ph$7.80 PB 147 580

The various types of trim systems and their operational characteristics are defined. The most significant and recent of the trim system investigations are briefly reviewed. Many aspects of trim system and component design are discussed to illustrate potential problem areas and present possible solutions to problems which are encountered. A brief outline of investigative procedures is presented. Recommendations are given which will assist in achieving the maximum possible degree of safety in trim systems. (Author)

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ROLE OF STRUCTURAL DAMPING IN ACOUSTICAL FATIGUE, by W. J. Trapp and B. J. Lazan (U. of Minnesota). Rept. on Materials Analysis and Evaluation Techniques and reprint of "Acoustic Fatigue and Damping", presented at 26th Shock and Vibration Symposium, San Diego, Calif., 22 May 58. Jan 60, 31p. 7 refs. WADC Technical rept. 59-304.
Order from OTS $1.00 PB 161 742

Techniques proposed to reduce or eliminate materials fatigue damage due to high level noise fields of propulsion systems and aerodynamically induced pressure fluctuations are discussed. The mechanisms, the significant parameters involved and the response of materials and structures are analyzed. The activities undertaken and notions on the solution of the problem by employing certain damping concepts are presented. (Author)

National Research Labs., Ottawa (Canada).
BRIEF EXPERIMENTS ON A FLAPPED AEROFOIL HAVING A CUSPED CAVITY AND A BLOWING JET AT THE CUSP, by A. D. Wood. Dec 59, 22p. 4 refs. Aeronautical rept. LR-269.
Order from LC mi$2.70, ph$4.80 PB 147 332

Experiments on a simple flapped aerofoil incorporating a cusped cavity and having a blowing jet at the cusp show that it is possible to produce a flow regime in which the cavity is occupied by a stable trapped vortex. With the aerofoil immersed in a quasi-two-dimensional finite stream, greater rotation of the resultant force vector was obtained with a flap of this type than with a flap having no cavity. The results indicate that the combination of a blowing jet and a trapped vortex may be used to advantage in enabling an external flow to overcome an adverse pressure gradient. (Author)

Naval Weapons Lab., Dahlgren, Va.
FEASIBILITY STUDY OF SHAPED CHARGE SEPARATION OF THE AIRCRAFT FLIGHT CAPSULE, by G. W. Baker, M. E. Conlon and others. Final rept. for Aug 59-25 Mar 60. 11 May 60, 70p. NWL rept. no. 1704.
Order from LC mi$3.90, ph$10.80 PB 147 123

In support of the Navy Integrated Flight Capsule study, the feasibility of completely severing service aircraft fuselages, in air and underwater, reliably and with acceptable side effects, was established using prototype flexible linear shaped charge installations. Design, installation and maintenance characteristics are described, component and system tests summarized, system reliability analyzed and factors determining feasibility evaluated. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
FORCED FLEXURAL VIBRATIONS OF SANDWICH PLATES IN PLANE STRAIN, by Yi-Yuan Yu. Technical note no. 4 on Contract AF 49(638)453. July 59, 23p. 7 refs. AFOSR-TN-59-567.
Order from LC mi$2.70, ph$4.80 PB 146 974

On the basis of the new flexural theory of elastic sandwich plates the problem of general forced flexural vibration in the plane-strain case is solved. The results are made use of in solving the problem of a simply supported sandwich plate in plane strain with one of the two end sections prescribed a transverse deflection varying with time.

Princeton U., N. J.
PRELIMINARY FLIGHT EXPERIMENTS WITH THE PRINCETON UNIVERSITY TWENTY-FOOT GROUND EFFECT MACHINE, by W. B. Nixon and T. E. Sweeney. Rept. on Contract DA 44-177-TC-524. Jan 60, 25p. Dept. of Aeronautical Engineering rept. no. 506.
Order from LC mi$2.70, ph$4.80 PB 146 759

This paper deals with measurement of control moments and rates, drawing a comparison with the controllability of a HUP-1 helicopter. Fundamental flow studies are discussed and illustrated by means of diagrams and tuft pictures. Full scale drag measurements are reported and the problem of momentum drag is discussed and shown to be a function of the flow change over the machine's surface produced by the sink. Full scale lift augmentation ratios as a function of the height parameter are presented and compared with those of a 1/12 scale model. The results of hovering performance studies are reported and compared to Chaplin's simple momentum theory. Over-all handling characteristics are discussed and observations of the machine's performance over rough and smooth surfaces and snow are included. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
A THEORETICAL EVALUATION OF THE COANDA NOZZLE, by Kuo-Tai Yen. Rept. on Contract AF 18(600)992. 5 July 55, 32p. 7 refs. TR AE5501; [AFOSR-TN-55-253] AD-84 518.
Order from LC mi$3.00, ph$6.30 PB 147 161

An investigation of the Coanda Effect as applied to a two-dimensional nozzle (Coanda Nozzle) with a bend attached to one side of its exit is made in this report. By considering a perfect fluid, theoretical analysis shows that an appreciable mass flow rate increase is obtained when the flow follows the bend and is deflected. Theoretically, the sharper the corner at the bend, the longer the bend attached to the nozzle, and the longer the overhang, the larger the mass flow rate which can be obtained. In particular, the best theoretical result is obtained when the bend is sharp-edged. If the viscous effect of the fluid is considered, the Coanda phenomenon, although theoretically sound, is difficult to put into practical use. Unless effective and positive boundary layer control can be devised and applied, the "Coanda nozzle", in its present form, seems to be limited in its practical value. (Author)

Research, Inc. [Hopkins, Minn.]
INVESTIGATION OF WINDSHIELD RAIN REMOVAL METHODS FOR RE-ENTRY TYPE VEHICLES, by Harry R. Meline and Dennis H. Andersen. Rept. on Contract AF 33(616)5831. Feb 60, 206p. 5 refs. WADC Technical rept. 59-690.
Order from OTS $3.50 PB 161 722

This report contains the results of a study and wind tunnel test program conducted to investigate methods of improving windshield visibility during landing under rain conditions. The investigation was directed towards systems which would be applicable to hypersonic boost-glide vehicles or manned satellites using aerodynamic lift for re-entry speed reduction and landing. Various methods were studied and potential systems were wind tunnel tested under simulated rain conditions to experimentally investigate and demonstrate the effectiveness of the more promising methods. Systems were evaluated on the basis of visibility improvement, weight and space penalty, complexity, and reliability. Data are presented in the form of sketches, curves, and photographs to illustrate the effectiveness of the various systems. The results indicated that several of the methods tested could provide satisfactory improvement of windshield visibility under rain conditions during landing and would be feasible for installation on this type of vehicle. The most desirable systems, however, did exhibit certain inherent limitations and disadvantages. (Author)

Sperry [Phoenix Co., Ariz.]
DEVELOPMENT OF A UNIVERSAL AUTOMATIC FLIGHT CONTROL SYSTEM. Quarterly progress rept. no. 1, Apr-July 58, on Contract DA 36-039-sc-75040. Aug 58, 19p. 2 refs. Rept. no. 3263-3768.
Order from LC mi$2.40, ph$3.30 PB 147 407

A theoretical discussion of the design considerations of the differential required for the helicopter system is presented. Applicable design equations and criteria are developed. (Author)

Sperry Phoenix Co., Ariz.
DEVELOPMENT OF A UNIVERSAL AUTOMATIC FLIGHT CONTROL SYSTEM. Quarterly progress rept. no. 2, 1 July-1 Oct 58, on Contract DA 36-039-sc-75040. Oct 58, 45p. 4 refs. Rept. no. 1260-0001.
Order from LC mi$3.30, ph$7.80 PB 147 408

A theoretical and practical discussion of potentiometer power supplies, and signal demodulator is presented. Schematic diagrams of the components are provided, together with parts data pertinent to reliability analysis. The mathematics and concepts of reliability prediction are explained and applied to significant power supply and demodulator components. Mathematical formulae are presented in exposition of the applied theory. Component failure data from a variety of sources is presented, correlated and evaluated. (Author) (See also PB 147 407)

Sperry Phoenix Co., Ariz.
DEVELOPMENT OF A UNIVERSAL AUTOMATIC FLIGHT CONTROL SYSTEM. Quarterly progress rept. no. 3, 1 Oct 58-1 Jan 59, on Contract DA 36-039-sc-75040. 31 Jan 59, 88p. 2 refs. Rept. no. LJ-1260-0001-3.
Order from LC mi$4.80, ph$13.80 PB 147 409

The RPM control system for helicopters is reviewed in the light of the development of new simplifying concepts and of completion of flight tests of a Sperry RPM Control System developed for the Air Force. The ability to meet the requirements of SCL 1868 with a significantly simplified system is demonstrated. A discussion of signal switching and interlock functions required in the Universal Automatic Flight Control System is presented. (Author) (See also PB 147 408)

Sperry Phoenix Co., Ariz.
DEVELOPMENT OF A UNIVERSAL FLIGHT CONTROL SYSTEM. Quarterly progress rept. no. 4, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-75040. 30 Apr 59, 115p. 3 refs. Rept. no. LJ-1260-0001-4.
Order from LC mi$6.00, ph$18.30 PB 147 410

The results of a computer study of the pitch axis performance of the Universal Automatic Flight Control System (AFCS) and AO-1 aircraft are reported. It is shown that the universal AFCS is capable of stabilizing the pitch atitude of the aircraft well within the requirements of SCL 1870 in the presence of a ten knot step vertical gust. Other subjects investigated in this study include altitude control and the effects of servo dead zone. Analysis of the helicopter RPM System also continued during the past quarter. Controller characteristics are combined with the dynamics of the H-34 helicopter in this report to show the ability of the RPM system to stabilize the helicopter in the case where the rotor is very lightly loaded. (Author) (See also PB 147 409)

Sperry Phoenix Co , Ariz.
DEVELOPMENT OF A UNIVERSAL AUTOMATIC FLIGHT CONTROL SYSTEM. Quarterly progress rept. no. 5, 1 Apr-30 June 59, on Contract DA 36-039-sc-75040. 31 July 59, 50p. 2 refs. Rept. no. LJ-1260-[0001]-5.
Order from LC mi$3.30, ph$7.80 PB 147 411

The installation of the first engineering test model of the Universal Automatic Flight Control System in Sperry's S-55 helicopter is described. General installation requirements are reviewed, and the approach toward meeting these requirements in the S-55 helicopter is discussed. (Author) (See also PB 147 410)

Sperry Phoenix Co., Ariz.
DEVELOPMENT OF A UNIVERSAL AUTOMATIC FLIGHT CONTROL SYSTEM. Quarterly progress rept. no. 6, 1 July-30 Sep 59, on Contract DA 36-039-sc-75040. 31 Oct 59, 101p. 3 refs. Rept. no. LJ-1260-0001-6.
Order from LC mi$5.70, ph$16.80 PB 147 412

The results of a computer study of the Automatic Flight Control System AN/ASW-12(V) controlling the YAQ-1 aircraft are reported. The study indicates that the system is capable of satisfying the Signal Corps Technical Requirement 1870 over a range of flight conditions extending from approach speed to maximum indicated air speed at sea-level. Results are reported in terms of the servo system calibration for each axis. The simulation utilizes deliverable servo system calibration for each axis. The simulation utilizes deliverable servo systems (i.e. Electro-Mechanical Rotary Actuators). (Author) (See also PB 147 411)

Ultrasonic Testing and Research Lab.
RESEARCH AND DEVELOPMENT LEADING TO THE ESTABLISHMENT OF ULTRASONIC TEST STANDARDS FOR AIRCRAFT MATERIALS, by G. L. Cross, R. E. Kleint, and R. D. McKown. Rept. for June 58-June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5877. Feb 60, 147p. 10 refs. WADC Technical rept. 59-466.
Order from OTS $2.75 PB 161 753

The report contains results of a four phase study of materials and techniques concerning the evaluation of internal flaws by ultrasonic means. The four questions studied were: what material variables affect the transmission of ultrasonic compressional waves in certain aircraft materials; what material and geometrical variables affect transmission of shear and surface waves in thin sheet materials; what are the quantities involved when altering the beam diameter by collimation; and, what correlation exists between the ultrasonic and mechanical properties of materials which contain quantities of minute porosity. (Author)

University of Southern California. Engineering Center, Los Angeles.
DESIGN AND TESTS OF AERODYNAMIC STATIC PRESSURE COMPENSATORS FOR FOUR SERVICE AIRCRAFT, by Frederick O. Smetana. Rept. on Contract AF 33(600)36143. May 59, 43p. WADC Technical rept. 59-383; AD-233 999.
Order from LC mi$3.30, ph$7.80 PB 147 872

Aerodynamic static pressure compensators, the necessary shortened nose booms, pitot-static tubes, and Mach switches have been developed for four types of service aircraft. These devices permit the sensing of free stream pressure to within .015 q_c for $M<1.0$ and .01 P for $M>1.0$ with nose booms 1/3 to 1/2 as long as existing production systems. Further work is reported which indicates that the resultant error for $M<1.0$ can be reduced to $0.006q_c$ or less. (Author)

Vertol Aircraft Corp., Morton, Pa.
DEVELOPMENT OF IMPROVED CARGO SLING SYSTEM INCORPORATING LOAD STABILIZATION. ENGINEERING ANALYSIS. Final rept., phase 1, on Contract DA 44-177-TC-587. Mar 60, 78p. 1 ref. R-186.
Order from LC mi$4.50, ph$12.30 PB 146 903

Design and analytical studies were performed to determine optimum configurations of equipment to be used with Army cargo helicopters to improve their capabilities in airlifting standardized Army loads externally. Devices investigated covered all feasible concepts (1) for improving the effective pivot point of the load with respect to the helicopter center of gravity, and (2) for reducing to a minimum the motions of the load with respect to the fuselage. Specific configurations are recommended. (Author)

Winzen Research, Inc., Minneapolis, Minn.
MANHIGH II. USAF MANNED BALLOON FLIGHT INTO THE STRATOSPHERE FLOWN BY DAVID G. SIMONS. Final rept. on Contract AF 29(600)808. June 59, 355p. 49 refs. AFMDC-TR-59-28; AD-230 805.
Order from LC mi$11.10, ph$84.90 PB 146 511

Project MANHIGH II was undertaken to investigate the human factors of space flight. The project sought to (1) discover how man reacts in this hostile environment, (2) learn more of the design principles for space capsules, and (3) how to study man's reactions to permit intelligent planning of future space flight experiments. (Author)

Chemical Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
COLD GAS ATOMIZATION OF LOW VOLATILITY LIQUIDS, by Malcolm G. Gordon. Jan 60, 30p. 8 refs. CWLR-2333; AD-231 235.
Order from LC mi$2.70, ph$4.80 PB 146 859

Bis(2-ethylhexyl)hydrogen phosphite was atomized by compressed air using a device similar in design to a multicompartment thermal generator and equipped with various nozzle configurations. Several different sampling techniques were used as a means of characterizing the aerosol produced. The data obtained were compared to the Nukiyama-Tanasawa equation characterizing the process, and the application of the cold gas technique to a practical munition device was considered.

Army Chemical Warfare Labs., Army Chemical Center, Md.
PROTECTOR, COLLECTIVE, EMD, 75 CFM, E36; FILTER, PARTICULATE, 75 CFM, E37; AND FILTER, GAS 75 CFM, E36R1 (FINAL ENGINEERING TESTS NOS. 115, 134, AND 135) by Paul E. Oliver, James W. Waddey, Jr. and Irving S. Sherman. Jan 60, 49p. CWLR-2335; AD-231 790.
Order from LC mi$3.30, ph$7.80 PB 146 861

Final engineering tests of the E36 75-cfm collective protector, and its component E37 particulate and E36R1 gas filter units, designed to provide protection for AACS shelters during CBR attacks, and to heat and/or ventilate the shelters during normal operation are presented. The test program showed that the prototype unit and its components fulfilled the design characteristics under which it was developed. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THERMAL ATTENUATION BY CHEMICAL SMOKES, by Jerry J. Mahoney, Douglas D. Keough and David T. Kilminster. Rept. for Apr-June 55 on Thermal Radiation Attenuating Cloud Study. Jan 60, 28p. 12 refs. CWLR 2353.
Order from LC mi$2.70, ph$4.80 PB 147 550

The transmissivity of thermal radiation from a carbon arc through six different smokes was measured at concentrations of from 0 to 5 g/sq m. The smokes were tested to evaluate their capabilities to attenuate thermal radiation from nuclear detonations. (Author)

Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF THE ZONE-PURIFICATION PROCESS FOR PREPARING POTABLE WATER FROM SEA WATER, by W. H. Mink, G. F. Sachsel, and R. B. Filbert, Jr. Rept. for 16 June 59-31 Mar 60 on Contract No. 14-01-001-175. 1 June 60, 36p. 2 refs. Saline Water Research and Development Progress rept. no. 39.
Order from OTS $1.00 PB 161 766

As a first step toward obtaining the optimum economic zone-freezing process, the vertical-tube unit was simulated on an analog computer to determine the effect of design parameters on product salinity. With this information plus some additional experimental freezing data, it was possible to show that the optimum vertical-tube unit would require four stages, would freeze 13 per cent of the feed before discharging it, and would require that the temperature difference in the freezing zones be 3 F. Based on these results, it was possible to estimate that the total plant investment for a plant producing 100,000 gallons of potable water per day would be about $2,600,000. The estimated operating cost for a plant this size was found to be about $9.60 per 1,000 gallons of potable water. For a plant designed to produce 10 million gallons of potable water per day, the total plant investment and the daily operating cost were estimated at about $115,000,000 and $4.20 per 1,000 gallons, respectively. It is unlikely that these costs could be reduced further even with major changes in the process.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PRESS-FIT CLOSURES FOR 8-INCH T174 CHEMICAL SHELL, by Walter J. Puzia. Mar 60, 24p. Technical rept. 2678.
Order from LC mi$2.70, ph$4.80 PB 145 243

This report presents the results of a study to establish the optimum burster casing wall thickness at the press-fit for the 8-inch T174 chemical shell. Since it is known that leakage of the shell filler is usually associated with "galling," or abrasion, of the press-fit surfaces, it is the objective of this study to determine the burster casing wall thickness which produces the least amount of galling of the press-fit surfaces when assembled. As this study does not cover variations in degree of interference, surface finishes, or entrance radii, these were kept as nearly constant as possible and representative of established practice for shell press-fits. Only the wall thickness was varied. Rate of pressing the parts together and lubrication of surfaces were also representative of actual practice. Traces were made of assembling load versus travel, using electrical strain gage equipment, to determine smoothness of assembling and magnitude of assembling load. The assemblies were then sectioned longitudinally, and the press-fit surfaces were photographed to note the degree of abrasion. (Author)

Naval Research Lab., Washington, D. C.
THE PRESENT STATUS OF CHEMICAL RESEARCH IN ATMOSPHERE PURIFICATION AND CONTROL ON NUCLEAR-POWERED SUBMARINES, by R. R. Miller and V. R. Piatt. Interim rept. 21 Apr 60, 167p. 232 refs. NRL rept. 5465.
Order from OTS $3.00 PB 161 518

A comprehensive report has been written on the past and present research and development effort of the U.S. Naval Research Laboratory on the atmospheric habitability of submarines. Topics covered include atmospheric sampling, analysis and monitoring, the generation of oxygen, and the removal of unwanted components such as carbon monoxide, carbon dioxide,

hydrogen, organic contaminants, and aerosols. Emphasis is given to methods of preventing the gradual buildup of contaminants capable of decreasing the efficiency of the crew or of having deleterious effects on delicate or critical equipment. Future research must emphasize increasing reliability, complete independence of an external supply of oxygen, and more attention to the evolution of an integrated and automatically controlled system. (Author)

Naval Supply Research and Development Facility, Bayonne, N. J.
ULTRASONIC CLEANING, by S. Cholmar and S. Stambler. 20 Nov 58, 67p. 35 refs. Proj. NT003017(j) Engineering rept. no. 2.5064.
Order from LC mi$3.90, ph$10.80 PB 147 146

The technical and economic factors involved in the use of ultrasonic cleaning methods were determined. Ultra sonic cleaning is applicable to the cleaning of small, critical parts and is economical when the savings in labor, solvent costs and the increase in efficiency offset the cost of the ultrasonic cleaning equipment. Criteria developed for the use of ultrasonic cleaning methods can be used by interested activities as a guide in determining the applicability of ultrasonic techniques to their cleaning operations. (Author)

Texas A. and M. Research Foundation, College Station.
DEVELOPMENT OF THE SOLVENT DEMINERALIZATION OF SALINE WATER. Rept. on Contracts 14-01-001-77 and 14-01-001-106. Feb 60, 93p. 1 ref. Saline Water Research and Development Progress rept. no. 35.
Order from OTS $2.25 PB 161 769

Solubility and equilibrium data are presented for a variety of solvents of which secondary and tertiary amines appear to have many desirable properties. Use of radioactive sodium and chloride in the equilibrium determinations indicate that for amines the ions do not distribute equally between the phases because of the hydrolysis of these solvents in water. Operational data for the laboratory model of the extraction process are reported. The results were as predicted from the equilibrium and solubility data for the solvents employed, and no unusual operating conditions were encountered. A cost equation is developed to allow rapid evaluation of the results produced by different solvents and by various operating conditions. This equation is used to calculate the cost of two solvents under various conditions. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
TRAPPING OF NOBLE GAS IONS AND THE REEMISSION OF THE TRAPPED ATOMS FROM NICKEL AND MOLYBDENUM, by J. H. Carmichael and J. S. Knoll. [Rept. on Contract AF 18(600)1049] 25 Sep 58, 16p. 4 refs. Scientific paper 6-94439-9-pl; AFOSR-TN-58-971; AD-205 601.
Order from LC mi$2.40, ph$3.30 PB 138 058

The electrical cleanup of noble gases on nickel and molybdenum surfaces has been investigated. The reemission of the trapped atoms has been measured and is shown to be an important factor in the observed saturation of the cleanup process. Pumping speeds and re-emission rates for helium, neon, argon, and krypton have been measured and compared with the phenomenological theory (J. Appl. Phys. 28, 913 (1957)) which had previously been proposed to explain the contribution of re-emission to the pumping process of helium on molybdenum surfaces. (Author)

Civil Engineering

Beach Erosion Board, Corps of Engineers, Washington, D. C.
ANNUAL BULLETIN. VOL. 13. July 59. 60p. 5 refs.
Order from LC mi$3.60, ph$9.30 PB 147 492

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Michigan U. [Research Inst.] Ann Arbor.
STRUCTURAL INSTABILITY UNDER TIME-DEPENDENT LOADS, by E. F. Masur. Final rept. on Contract DA 20-018-ORD-14027. June 58, 51p. 10 refs. OOR rept. 1591. 1-E; AD-161 938.
Order from LC mi$3.60, ph$9.30 PB 146 798

Possible definitions of time-dependent stability are discussed. The response of simply supported columns to linearly attenuating lateral and axial forces is computed and charted for a broad variety of parameters, including asymptotic cases. The equations governing columns of other boundary conditions are developed and their solution is indicated. Special sections are devoted to multi-story frames and arches. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
PASSIVE RESISTANCE OF EARTH-ANCHORS IN SAND, PART. II, by J. E. Smith. Interim rept. 8 Mar 60, 55p. 3 refs. Technical rept. 073.
Order from LC mi$3.60, ph$9.30 PB 147 118

Various size prototype earth-anchors are being tested singly and in rectilinear groups at different depths behind trapezoidal and triangular shaped berms of different sizes, in order to improve designs using earth-anchors for lateral support. This report outlines the earth-anchor test program, Part 2, describes the methods, equipment and apparatus employed, and gives the results of tests conducted to date. The test program is about 15% completed. (Author)

Electrical and Electronic Engineering

Aeronutronic [Newport Beach] Calif.
TELEMETRY SYSTEM STUDY, VOLUME I (of I) by C. Harrison Smith, J. W. Capps and others. Semi-annual rept. for 6 Feb-30 Nov 58, on Contract DA 36-039-sc-73182. 31 Dec 58, 112p. 14 refs. ASI Publication no. U-320; AD-213 319.
Order from LC mi$6.00, ph$18.30 PB 147 629

The objectives of the program are: (1) to forecast the individual flight requirements for telemetry at the test ranges in the next decade and the effect of heavy traffic on multiple range operations; (2) to recommend suitable operating frequencies for further telemetry systems; (3) to examine various modulation or coding methods and recommend an optimum technique for future systems; (4) to investigate the performance of present systems and recommend improvements. Experimental telemetry system test setups for a number of modulation systems are presented. A summary of telemetry interference measurements made in the 225-260 mc/s, 1435-1535 mc/s and the 2200-2300 mc/s frequency bands aboard the USS GALVESTON December 2 - 6, 1958 is given, and the results of a transmitter frequency stability study to determine feasibility of .001% operational stability in near-future applications for the 2200-2300 mc/s frequency band is reported.

Air Force Cambridge Research Center, Bedford, Mass.
AN EVALUATION OF THE P-N-P-N NEGATIVE RESISTANCE DIODE, by H. I. Honor. Master's thesis. Mar 59, 39p. 10 refs. AFCRC-TR-59-140; AD-230 945.
Order from LC mi$3.00, ph$6.30 PB 146 446

The operation of the three junction diode is analyzed and interpreted in terms of two contiguous transistors It is seen that avalanche breakdown and the sum of the forward alphas determine the switching characteristics. The properties of four varieties of the diode are presented and comparisons made. A piecewise-linear equivalent circuit is developed. Some simple circuit applications are analyzed. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
SPHERICAL GRIDS FOR ELECTRON TUBES, by George P. Ploetz. Feb 60, 12p. AFCRC-TN-60-160.
Order from LC mi$2.40, ph$3.30 PB 147 508

Hemispheric shaped grids for spherical electron tubes are described. A number of design variations are given. From these basic considerations many special grid designs can be readily visualized and made. (Author)

Antenna Lab., Ohio State U. Research Foundation, Columbus.
CALCULATED VALUES OF SELF AND MUTUAL IMPEDANCES FOR PARALLEL SHORT DIPOLES, by Frank Serracchioli. Rept. on Antenna Phenomena Research, Contract DA 36-039-sc-70174. 24 Mar 59, 84p. 8 refs. Rept. no. 662-23; AD-220 546.
Order from LC mi$4.80, ph$13.80 PB 146 938

Research concerns a study of surface waves supported by Yagi arrays. A large number of self and mutual impedances for center-fed dipoles were calculated by means of an IBM 650-653 B4 digital electronic computer. Although the values obtained do not form a uniform table, i.e., a table in which the parameters vary by constant steps, the information made available by this large number of impedances may be useful whenever a zeroth order approximation is sufficient; hence the values were tabulated in such a way as to make table look-up and interpolation as easy as possible. The formulae used for the calculations are reported and their approximations discussed. Details on the mathematical devices adopted for computer programming are explained. The tabulated results were compared with values given by more advanced theories and with experimental measurements, and a simple correction formula is deduced therefrom. The computer flow chart and the complete machine program, with a brief explanation of the, are included in the appendix. (Author)

Antenna Lab., Ohio State U. Research Foundation, Columbus.
AN EXPERIMENTAL INVESTIGATION OF THE RADIATION PATTERNS OF ELECTROMAGNETIC HORN ANTENNAS, by Donald R. Rhodes. Rept. on Contract W33-038-ac-16520. 22 Sep 47, 26p. 7 refs. Rept. 301-3; ATI 33 451.
Order from LC mi$2.70, ph$4.80 PB 147 126

A fund of radiation pattern design data on electromagnetic horns is provided for applications requiring patterns which have special characteristic shapes. Electromagnetic horn patterns for horns having flare angles up to 50° and horn lengths up to 50 wavelengths are included. Klystron and magnetron oscillators are used for sources of radiation. Consideration is given to frequency limitations which must be placed upon the throat aperture dimensions. References and applications are made to wave guides.

Antenna Lab., Ohio State U. Research Foundation, Columbus.
IMPEDANCE CHARACTERISTICS OF A UNIFORM CURRENT LOOP HAVING A SPHERICAL CORE, by Saburo Adachi. Rept. on Antenna Phenomena Research, Contract DA 36-039-sc-70174. 15 Apr 59, 18p. 4 refs. Rept. 662-26; AD-220 386.
Order from LC mi$2.40, ph$3.30 PB 146 939

The impedance characteristics of a uniform current loop with a spherical core of an arbitrary composition of μ and ϵ were theoretically investigated. The radiation impedance is derived by the emf method in a convenient form as the sum of the self-radiation impedance of an air loop and an additional term due to the reaction between the loop and the sphere which is proportional to the well-known expansion coefficient of a magnetic-type scattered wave from a sphere in an incident plane wave. The first antiresonance frequency was given in the form of a universal curve for a very small uniform current loop with a core of an arbitrary

composition of μ_s and ϵ_s, subject to the condition that the refraction coefficient $N = \sqrt{\mu_s \epsilon_s}$ is extremely large. It should be noted that the above results can be directly applied to the first magnetic-type resonance frequency of a sphere in an incident plane wave. To show quantitative impedance characteristics of a loop with an arbitrary composite core, the radiation impedances for 2 cases, namely $\epsilon_s = 100$, $\mu_s = 1$, and $\mu_s = 100$, $\epsilon_s = 1$, were calculated and compared with an air loop. It is concluded that high-μ core is desirable for a comparatively lower frequency region, and high-ϵ core is rather desirable in an antiresonance frequency region. (Author)

Antenna Lab., Ohio State U. Research Foundation, Columbus.
A MODIFIED HELICAL ANTENNA, by T. S. M. Maclean. Rept. on Antenna Phenomena Research, Contract DA 36-039-sc-70174. 15 Apr 59, 15p. 3 refs. Rept. 662-28; AD-226 742.
Order from LC mi$2.40, ph$3.30 PB 146 940

A study of the modulated helical antenna was begun with the object of applying linear array theory to its operation. It is well known that the optimum pattern which can be obtained from such an array is produced by a Tchebyscheff source distribution along its axis. When applied to a singly fed end-fire array like the helical antenna this entails several aspects which must be considered: (1) the amplitude distribution is no longer uniform, (2) the phase shift between successive elements is greater than that required for satisfying the Hansen-Woodyard condition, and (3) the radiation from turns connecting the adjacent elements has to be superimposed on the Tchebyscheff pattern. A study of the effect of these modifications to the theory of the uniform helix was made, and it is shown that they considerably restrict the possibility of obtaining increased directivity. An incidental outcome of the study, however, is that it is comparatively easy to obtain a pattern with reduced sidelobe level. (Author)

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF HIGH ALTITUDE WAVEGUIDES, by Henry Zucker, Charles M. Knop, and Kurt Gutfreund. Rept. on Thermonic and Solid State Electronic Technology, Contract AF 33(600)32202. Feb 60, 115p. 9 refs. WADC Technical rept. 59-741.
Order from OTS $2.50 PB 161 725

The objective was the development of C, X, and Ku band rectangular waveguide components capable of operating at high power levels, at temperatures from -65°C to 250°C, and at altitudes up to 80,000 feet without the use of auxiliary pressurization equipment. The methods investigated to attain this objective were: waveguides completely filled with dielectric, waveguides sealed by means of tapers (continuous and stepped), and waveguides sealed by dielectric windows. The analysis of waveguides completley filled with dielectric indicates that this technique is not suitable because of the excessive attenuation encountered with presently known dielectric materials. Design techniques for broadband dielectric tapers, both continuous and stepped, and for dielectric windows are established, and the experimental data indicates good correlation with the predicted performance. Dielectric windows using glass-reinforced Teflon laminates were selected for the final waveguide components because of the compact nature of this sealing technique. For frequencies above Ku band, the dielectric taper seals are recommended. (Author)

Armour Research Foundation, Chicago, Ill.
IRRADIATION TESTING OF OPERATING ELECTRONIC EQUIPMENT BY FAST NEUTRONS AND GAMMAS, by R. J. Arndt and C. W. Terrell. Final rept. on Contract N62269-253. 30 Apr 58, 41p.
Order from LC mi$3.30, ph$7.80 PB 147 371

The work reported herein consists of a study of the radiation effects of fast neutrons (0.5 ev to about 15 mev) and gamma rays (fission spectrum) on various pieces of aircraft instrumentation. Components studied were: (1) Fuel Gage Vacuum-tube Amplifier and Indicator, (2) Transistorized (germanium and silicon) Servo Amplifier System, (3) 4 inch Diameter Gyro. The Fuel Gage was subjected to a total neutron flux of about 6×10^5 nvt and about 5×10^8R gamma with no adverse electrical effect. Physical damage was evident. Four Transistorized Amplifiers were irradiated in a fast flux of about 1.0×10^{10} n/cm^2/sec. Rapid loss in gain, rapid increase in d.c. current drain, and complete failure occurred when the integrated flux reached about 10^{13} n/cm^2. The silicon diodes were unaffected by the same flux. Studies on the gyro were inconclusive due to equipment failure. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
NOISE REDUCTION THROUGH ELASTIC PULSE MODULATION, by Erich Pieruschka. 1 July 58, 29p. 9 refs. Rept. no. 2R29F; AD-205 574.
Order from LC mi$2.70, ph$4.80 PB 147 463

The noise reduction in a new type of transmission system, elastic pulse modulation, is investigated analytically in this study. The signal-to-noise ratio of this system is compared with that of pulse position modulation, the system from which it is derived. The analysis is made both for a single link transmission system and for one in which successive regenerative repeaters are applied. The noise reduction for the case where the position of the pulse in a staircase waveform is transmitted by a binary pulse code group is also investigated. This investigation is then expanded to include the case of a system employing a chain of regenerative repeaters. (Author).

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
SPECTRUM UTILIZATION OF DORSETT TR-12, RADIATION 3021A26, RADIATION A-3115-2A, TELECHROME 1472A2, FM/FM TELEMETRY TRANSMITTERS, by William E. Castilo, Virgilio Cisneros, and Charles R. Wise. 9 Dec 59, 107p. AFC Rept. no. TM-9-12-59-T; AD-233 395L.
Order from LC mi$5.70, ph$16.80 PB 146 835

The operational characteristics of these four telemetry transmitters were tested to determine the frequency allocation necessary for operation with a minimum of interference. The tests were run by subjecting the units to parameters of supply voltage variation, operating time, simulated altitude, acceleration and vibration, while empirical measurements were made of their frequency stability, modulation sensitivity and power output. In addition interference characteristics (spurious emissions), VSWR and residual FM were tested.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
ARC SUPPRESSION FOR RELAY CONTACTS, by Ronald Green and Arthur P. Boylan. 15 Aug 59, 17p. 9 refs. USASRDL Technical rept. 2061; AD-227 716.
Order from LC mi$2.40, ph$3.30 PB 146 934

Various methods of arc suppression for relay contacts are investigated, including RC networks and utilization of semi-conductors. Theoretical considerations are presented and the effects of relay characteristics on the suppression parameters discussed. Results of laboratory experiments, comparing theoretical circuit constants with actual values required for optimum suppression, are reported. Empirical formulae are presented for selection of RC networks and guidelines established for application of semiconductor suppression techniques. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
TESTING FOR CORONA IN COAXIAL CABLES, by John P. Agrios. 1 Mar 60, 11p. 3 refs. USASRDL Technical rept. 2100.
Order from LC mi$2.40, ph$3.30 PB 146 936

This report supplements the information for corona testing of coaxial cables for Specification MIL-C-17C. The test circuitry and the calibration of the equipment are discussed to serve as a guide to cable manufacturers for such testing. The cable specimen preparation is also discussed to ensure corona free cable specimens. A brief discussion of the discharges within coaxial cables under high voltage stress is included. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
VOLTAGE SENSITIVE DIODE TUNING SYSTEMS, by Richard S. Tilton and Louis V. Bessen. 15 Apr 59, 26p. 1 ref. USASRDL Technical rept. 2045; AD-220 338.
Order from LC mi$2.70, ph$4.80 PB 146 933

Voltage-sensitive variable-capacitance semi-conductor diodes were investigated for use in tuning systems. Variation of C and Q with voltage and temperature in the 10-80 mc frequency range are reported. Circuits for obtaining straight-line-frequency tuning, tracking of ganged diodes, and temperature compensation are described. (Author)

Arnold Engineering Development Center, Tullahoma, Tenn.
A TRANSISTORIZED GALVANOMETER CURRENT LIMITER, by P. L. Clemens and R. L. Ledford. Rept. on ARO, Inc. Contract AF 40(600)800. Nov 59, 19p. 3 refs. AEDC-TN-59-110; AD-229 206.
Order from LC mi$2.40, ph$3.30 PB 146 763

Design, operating characteristics, and typical applications of a newly developed, transistorized, galvanometer current limiter are described. The limiter, which provides continuously variable adjustment of maximum permissible galvanometer current, has but small effect on other characteristics of the instrumentation system within which it is used (i.e., accuracy, linearity, and frequency response). Use of this galvanometer current limiter permits a decrease of system scale factor, resulting in greater resolution of diminutive data areas, while preventing destructively large galvanometer currents or deflections which might result from occasional extremes of value of the measured parameter. Although intended for use with oscillograph galvanometers, the current limiter is also applicable to other galvanometers and to meter movements as well. (Author)

Bell Telephone Labs., Inc. [New York]
ENGINEERING SERVICES ON TRANSISTORS, by H. G. Follingstad, J. H. Forster and others. Interim technical rept. no. 8, 16 Dec 56-15 Mar 57, on Contract DA 36-039-sc-64618. [1957] 46p. 3 refs. AD-133 294.
Order from LC mi$3.30, ph$7.80 PB 147 386

Contents:
Task 2. Transistor reliability
Task 4. New and improved transmission-type transistors
Task 5. Transistor test methods

Bulova Research and Development Labs., Inc., Woodside, N. Y.
AUTOMATIC MACHINE FOR SEALING OF QUARTZ CRYSTAL UNITS, by Robert J. Bibbero and R. Giglio Tos. Quarterly progress rept. no. 1, 24 June-24 Sep 57, on Contract DA 36-039-sc-72775. [1957] 19p.
Order from LC mi$2.40, ph$3.30 PB 137 444

The purpose of this contract is to develop the prototype of an automatic projection-welding sealing machine for quartz crystal holders HC-6/U, -13/U, and -18/U. This report outlines the general concept of the machine and the design of holders for projection-welding.

Bulova Research and Development Labs., Inc., Woodside, N. Y.
AUTOMATIC MACHINE FOR SEALING OF QUARTZ CRYSTAL UNITS, by Robert J. Bibbero and R. Giglio Tos. Quarterly progress rept. no. 3, 25 Dec 57-24 Mar 58, on Contract DA 36-039-sc-72775. [1958] 15p.
Order from LC mi$2.40, ph$3.30 PB 137 442

Samples of special crystal holders for projection welding, of a size meeting HC-6/U specifications, were manufactured. Crystal holder loading racks (used for evacuation and handling during welding) have been designed and fabricated. (See also PB 137 443)

Bulova [Research and Development Labs., Inc.] Woodside, N. Y.
INDUSTRIAL PREPAREDNESS MEASURE ON TIGHTER TOLERANCE CRYSTAL UNITS CR-(XM-9)/U, by A. S. Matistic. Quarterly rept. no. 1, July 57-Apr 58 on Contract DA 36-039-sc-75940. [1958] 56p. 4 refs.
Order from LC mi$3.60, ph$9.30 PB 137 439

Quartz Crystal processing: Determination and Selection of a Suitable Wafer Cutting Method, Double Crystal X-Ray Set-Up Determination of Z-Z' Orientation Limits over the frequency range from 50MC to 100MC, and, Selection and Determination of Suitable Lapping Procedures.

Burroughs Corp., Paoli, Pa.
REMOTE ELECTRONIC ALPHANUMERIC DISPLAY, by P. J. Barnes, R. E. Benn and others. Final rept. on Contract AF 19(604)3870. 28 Feb 59, 130p. TR-59-9; AFCRC-TR-59-231; AD-213 237.
Order from LC mi$6.30, ph$19.80 PB 146 039

The Remote Electronic Alphanumeric Display (READ) is intended to display local airfield observations sent from the Weather Information Telemeter Station, at such locations as control towers, ready rooms, GCA units, operations office, and weather office. The device receives either 5 or 6 level serial teletype code and electrostatically prints incoming messages at the rates of 1000 or 2000 words per minute. The character size is 5/8 inch high x 3/8 inch wide allowing a 72 character message to be legible from a distance up to 12 feet under both night and daylight conditions.

Chatham Electronics, Livingston, N. J.
DEVELOPMENT AND EVALUATION OF ELECTRON TUBE GLASSES RESISTANT TO RADIATION DAMAGE, by G. R. Weinberg. Semi-annual progress rept. no. 1 for 1 May-1 Nov 59 on Contract DA 36-039-sc-78312; Continuation of Contract DA 36-039-sc-75065. [1960] 22p.
Order from LC mi$2.70, ph$4.80 PB 146 943

Dummy bulbs, with and without leads, made of Owens-Illinois 51-26 boron-free glass, of 3% B_2O_3 and 6% B_2O_3 glass and Corning 7052 and 1723 glass were exposed to neutron bombardment of integrated thermal flux of 10^{16} NVT. Some of these enclosures were checked for strain before and after exposure and others were analyzed for gas content after exposure. A few tubes of type 5U4G and 5R4WGA with special envelopes and a few ionization gauge tubes of type VG1A were irradiated along with Cadmium-Aluminum activation foils as dosimeters. Analysis of these foils revealed an apparent discrepancy in integrated dose, amounting to about ten times the assumed dose, thereby casting some doubt on prior quantitative results in this and the previous contract. (Author) (See also PB 146 041)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
STUDY OF METHODS OF COOLING SEMICONDUCTOR DEVICES, by Steven K. Morrison and James P. Welsh. Final rept. on Contract AF 30(602)1842. Mar 60, 41p. 230 refs. Rept. no. HM-1247-D-4; RADC-TR-60-23.
Order from LC mi$3.30, ph$7.80 PB 146 874

The following techniques pertinent to cooling of semiconductor devices were investigated: methods of mounting, electrically insulating, and removing the dissipated heat by conduction through metals; methods of mounting, fin areas, configurations and orientation to enhance heat removal by natural convection; methods of mounting, geometry, fin configurations, air velocities, air flow rates, and other parameters pertinent to forced convection; and direct and indirect liquid cooling techniques.

Cruft Lab., Harvard U., Cambridge, Mass.
DIPOLE ANTENNAS COUPLED ELECTRICALLY TO A FOUR-WIRE TRANSMISSION LINE TO ACHIEVE CIRCULARLY POLARIZED RADIATION (THEORETICAL AND EXPERIMENTAL STUDIES) by Kun-Mu Chen. Scientific rept. no. 3, series 2 on Contract AF 19(604)4118. 15 Sep 59, 48p. 4 refs. AFCRC-TN-60-127; AD-232 517.
Order from LC mi$3.30, ph$7.80 PB 146 084

Dipole antennas coupled electrically and in a balanced manner to a four-wire transmission line so as to maintain circularly polarized radiation are studied theoretically and experimentally. The configuration consists of a pair of two-wire transmission lines located on the diagonals of a square and driven 90° out of phase. To the lines are coupled many sets of four-dipole antennas arranged symmetrically in planes perpendicular to the transmission lines. If the sets of four-dipoles are separated by a distance of a half wavelength along the transmission line, a circularly polarized radiation with a bilateral end-fire pattern is obtained. By coupling at intervals of a quarter wavelength to the line with a traveling wave, a unidirectional end-fire array may be achieved in the direction along the transmission line. The current, the optimum length of the antenna, the general nature of the coupling, the coupling between additional sets, and the radiation field factor are studied. (Author)

Cruft Lab., Harvard U., Cambridge, Mass.
EXPERIMENTAL DETERMINATION OF THE ZERO-CROSSING DISTRIBUTION W(N,T) by Gerald M. White. Technical rept. on Contract Nonr-1866(16). 15 June 57, 33p. Technical rept. no. 265; AD-146 013.
Order from LC mi$3.00, ph$6.30 PB 147 135

A description is given of the additional equipment built to continue the study of zeros of noise (AD-135 934), and the additional data obtained are depicted by graphs. Broadband noise, narrow-band noise and intermediate cases were considered. The experimental curves agree with calculated curves, and the values of W(N,T), the probability of having N zero-crossings in a time interval T, agree with theoretical predictions.

David Sarnoff Research Center, Princeton, N. J.
FEASIBILITY STUDY OF COMPATIBLE SINGLE SIDE BAND TRANSMITTER, by K. H. Powers, C. A. Von Urff, and F. I. Zonis. Final rept. on Contract AF 19(604)4976. 30 Nov 59, 106p. 6 refs. AFCRC-TR-60-103.
Order from LC mi$5.70, ph$16.80 PB 146 083

A new method of generation of a Single Sideband signal has been developed which provides distortionless reception with a square law envelope detector. This unique compatibility is achieved through a new system design rather than a method such as carrier reinsertion. The system has been completely implemented and many tests made. It has been possible to obtain an average of 25 db sideband rejection using band limited while noise as the intelligence; an average of 2% harmonic distortion using single tone as the intelligence with square law detection and an average of 8-10% intermodulation distortion under the same conditions. In particular applications 25-30 db of sideband rejection may not be sufficient. It is possible to pass the signal through a single sideband filter to increase the rejection and at the same time not materially increase the harmonic and intermodulation distortion.

Diamond Ordnance Fuze Labs., Washington, D. C.
A GUIDE TO SELECTION AND USE OF DYNAMIC PRESSURE TRANSDUCERS, by Arthur Hausner. 14 Sep 59, 17p. 8 refs. Technical rept. TR-814; AD-233 007.
Order from LC mi$2.40, ph$3.30 PB 146 137

A survey was made of commercially available dynamic pressure transducers. The more important characteristics of these transducers taken from the manufacturers' literature are grouped according to principle of operation. For each group listed, the names and addresses of representative manufacturers of the transducers are given. Users of dynamic pressure transducers will find the information useful for selecting one which will best serve for a particular measurement. (Author)

Directorate of Flight and All-Weather Testing, Wright-Patterson AFB, Ohio.
MODIFICATION OF NORC TELEMETERING EQUIPMENT, by Robert L. Goff. Rept. by Radiation, Inc., on Contract AF 33(038)22817. June 54, 28p. Technical note WCT-54-36.
Order from LC mi$2.70, ph$4.80 PB 147 582

This modification program resulted in greatly improved functional characteristics and excellent packaging. Radio link signal levels lower than 20 microvolts allow radio interference to be superimposed upon the recorded signal so that information at frequencies greater than 10 cycles is difficult to measure accurately. Tests were conducted to determine system stability. Linearity characteristics of the system chain from transducer to recorder were better than one per cent under ideal video link conditions.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
DETECTION AND MEASUREMENT OF SPURIOUS SIGNALS GENERATED BY MICROWAVE OSCILLATOR TUBES, by R. E. Booth and R. G. Veltrop. Rept. on Contract DA 36-039-sc-73170. 9 Jan 58, 25p. 1 ref. Technical memo. no. EDL-M72; AD-158 646.
Order from LC mi$2.70, ph$4.80 PB 147 132

Two methods of detecting and measuring spurious signals generated by microwave oscillator tubes are given in this report. The first is a point-by-point technique which employs a manually tuned receiver to examine the output of the tube under test. The second is the search receiver technique which uses the tube under test as the swept local oscillator of a receiver. In the latter case, a simulated signal is supplied to the receiver to provide mixing with the spurious signals, if any. Step-by-step procedures are given and the problem of distinguishing between true spurious signals and signals produced by receiver phenomena are discussed. The origin of spurious signals near the main frequency is also discussed and experimental comparison is made with theory. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
MICROWAVE PHASE SHIFTING BY FERROELECTRIC ELEMENTS, by Howard Diamond. Rept. on Contract DA 36-039-sc-73170. 25 Apr 58, 20p. Technical memo. no. EDL-M134. AD-203 549.
Order from LC mi$2.40, ph$3.30 PB 146 059

Phase shifts have been measured for typical commercial non-linear ceramics placed in a terminating position on a coaxial transmission line. An appendix covering several definitions of ferroelectric properties is included.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
THE APPROXIMATION OF NETWORK FUNCTIONS USING TCHEBYCHEFF POLYNOMIALS, by Shlomo Karni. Technical note no. 12 on Contract AF 49(638)63. 18 Mar 60, 66p. 31 refs. AFOSR-TN-60-342.
Order from LC mi$3.90, ph$10.80 PB 146 920

Approximation is accomplished by expanding the prescribed response function and an assumed network response function in series of Tchebycheff polynomials. Matching a finite number of terms in the two series determines the desired network function, and the error of approximation. The results represent an extension of a method due to Darlington. The extensions include a method for the derivation of Padé approximants from the Tchebycheff polynomials series expansion of the prescribed gain, a procedure for the reduction of network complexity, and a technique for the matching of the power series expansions of the derivative of a prescribed gain function with that of a network function. The theoretical developments are supported by step-by-step procedures for use in design problems. Included are realizability tests, various tabulations, and graphs. The methods are illustrated by the following examples. (1) The equalization of gain distortion resulting from one or more poles on the negative real axis by means of all-pole network functions. (2) A method for the exact equalization of gain distortion in the approximation band. (3) The approximation of the so-called "brick wall" and the linearly decreasing gain functions by means of biquadratic network functions. (4) The reduction of the degree of a given network function. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
SYNTHESIS OF DOUBLE-TERMINATED ACTIVE NETWORKS, by King Sun Fu. Technical note no. 11 on Contract AF 49(638)63. 4 Mar 60, 32p. 14 refs. AFOSR-TN-60-368.
Order from LC mi$3.00, ph$6.30 PB 146 919

Methods are given for the synthesis of double-terminated active networks for zeros of transmission at zero, infinity, and on the imaginary axis, and also complex zeros of transmission. The network configuration used is a bridge-type active network containing negative impedance converters. (Author)

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
TRANSISTORIZED FOUR-SEGMENT COMMUTATOR FOR A DIRECT-CURRENT MACHINE, by Frederick L. Schwartz. Rept. on Contract AF 33(616)3984. Feb 60, 47p. 18 refs. WADC Technical rept. 59-682.
Order from OTS $1.25 PB 161 721

The main features of this electronic commutator are: (a) commutation is performed on the stator windings by means of an eight-switch arrangement; (b) the rotor position signal for controlling the switching operations is obtained from two Hall generators mounted in the air-gap of a separate machine which is rigidly coupled to the shaft of the commutated machine; (c) transistors are used as the switching elements and in the control circuitry; (d) the commutator switches are bilateral, allowing the machine to run either as a d-c motor or generator. A machine using the electronic commutator was successfully run as a d-c motor and generator at an input power level of 240 watts. The electronically commutated machine is capable of running at an input power level of 600 watts. Two sets of slip rings were the only sliding contacts required for the operation of the machine. A comparison between the electronic and mechanical commutator in terms of size, reliability, and efficiency shows that more work must be done, especially on solid-state switching devices, before the electronic commutator will be practical for moderate- and high-power machines. (Author)

Electronic Tech. Lab., Wright Air Development Div., Wright-Patterson, AFB, Ohio.
PHOTOCATHODE SIGNAL-TO-NOISE LIMITATIONS IN PICKUP TUBES, by Melvin R. St. John. Rept. on Electronic Tubes and Transistors. Feb 60, 25p, WADC Technical note 59-363.
Order from OTS $0.75 PB 161 728

The maximum signal-to-noise ratio of pickup tubes is limited by the noise due to statistical fluctuations in photoemitted electrons. This maximum has not been achieved in any pickup tube because of additional noise introduced into the tube by the scanning beam. This report shows the theoretical maximum signal-to-noise ratio that can be achieved under the specified conditions plus graphical illustrations of several approaches toward achievement of this limit. The treatment is not rigorous, but rather a highlight presentation to convey a better understanding of the problems to be considered when very low light levels are involved. (Author)

Electronic Tech. Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
THERMIONIC ENERGY CONVERTER, by Walter L. Knecht. Rept. on Thermionic and Solid State Electronic Technology. Mar 60, 54p. 4 refs. WADD Technical rept. 60-128.
Order from OTS $1.50 PB 161 713

High-vacuum and gas-filled thermionic energy converters are reviewed. Emphasis is placed on the significant phenomena underlying the operation of these two classes of converters. A treatment of fundamental thermionic emitter characteristics is given. The complex variety of simultaneous processes occurring in the plasma of gas-filled converters is illustrated. Principal problem areas existing in the field of both converter types are shown. The present state of the art in this field is discussed in connection with the results obtained with small-sized device samples developed up to date. Future applications of thermionic converters are projected, and, in turn, the report refers to the current need of continued applied research efforts aimed at advancing the state of the art from the presently available thermal conversion efficiency of about 10 percent up to the theoretically feasible level of approximately 30 percent. (Author)

Electronics Research Lab., U. of California, Berkeley.
THE COMMON COLLECTOR-COMMON EMITTER PAIR, by M. S. Ghausi and D. O. Pederson. Rept. on Contract N7onr-29529. 11 May 59, 18p. 8 refs. Rept. no. 87; IER Series no. 60, issue no. 236; AD-220702.
Order from LC mi$2.40, ph$3.30 PB 146 093

The analysis and design are presented of a CC-CE pair selected from a cascade of identical pairs. The primary interest is in low pass broadband amplifiers. Simple equivalent circuits for the pair are developed and a design procedure is given to achieve a flat-type magnitude transmission characteristic in the pass band. The gain bandwidth factor of a CC-CE pair is compared with the other broadband low pass amplifiers using the common emitter configuration with various broadbanding techniques. These other broadbanding techniques include: resistive broadbanding, series-peaking, local series feedback of a parallel RC network in the emitter lead and shunt-peaking. It is shown that for large bandwidths the combinational pair of CC-CE is superior in gain-bandwidth factor except for the shunt-peaked amplifier. (Author)

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF UNIMODE ANODE TECHNIQUE. Final engineering rept. for 10 July-27 Sep 57 and 20 Jan-20 May 58 on Contract AF 30(602)1768. 12 Aug 58, 84p. 3 refs. RADC-TR-58-150; AD-205 916.
Order from LC mi$4.80, ph$13.80 PB 146 510

An analysis of the unimode problem, combining equivalent circuits and field theory analysis, was made. Several methods of unimoding were investigated, followed by the actual design of anodes using these methods. The unimode approach was then applied to new devices and experimental results obtained. (Author)

General Electric Co. [Schenectady, N. Y.]
A PROCEDURE FOR ESTIMATING OPERATING TEMPERATURES OF ELECTRONIC COMPONENTS, by Glen E. McIntosh. 15 Jan 53, 14p. 2 refs. Proj. Hermes Heat Transfer memo. no. 49.
Order from LC mi$2.40, ph$3.30 PB 145 984

General Electric Microwave Lab., Palo Alto, Calif.
COMPUTER APPLICATIONS, by V. Met, M. P. Forrer, and T. M. Shaw. Final rept. for Mar 58-June 59 on Contract Nonr-2127(00). [1959] 38p. 19 refs. Rept. R59ELM 79-5.
Order from LC mi$3.00, ph$6.30 PB 147 452

Contents:
Analysis of millimicrosecond pulse transmission, pub. in proceedings of the IRE 46:1830-1835, Nov 58.
Experimental and theoretical investigations of the regenerative pulse generator
Spin echo storage
(See also PB 143 986)

Granger Associates, Palo Alto, Calif.
ENGINEERING TEST MODEL, ANTENNA AS-1019(XE-1)/TRD. DESIGN AND FABRICATE 50-320 MC DF ANTENNA, by R. E. Hunter. Quarterly progress rept. no. 2, 1 Nov 59-1 Feb 60, on Contract DA 36-039-sc-84533. [1960] 10p.
Order from LC mi$1.80, ph$1.80 PB 147 424

The majority of effort during this period was expended finalizing the design of the D/F atenna array with its supporting structure and preparing engineering drawings for these items for release to the manufacturing departments. The stress analysis was based upon wind loadings of 25 pounds per square foot (100 mph winds) from a direction relative to the antenna found to provide the maximum loads. Besides contractual environmental requirements, the D/F antenna array was designed to withstand handling and mis-handling of components and assemblies during field installation. These conditions were considered in conjunction with the weight limit established by the contractual specifications. The engineering drawings were prepared to meet military specifications as much as possible and specify all military specifications pertaining to the production of the parts. Fabrication was started on the first unit and associated tooling. Any items requiring long procurement time were ordered for both units. (Author) (See also PB 147 423)

Granger Associates, Palo Alto, Calif.
ENGINEERING TEST MODEL, ANTENNA AS-1019(XE-1)/TRD: A LOW FREQUENCY EXTENSION OF MODIFICATION KIT ELECTRONIC EQUIPMENT MK-383/TRD. DESIGN AND FABRICATE 50-320 MC DF ANTENNA, by R. E. Hunter and R. B. Kolbly. Quarterly progress rept. no. 1, 1 Aug-1 Nov 59, on Contract DA 36-039-sc-84533. 2 Jan 60, 31p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 147 423

The electrical design has been finalized using a log-periodic transposed-dipole array as the basic element. The log-periodic antenna has the characteristic that its radiation and impedance characteristics repeat as the frequency is changed by a factor, hence very large bandwidths with essentially constant radiation and impedance characteristics are obtainable. Two of these elements are mounted on the same axis to give both horizontal and vertical polarization; and three of these structures, consisting of two elements each, are arrayed forming the complete antenna. The antenna parameters have been optimized and are given in this report. Patterns for all modes of operation, as well as illustrative developmental patterns, are given. Impedance data for the element is also given. The VSWR of one antenna, relative to 75 ohms, is 1.3:1. For lobe-switched operation the half-power beamwidths are 42 degrees and 45 degrees for horizontal and vertical polarization, respectively. The equal-amplitude points are between 3 and 4 db for vertical polarization and from 2.8 to 3.6 db for horizontal polarization. In single-lobe operation the half power beamwidth is 65 degrees for horizontal polarization and 95 degrees for vertical polarization. (Author)

Hughes Aircraft Labs., Culver City, Calif.
STUDY OF ATOMIC AND MOLECULAR RESONANCES FOR MICROWAVE GENERATION AND AMPLIFICATION, by T. Maiman, R. Hoskins, and D. Devor. Quarterly progress rept. no. 6, 15 Mar-15 June 59, on Contract DA 36-039-sc-74967. [1959] 17p. 12 refs. AD-228 178.
Order from LC mi$2.40, ph$3.30 PB 147 425

X-band ruby maser operation was observed up to a temperature of 195°K with dry ice used as a coolant. It was found that ruby crystals with high chromium content functioned poorly (low gain-bandwidth product) at 4.2°K but behaved normally at higher temperatures. An explanation based on cross relaxation is presented. A noise temperature of 100°K and a gain-bandwidth product of 14 Mc were measured for a maser operating at 77.4°K (temperature of liquid nitrogen). Preliminary results on calculations of the fine structure levels of Cr^{+3} in TiO_2 (rutile) are reported. Pulsed magnetic field experiments were conducted with ruby as the paramagnetic material. Inversion of successive spin levels by adiabatic fast passage at X-band followed by the application of a pulsed magnetic field resulted in pulsed amplification and oscillation at several frequencies from 14 kmc to 28 kmc. The rapid attainment of a Boltzmann distribution of spin populations when the energy levels become equidistant in a multilevel spin system was demonstrated directly. (Author)

Integrated Range Mission, White Sands [Missile Range] N. Mex.
A MICROWAVE TELEMETRY RELAY, by Leonard S. Taylor. 15 Apr 58, 88p. AD-216 078L.
Order from LC mi$4.80, ph$13.80 PB 147 367

A 2200 Mcps multichannel telemetry relay system has been developed. This equipment has been designed to provide a high capacity net interlinking all data recording sites and the fixed and mobile receiving stations on the proving ground. In addition, simultaneous calibration of all stations has been made possible. The relay employs the superheterodyne principle to translate all the VHF telemetry signals as a unit to the microwave region for transmission to the recording stations. The system features a large dynamic range. Close channel spacing is utilized for efficient use of bandwidth. Unattended operation of the equipment is possible. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
INSTRUMENTATION FOR THE DETERMINATION OF IONOSPHERIC POLARIZATION BETWEEN 100 AND 1,000 KC/S AND PRELIMINARY DATA, by H. N. Carlson. Scientific rept. no. 129 on Ionospheric Research, Contract AF 19(604)3875. 1 Feb 60, 41p. 10 refs. AFCRC-TN-60-406.
Order from LC mi$3.30, ph$7.80 PB 146 897

Equipment is described that receives ionospheric echoes over the swept range of radio frequencies 50-1000 kc/s and resolves them into their two circular components. This is accomplished by phase shifting and adding at a constant intermediate frequency. Circuits are designed for fast recovery since operation near the transmitter is necessary for RF tracking. Preliminary results are presented. (Author)

Keystone Electronics Co., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON MINIATURE SIZE QUARTZ CRYSTALS. COMPLETION REPORT FOR STEP I: INDUSTRIAL PREPAREDNESS STUDY ON CR-55/U CRYSTAL UNITS, by James M. Ronan. Rept. on Contract DA 36-039-sc-54696. 15 Jan 58, 33p.
Order from LC mi$3.00, ph$6.30 PB 137 445

Manufacture of CR-55/U quartz crystal units in the frequency range of 17.0 MC to 60.750 MC has not proven to be too difficult. Standard equipment was used for fabrication.

Land-Air, Inc., Hollorman, N. Mex.
DEVELOPMENT OF MIRAN REMOTE OPERATION. Final rept. on Contracts DA 29-040-ORD-1010 and DA 29-040-ORD-1302. Dec 58, 83p. 5 refs. LA-58-13; AD-214 433.
Order from LC mi$4.80, ph$13.80 PB 146 980

Automation of the Miran Relay Stations has been accomplished with the development of remote-control equipment. By means of a modulated RF signal, an operator at the Master Station is able to activate Miran equipment at distant Relay Stations, and to de-activate the equipment on completion of a mission. Considerable savings in manpower, travel time, and vehicles are effected. This report incorporates a description of the equipment and instructions for installation and operation. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
A FIXED-CAP UHG TR TUBE, by C. W. Jones, C. E. Muehe, and S. J. Miller. Rept. on Contract AF 19(122)458. 29 Mar 57, 23p. 7 refs. Technical rept. no. 155; AD-147 407.
Order from LC mi$2.70, ph$4.80 PB 146 979

The existing TR tubes used in the region of the frequency spectrum between 1200 and 3000 Mcps are not satisfactory for use in UHF applications. This report describes a fixed-gap TR tube and its accompanying circuits that have been used successfully in UHF radar applications.

Material Lab., New York Naval Shipyard, Brooklyn.
EVALUATION OF BRAID COATINGS FOR CABLE CONDUCTORS WITH CLASS E INSULATION, by Samuel H. Behr and Edward J. Hoerauf. Final rept. 27 May 58, 9p. Lab. project 5248-111; AD-206 089.
Order from LC mi$1.80, ph$1.80 PB 147 368

Nylon lacquers with a four mil wall thickness will give substantial abrasion resistance providing they are applied in several thin coats with adequate heat drying between coats or after coating. Thinner walls of extruded nylon will give equal abrasion resistance. However, a braid saturant is necessary under the extruded nylon to lay down the glass fibers before tubing and also retard the flow of water through the glass braid. The improved abrasion apparatus described in this report will compare the abrasion resistance of braid coating materials with reasonable accuracy and is recommended for inclusion in the forthcoming amendment to specification MIL-C-2194B. (Author)

McCoy Electronics Co., Mount Holly Springs, Pa.
FINAL TECHNICAL AND PROCESS MANUAL APPLYING TO INDUSTRIAL PREPAREDNESS STUDY COVERING TYPE CR-55/U CRYSTAL UNITS. Rept. on Contract DA 36-039-sc-66073. [1958] 46p.
Order from LC mi$3.30, ph$7.80 PB 137 421

Michigan U. [Research Inst.] Ann Arbor.
SERIES-PARALLEL GRAPHS AND LATTICES, by Calvin C. Elgot and Jesse B. Wright. Rept. on Project Michigan, Contract Nonr-1224(21). 25 Feb 58, 26p. 2144-1120-M; AD-204 494.
Order from LC mi$2.70, ph$4.80 PB 138 247

A path in a doubly rooted graph $G=(N, E, R, p_0, p_1)$ is a sequence of distinct points in G, initiating with p_1 and terminating with p_2. The link relation of $G=(N, E, R, p_0, p_1)$ is the set of ordered pairs of points which are consecutive in some path. A graph is admissible if each of its points is in some path and for each edge of the graph with end points a, b, either (a, b) or (b, a) is an element of its link relation. Theorem: If $G=(N, E, R, p_0, p_1)$ is admissible, then it is series-parallel if and only if its link relation is asymmetric. This theorem is proved by obtaining intermediate results which characterize the transitive closure of the link-relations of series-parallel graphs (as series-parallel lattices). (Author)

Michigan U. Research Inst., Ann Arbor.
TRANSISTOR-DIODE LOGIC, by R. A. Carlsen. Technical memo. no. 66 on Contract DA 36-039-sc-63203. Oct 58, 22p. 6 refs. 2262-197-T; AD-227 096.
Order from LC mi$2.70, ph$4.80 PB 146 942

The design features are discussed of direct-coupled transistor diode logic. The discussion includes comments on the effect of diode reverse transients on circuit performance, the dependence of the number of gate drives on transistor and diode properties, and isolation obtained between input and output gate terminals for the circuit presented. The unique feature of the circuit is the use of the low collector-to-emitter transistor as a replacement for a diode clamp. (Author)

Microwave Associates, Inc., Burlington, Mass.
HIGH REPETITION RATE BROADBAND DUPLEXER, by Emanuel L. Horn. Quarterly progress rept. no. 5, 15 Aug-15 Nov 59, on Contract DA 36-039-sc-78165. [1959] 14p. AD-232 341.
Order from LC mi$2.40, ph$3.30 PB 147 428

Measurements of arc loss and recovery time have been continued at low repetition rates. The data show that although the dumbell type iris structure yields lower values of arc loss it also yields larger values of recovery time than the encapsulated window. A design investigation has been initiated to fabricate tubes with all elements encapsulated in order to eliminate the difficulties normally encountered in fabricating dual S band TR tubes. (Author) (See also PB 146 494)

Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF DUPLEXING TECHNIQUES AT HIGH DUTY CYCLE CONDITIONS, by Lawrence Gould. Quarterly progress rept. no. 4, 1 July-30 Sep 59, on Contract DA 36-039-sc-78233. 29p. AD-231 514.
Order from LC mi$2.70, ph$4.80 PB 146 795

The study of Tee circulators as an element in a high duty cycle duplexer has been continued. Operation at 180 watts average power in X band has been achieved. The characteristics of leakage power and recovery time for crystal protector TR tubes have been measured for various mixtures of argon, water, and ammonia. The most promising gas fill is a mixture of water and ammonia which yields a recovery time independent of temperature from -55°C to 85°C with a recovery time value of the order of 0.2 μs. The analysis of the silicon diffuse junction diode in a microwave circuit is considered as a possible element in a high duty cycle duplexer. (Author) (See also PB 146 495)

Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF DUPLEXING TECHNIQUES AT HIGH DUTY CYCLE CONDITIONS, by Lawrence Gould. Quarterly progress rept. no. 5, 1 Oct-31 Dec 59, on Contract DA 36-039-sc-78233. [1960] 16p.
Order from LC mi$2.40, ph$3.30 PB 146 796

A circulator can be designed having a 10% bandwidth. The recovery time characteristics of a crystal protector TR tube have been investigated at low values of peak power. The results indicate that excessively large values of recovery time can be achieved during the ranges of incident power in which the input gap and window fire. The analysis of the silicon diffused junction diode as an element in a high duty cycle duplexer has demonstrated inferior performance at X band because of the series inductance associated with the diode package. (Author) (See also PB 146 795)

Microwave Engineering Labs., Inc., Palo Alto, Calif.
INVESTIGATION OF MICROWAVE NON-LINEAR EFFECTS UTILIZING FERROMAGNETIC MATERIALS, by Roy W. Roberts. Quarterly progress rept. no. 10, 1 Aug-31 Oct 59, on Contract DA 36-039-sc-73278. [1959] 24p. 3 refs. AD-231 484.
Order from LC mi$2.70, ph$4.80 PB 146 941

A high moment nickel-zinc ferrite was made in the laboratory for use in harmonic generation. Measured linewidths were approximately 45-60 oer. This material had a high efficiency in 2 mm generation, giving approximately 10-20 peak output. Further experiments were run on the ferrite parametric amplifier and magnetic Q, gain, and noise power were measured. Three additional batches of single crystal garnets were grown with better temperature control and mechanical stability. One batch was grown with a modified flux of PbO and PbF_2 and using a technique of recharging the crucible so that total reactant mass was increased 3-fold over previous runs. This batch gave many large crystals with linewidths as narrow as 2.5 oer. (Author)

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH, by M. Chodorow. Scientific rept. no. 17, 1 July-30 Sep 59, on Contract AF 19(604)1930. Nov 59, 27p. 5 refs. M. L. Rept. no. 662; AFCRC-TN-60-101; AD-232 521.
Order from LC mi$2.70, ph$4.80 PB 145 968

Contents:
Microwave tube studies
- Studies in the theory of coupled cavities
- Investigation of the behavior of velocity-modulated electron beams in long gaps
- Electron beam parametric amplifier

Plasma physics studies
- Electron beam interaction with a plasma
- Electron plasma waves
- Parametric effects
- Electrostatic sound waves
- Plasma confinement
- Thermal plasma
- Noise in plasmas
- Harmonic generation in plasmas
- Microwave measurements in plasmas

Ferrite nonlinear propagation
(See also PB 145 574)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
ELECTRONICALLY-TUNABLE MICROWAVE OSCILLATIONS AND DETECTION AND MIXING PROPERTIES OF A COAXIAL MAGNETRON, by R. M. Hill and F. A. Olson. Rept. on Contract DA 36-039-sc-73188, Continuation of Contract DA-36-039-sc-71053. 30 June 57, 30p. 16 refs. Technical rept. no. MPL-7.
Order from LC mi$2.70, ph$4.80 PB 146 789

Results are given of preliminary investigations of the behavior of self-excited electron oscillations originating in the space charge region between a hot wire filament and a cylindrical anode in the presence of a magnetic field. This coaxial magnetron is observed to oscillate and emit radiation at a frequency nearly equal to the electron cyclotron frequency divided by the $\sqrt{2}$. Although this phenomenon has been mentioned in the early magnetron literature, it has received little attention from a practical standpoint. By varying the magnetic field and programming the anode voltage, it is possible to tune the frequency of this tube and the possibility of rugged construction, it appears promising as a useful local oscillator tube that could be designed to cover at least octave bandwidths throughout the frequency range from about 300 megacycles to 12 kilomegacycles.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ELECTROMECHANICAL PULSE GENERATORS, by Enrico Levi. Rept. on Contract Nonr-839(05). 6 July 59, 36p. Research rept. R-751-59; PIB-679; AD-220 852.
Order from LC mi$3.00, ph$6.30 PB 147 084

Generation of electrical pulses directly at the electromechanical energy conversion stage may prove to be most economical for radar and fusion research applications, in view of the ever increasing power levels required. Conventional types as well as the induction pulser, considered as a model for future thermonuclear generators, are described in terms of a fundamental set of equations of which the solution is presented for limiting cases. On this basis it is possible to evaluate the relative merits of each type, to deduce design principles and derive efficiency expectancies and ultimate power capabilities. (Author)

Microwave Research Inst., Polytechnic Inst., of Brooklyn, N. Y.
STUDY OF MICROWAVE FERRITE DUPLEXERS, by Lawrence Levey and Leo M. Silber. Final rept. for 1 Apr 58-30 Sep 59 on Contract DA 36-039-sc-78000. 15 Jan 60, 44p. 5 refs. Rept. no. R-795-59; PIB-723.
Order from LC mi$3.30, ph$7.80 PB 146 792

The development is summarized of a microwave circulator in which the ferrite element is in the form of a hollow tube of rectangular cross-section. This ferrite geometry lends itself to fast switching applications. A discussion is included of the requisite properties of ferrite materials for optimum operation of a switching circulator and describes the development of suitable materials and the means by which they were fabricated into the necessary shapes. The switching performance of a prototype circulator is described. (Author)

Midland Mfg. Co., Inc., Kansas City, Kan.
INDUSTRIAL PREPAREDNESS STUDY ON TIGHTENED TOLERANCE CR-54/U CRYSTAL UNITS CR-(XM-9)/U. Final rept. for 31 Dec 57-7 Apr 58 on Contract DA 36-039-sc-75936. 23 May 58, 47p.
Order from LC mi$3.30, ph$7.80 PB 137 440

An outline for the process specification for tightened tolerance CR-54/U quartz crystal units is presented. (See also PB 137 441)

Midland Mfg. Co., Inc., Kansas City, Kan.
INDUSTRIAL PREPAREDNESS STUDY ON TIGHTENED TOLERANCE CR-54/U CRYSTAL UNITS CR-(XM-9)/U. Quarterly progress rept. nos. 1 and 2 for period through 31 Dec 57 on Contract DA 36-039-sc-75936. 14 Mar 58, 22p.
Order from LC mi$2.70, ph$4.80 PB 137 441

Techniques involved in changing the production process to producing an acceptable yield under the tightened tolerance condition were developed and tested in an effort to determine their suitability.

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Annual rept. no. 1 (4th quarter) 1 Mar-1 June 57, on Contract DA 36-039-sc-72378. [1957] 32p. 2 refs. AD-138 882.
Order from LC mi$3.00, ph$6.30 PB 147 415

A number of crystal oscillators presently used in commercial equipment have been analyzed to determine the maximum value of series R capable of sustaining oscillations. The three oscillators to be used in the final instrument are individually described. Data obtained with experimental models and available crystals are given for the high and low bands. The composite test set is described both functionally and physically. (Author) (See also PB 147 418)

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Final rept. for 13 Feb 56-30 Nov 58 on Contract DA 36-039-sc-72378. [1958] 97p.
Order from LC mi$5.40, ph$15.30 PB 147 422

The present status of the "Unwanted Crystal Mode Detector" is discussed. A complete schematic for each of the two units comprising the complete detector test set is illustrated and described. Circuitry for the low, mid and high band detectors is covered extensively as are the special voltage metering circuits. The panel layout of each unit is illustrated. The functions of all variable controls are discussed. The operating procedure for testing a crystal for harmful spurious modes is covered in detail. A series of reference oscillators chosen from ARF designs are described and their use in determining which spurious responses are harmful is discussed. Spurious data obtained from the entire quantity of two hundred crystals furnished by the Signal Corps is presented in tabular form. The results are analyzed from the standpoint of the Detectors ability to detect all crystal modes considered harmful. The gain calibration curves for the two prototype units are illustrated. The twenty-seven crystals previously tested at the Signal Corps, have been tested at their maximum allowable drive level whenever possible. This data is presented in tabular form. (Author) (See also PB 147 421)

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Quarterly rept. no. 1, 1 June-1 Sep 56, on Contract DA 36-039-sc-72378. [1956] 34p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 147 416

The required instrument is divided into the following three parts - R. F. oscillator-selective network - metering. Complete functional details are given for each of these proposed parts. The R. F. oscillator has been built and the circuit is given. Work has begun on an R. F. detector, having good response characteristics between the frequency limits of 1 to 110 megacycles, which is to be used in conjunction with the metering circuits. The crystal oscillators to be used in determining the spurious specifications are described. The two oscillators most likely to prove unstable, the Colpitts and the Butler, are now being constructed. (Author)

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Quarterly rept. no. 2, 1 Sep-1 Dec 56, on Contract DA 36-039-sc-72378. [1956] 23p. 1 ref.
Order from LC mi$2.70, ph$4.80 PB 147 417

The crystal oscillators to be used in determining the spurious specification are described. Circuits of these oscillators at three test frequencies are given. Two methods which will be used at the lowest test frequency to experimentally determine the susceptibility of an oscillator to operate on a spurious response are explained. The results of the crystal procurement program to date are given. (Author) (See also PB 147 416)

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Quarterly rept. no. 3, 1 Dec 56-1 Mar 57, on Contract DA 36-039-sc-72378. [1957] 57p. AD-133 350.
Order from LC mi$3.60, ph$9.30 PB 147 418

The Butler and Hartley oscillator circuits were analyzed to determine the highest values of crystal spurious resistances capable of sustaining oscillations. Schematic diagrams are given of the 6- to 7-mc Butler and Hartley oscillator circuits. By utilizing the equations derived, the highest values of spurious resistances capable of controlling oscillations in these 2 circuits were computed. The main and spurious mode resistances and frequencies of the crystals used to test the oscillators are tabulated, and the spurious responses detected by the test oscillators are indicated. The over-all ability of the Hartley oscillator to detect spurious responses is given by a curve of highest spurious resistances detected vs the percentage of the frequency difference from the main response. A similar curve which is expanded to include only those responses within 1% of the main response frequency is also obtained by the use of the similated spurious technique. (See also PB 147 417)

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Quarterly rept. no. 5, 1 June-1 Sep 57, on Contract DA 36-039-72378. [1957] 31p. AD-149 751.
Order from LC mi$3.00, ph$6.30 PB 147 419

The completed laboratory experimental model of the Crystal Spurious Mode Detector is described. Experimental high band oscillators using an "Inductuner" to cover the entire band are described. One oscillator is a standard Butler and the other a grounded-grid circuit with the feedback taken from a capacitor tap. Three standard grounded-grid oscillators specifically constructed for high frequency operation and designed to cover the high band are described. The results obtained by testing available crystals are given. Two oscillators, constructed for the purpose of defining an "unwanted crystal mode", are described and results given. (Author) (See also PB 147 415)

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Quarterly rept. no. 6, 1 Sep 57-1 Feb 58 on Contract DA 36-039-sc-72378. [1959] 44p.
Order from LC mi$3.30, ph$7.80 PB 147 420

A summary is given covering the low, mid and high-band detectors. Included are the major electrical and mechanical changes for the mid-band detector. Development information covering all three bands is presented. The inductuner oscillator is compared with the three separate oscillator method of covering the high-band. Tuning requirements and the present status of the low-band oscillator are given. Spurious detection data covering the mid-band (6-40 Mc) and the high-band (40-125 Mc) ranges are presented and analyzed. (Author) (See also PB 147 419)

Motorola, Inc., Chicago, Ill.
INVESTIGATION OF METHODS AND TECHNIQUES FOR DETECTING UNWANTED CRYSTAL MODES, by B. Niederman and J. Loos. Quarterly rept. no. 7, 1 Feb-1 May 58, on Contract DA 36-039-sc-72378. [1958] 51p.
Order from LC mi$3.60, ph$9.30 PB 147 421

The status of the two prototype Unwanted Crystal Mode Detector units is discussed. A complete circuit diagram of each detector unit is illustrated and described. Functions of all variable controls are discussed. Metering circuits are also explained. The panel layout of both units is illustrated. The controls are described in detail. The operating procedure of testing a crystal for unwanted spurious modes is outlined. Spurious data obtained with the low frequency detector (1-40 Mc) using government supplied crystals are given. Data at 10 Mc, 30 Mc, 50 Mc, 75 Mc and 100 Mc using both prototype detector units and A.R.F. "reference" oscillators are presented. The results are analyzed from the standpoint of the Detectors ability to detect all crystal modes considered harmful. (Author) (See also PB 147 420)

National Union [Electric] Corp., Orange, N. J.
MINIATURE CATHODE RAY TUBE, R-2163, by F. Holborn and C. Bartholomew. Final engineering rept. on Contract AF 33(038)17345. [1953] 43p. AD-14 027.
Order from LC mi$3.30, ph$7.80 PB 146 916

Two versions of the tube were developed. The first uses a Willemite screen (P-1) which gives a green trace and has medium persistence. The second uses a long-persistence cascade phosphor (P-7). The tube envelope consists of lead glass (Corning 0120) except for the face plate, which is made of Fourco glass. A modified small-button 9-pin stem is used. Electrostatic focus and deflection are utilized in the electron gun which is supported in the envelope by 4 support springs. The springs also serve to absorb shock and vibration. About 10% of the cathode current reaches the screen, and the rest is absorbed by the limiting apertures. The tube passed the vibration test and a 500-g shock test. Both versions of the tube suffered

a burning of the phosphor screen during life tests. A life test period of 500 hr or less was considered to be more realistic than the 1000-hr test. The method of producing the tube is described. The tubes operated at LV, had good light output, and did not have an exposed exhaust tip.

Mound Lab., Miamisburg, Ohio.
NUCLEAR BATTERY, THERMOCOUPLE TYPE, by B. C. Blanke. Quarterly rept. no. 1, 1 Jan-31 Mar 57, on Contract R-50-799965-sc-01-91. 26 Apr 57, 18p. 6 refs. MLM-CF-57-4-34; AD 146 708.
Order from LC mi$2.40, ph$3.30 PB 147 127

The potential usefulness as a heat source for the thermal battery of 1300 radioactive isotopes was investigated. All but thirty-two have been eliminated because of too long or too short a half-life and/or excessive gamma radiation of the isotope or element. Further eliminations are being made on the basis of relative availability and costs. (Author)

National Bureau of Standards, Washington, D. C.
AN IMPROVED HYDROGEN ATOM BEAM FURNACE, by Ralph Klein and John Pararas. May 60, 9p. 2 refs. Technical note 47.
Order from OTS $0.50 PB 151 406

An improvement in the construction of the tungsten furnace for use in a hydrogen atom-beam apparatus has been effected by fabricating the furnace from a tungsten rod. This avoids the possibility of leakage of molecular hydrogen which may occur when the tungsten tube is made from rolled tungsten sheet, the technique used heretofore. The fabrication of the seamless furnace and the method of mounting are described. (Author)

National Union [Electric] Corp., Orange, N. J.
MINIATURE TWIN INDICATOR TUBE R-2164, by H. J. Koch. Final engineering rept. on Contract AF 33(038)17345. [1952] 51p. AD-13 884.
Order from LC mi$3.60, ph$9.30 PB 146 917

A twin indicator miniature equivalent of the 6AF6G was developed. The solder glass, poli-optic sealing, and fused glass techniques were employed in an effort to seal the tube in a vacuum after processing. It was concluded that it was impractical to seal a tube together in the bell jar under vacuum with a glass-to-glass seal. Another method was tried which consisted of sealing the bulb and stem in the usual manner and exhausting through a tubulation in the stem. To eliminate the projecting tip-off, the glass had to be mashed down while still soft. The first tubes made in this fashion developed stem cracks. Test diodes were made using Pb glass bulbs. Prior to tipping-off, the getters were flashed lightly to absorb gas liberated from the glass during the annealing period; however PB was reduced out of the glass. Life tests indicated that tubes having soft glass (lime) envelopes can be made to operate at bulb temperatures up to 400°C.

Naval Civil Engineering Lab., Port Hueneme, Calif.
CONTIGUOUS WRAPPING OF TRANSMISSION LINE CONDUCTORS WITH HIGH-MU TAPE FOR LARGE RADIO-INTERFERENCE ATTENUATION, by Don B. Clark and Robert D. Hitchcock. Interim rept. 7 Mar 60, 47p. 10 refs. Technical rept. 062.
Order from LC mi$3.30, ph$7.80 PB 147 115

Wrapping high-permeability SiFeMg tape around transmission line lowers radio frequency energy in normal interference frequency ranges. In theory, a long conductor coated with high-permeability material has high skin effect losses at frequencies above those of power transmission. Three long conductors were wrapped with thin, high-permeability tape; two conductors had small helical air-gaps between wrappings to reduce saturation effects. These two had about half the attenuation of the fully wrapped line, lower standing wave ratios and lower characteristic impedance phase shift. (Author)

Naval Ordnance Lab., Corona, Calif.
TEST SET, ELECTRICAL OUTPUT, FUZE, MK 378 MOD O: DESCRIPTION AND OPERATION. 7 Apr 60, 66p. NAVWEPS rept. 5988; NOLC rept. 494; Includes NAVORD OS-(10325-10326).
Order from LC mi$3.90, ph$10.80 PB 147 285

This report presents a description and instructions for operation of the Test Set, Electrical Output, Fuze, Mk 378 Mod O, which was developed at the Naval Ordnance Laboratory Corona for use in factory acceptance testing of the Switch, Firing, Electronic, Mk 73 Mod O, and the Triggering Device, Fuze, Mk 3 Mod O. The set is constructed in two sections, so that it may be used either for combined tests of the triggering device and firing switch or for separate testing of either component. Appendixes A and B present the original Ordnance Specifications (NAVORD OS 10326 and NAVORD OS 10325) for the two components to be tested. (Author)

Naval Ordnance Lab., White Oak, Md.
MAGNETIC PULSE MODULATORS, by Walter Raskin. 25 Aug 58, 21p. 9 refs. NAVORD rept. 6190; AD-206 318.
Order from LC mi$2.70, ph$4.80 PB 147 389

The magnetic pulse modulator of the Melville type is analyzed, the present state of the art is summarized, and engineering limitations imposed by components are discussed. A bibliography of literature in this field is included. (Author)

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
A SMALL-TANK CALIBRATION SYSTEM, by Gerald F. Ginty. 31 Aug 55, 13p. USL Research and Development rept. no. 292.
Order from LC mi$2.40, ph$3.30 PB 147 602

The small-tank calibration system measures hydrophone sensitivity and directivity pattern in the frequency range from 5 to 150 kc by means of AC tonal pulses. A pulse of the desired frequency is gated into a transmitting power amplifier and projector and is received by the hydrophone under test. The received

pulse is then logarithmically amplified; any desired part of the pulse is selected by a receiver gate, and the gated portion is peak detected and stored as a direct voltage. The direct voltage is fed to a sine-cosine potentiometer, the output of which drives a cathode-ray tube in order to provide a PPI display of received decibel level as a function of hydrophone bearing. In addition, the direct voltage is chopped and used to drive conventional polar ink recorders. The transmitted and received pulses are controllable in duration and repetition rate and may be set in accordance with considerations of tank dimensions and transducer-response time. The repetition rate of transmitted and received pulses may be varied from 15 to 60 pulses per second. The duration of the transmitted pulse may be varied from 100 microseconds to 100 milliseconds, and the duration of the receiver gate may be varied from 50 microseconds to 10 milliseconds. Time delay between the transmitter and receiver gates is variable between 100 microseconds and 100 milliseconds. (Author)

New York U. Coll. of Engineering, N. Y.
THE EFFECTS OF DISTORTION ON VIDEO CORRELATION, by M. Frankfort, B. Harris and others. Technical note on Contract AF 30(602)1655. 15 Oct 58, 69p. 16 refs. RADC-TN-58-360; AD-206 042.
Order from LC mi$3.90, ph$10.80 PB 146 173

An analysis is made of a video correlator which has distortion present in its input channels. In particular power law distortions, ideal limiting, and partial limiting, are considered. Assuming a sampling correlator and use of sufficient number of samples to make the central limit theorem applicable, the effect of power law distortion is found to be a few decibels drop in the output signal-to-noise ratio of the correlator. An exact analysis carried out for some limiting cases shows that even this small reduction may be due only to the approximations made in the general analysis. These results are obtained for distortion in one or both of the correlator input channels. It is felt therefore, that in many cases it may be possible to make considerable savings in equipment at only a small cost in performance by relaxing fidelity requirements on signal transmission to the correlator.

Office of Scientific Research and Development. Div. 13.
DIRECTION FINDER AND ANTENNA RESEARCH. Summary technical rept. vol 1, Contract OEMsr-1131. 1946, declassified 23 Apr 58, 299p. 123 refs.
Order from LC mi$11.10, ph$45.60 PB 139 790

Contents:
BTL high-frequency direction-finder research
NBS high-frequency direction-finder research
Study of radio pulse propagation
Ultra-high-frequency direction-finding study
Errors in direction finders
Correlation of DF errors with ionosphere measurement
Miscellaneous direction-finder research
UHF radio-sonde direction finder
Demountable short-wave direction finder
Direction finding by improvised means
Portable radio assault beacon
UHF direction-finding antenna study
Locating tanks by radio
UHF friendly aircraft locator
Electrical direction-finder evaluator
A study of sferics
Antenna patterns for aircraft
Airborne antenna design at UHF and VHF
Development of faired-in antennas
Miscellaneous antenna research

Office of Technical Services, Dept. of Commerce, Washington, D. C.
RELIABILITY AND QUALITY CONTROL (1950-1960). Apr 60, 9p. 125 refs. OTS Selective Bibliography 405.
Order from OTS $0.10 OTS SB-405

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations.

Olin Mathieson Chemical Corp., New Haven, Conn.
INDUSTRIAL PREPAREDNESS STUDY ON PAPER LINED BATTERIES TYPE BA-270/U-XPL, by S. M. Wajnowski. Quarterly progress rept. no. 19, 1 Dec 57-28 Feb 58, on Contract DA 36-039-sc-30266. 28 Feb 58, 12p.
Order from LC mi$2.40, ph$3.30 PB 138 084

Pacific Semiconductors, Inc., Culver City, Calif.
INTRINSIC-BARRIER TRANSISTOR TECHNIQUES (SILICON), by J. L. Buie. Quarterly rept. no. 8, 15 Apr-15 July 59, on Contract DA 36-039-sc-74887. [1959] 19p. PSI rept. no. 3000:15-23-Q; AD-229 488.
Order from LC mi$2.40, ph$3.30 PB 146 791

A sequence of design, fabrication, and characterization techniques was developed for very-high-frequency silicon transistors. In the course of evaluating these techniques, it was shown that a wide range of useful transistors could be constructed. These transistors demonstrated power outputs of 100 mw at 200 mc, 1 watt at 70 mc, 3/4 watt at 108 mc, and 5 watts at 10 mc. In addition, techniques-evaluation samples were delivered which exceeded these specific requirements, showing power output approaching 5 watts at 70 mc, and exceeding 3 watts at 100 mc, and 2 watts at 150 mc. An even wider range of frequency and power is known to be within the capability of the techniques developed. (Author) (See also 142 768)

Pan-Electronics Corp., Griffin, Ga.
INDUSTRIAL PREPAREDNESS STUDY: QUARTZ CRYSTAL UNITS CR-56/U; COMPLETION REPORT ON STEP I. Rept. on Contract DA 36-039-sc-72680. [1958] 28p.
Order from LC mi$2.70, ph$4.80 PB 137 414

A process is described for the fabrication of CR-56/U Quartz Crystal Units in the range of 50 to 100 Megacycles. No drastic changes in normal production techniques were required although many refinements in existing procedures were found necessary to get acceptable yields.

Philco Corp., Philadelphia, Pa.
RESEARCH AND EXPERIMENTAL WORK ON MICROWAVE TRANSISTORS, by W. C. Follmer, M. M. Fortini and others. Quarterly progress rept. no. 6, 15 Apr-15 July 59, on Contract DA 36-039-sc-74988. [1959] 19p. 4 refs. Philco H-2153-6; AD-228 330.
Order from LC mi$2.40, ph$3.30 PB 146 489

Studies have been made of the frequency and power-handling capabilities of silicon NPN transistors operating as negative-resistance oscillators. The highest output power was 0.42 mw with a DC input of 205 mw. Investigation of the Esaki tunnel diode is being carried out. A microwave Hall oscillator was designed and built. See also PB 143 877.

Polytechnic Inst. of Brooklyn, N. Y.
RESEARCH ON AND DEVELOPMENT OF ION-SELECTIVE AND ION-SPECIFIC MEMBRANES FOR USE IN THE LARGE-SCALE, LOW-COST DEMINERALIZATION OF SALINE WATER BY SELECTIVE ELECTRODIALYSIS. Rept. on Contract no. 14-01-001-62. May 60, 77p. 42 refs. Office of Saline Water Research and Development Progress rept. no. 37.
Order from OTS $2.00 PB 161 694

The purpose of this investigation was to investigate known membrane systems which might be more permeable to ions with a double negative charge than to ions with a single negative charge, and to attempt the preparation of membranes of improved specificity. A membrane possessing this characteristic would be useful for removing sulfate from a solution of chloride and sulfate where the sulfate content is too high or to fractionate a mixture of the ions into two solutions, each one containing only one of the ions. Two commercial membranes, Nalfilm 2 and Nalfilm 4, were investigated. Four different heterogeneous membranes were prepared using anion exchange resins in a Dynel matrix. Tests were performed on the membranes to determine the amount of specificity. The various tests made on all the membranes indicate that other and more simple means may be found for determining the amount of ion-specificity in an ion-selective membrane than the relatively difficult procedure of measuring the transport numbers directly. It was demonstrated that the relative transport numbers for sulfate and chloride may vary from 0.75 to 1.12.

Radio Corp. of America, Harrison, N. J.
EVALUATION OF TWO TYPES OF S-BAND PULSED PENCIL-TUBE-AND-CAVITY TRANSMITTER UNITS. VOLUME 1: EVALUATION, by R. E. Brooks. Final rept. for 3 June 57-31 Jan 59 on Contract DA 36-039-sc-74845. [1959] 129p. AD-226 526.
Order from LC mi$6.30, ph$19.80 PB 145 963

This 3-volume report presents an evaluation of the performance of 2 types of S-band, pulsed, pencil-tube-and-cavity transmitter units. Vol. 1 presents the results, conclusions, recommendations, and proposed specifications of the RCA A-15095 plate-pulsed and A-15100 grid-pulsed developmental units. Vol. 2 contains the manufacturing specifications for the RCA developmental type A-15109 pencil tube used in both types of units, and manufacturing specifications for the two transmitter units. Vol. 3 contains the test data and X-ray pictures of each of the 200 units as well as drawings of the mismatch introducer developed for use in this contract. The major conclusion reached from this evaluation was that the greatest deterioration in power and frequency characteristics was obtained primarily under operating conditions that resulted in maximum peak current. A remarkable phenomenon observed was that operation of the units with reduced heater voltage increased life from about 150 hours to about 450 hours. The specified environmental conditions of shock, vibration, rotation, load mismatch, and increased pulse repetition rates were found to have little effect on the operation of these units. X-ray inspection techniques led to more realistic tolerances in the manufacturing specifications, and will serve as an important means of increasing yield during production. (Author)

Radio Corp. of America, Harrison, N. J.
EVALUATION OF TWO TYPES OF S-BAND PULSED PENCIL-TUBE-AND-CAVITY TRANSMITTER UNITS. VOLUME 2: MANUFACTURING SPECIFICATIONS, by R. E. Brooks. Final rept. for 3 June 57-31 Jan 59 on Contract DA 36-039-sc-74845. [1959] 153p. AD-226 527.
Order from LC mi$7.50, ph$24.30 PB 145 962

See also PB 145 963

Radio Corp. of America, Harrison, N. J.
EVALUATION OF TWO TYPES OF S-BAND PULSED PENCIL-TUBE-AND-CAVITY TRANSMITTER UNITS. VOLUME 3: TEST RESULTS, D, E and F, by R. E. Brooks. Final rept. for 3 June 57-31 Jan 59 on Contract DA 36-039-sc-74845. [1959] 145p. AD-226 528.
Order from LC mi$7.20, ph$22.80 PB 145 961

Contents:
X-ray photographs of 100 RCA A-15095 developmental plate-pulsed and 100 RCA A-15100 developmental grid-pulsed pencil-tube-and-cavity transmitter units
Test data on 100 RCA A-15095 developmental plate-pulsed and 100 RCA A-15100 developmental grid-pulsed pencil-tube-and-cavity transmitter units
The mismatch introducer
(See also PB 145 962, PB 145 963)

Radio Corp. of America, Princeton, N. J.
HIGH TEMPERATURE SEMICONDUCTOR MATERIALS AND DEVICES, by R. Bube, P. R. Celmer and others. Scientific rept. no. 1 for Oct 59-31 Jan 60 on Contract AF 19(604)6152, continuation of Contract AF 33(616)5029. 29 Feb 60, 53p. 20 refs. AFCRC-TN-60-178.
Order from LC mi$3.60, ph$9.30 PB 147 296

The program is divided into four main sections: preparation of pure material, impurity behavior, evaluation of material properties, and device studies. Research in this past period has been concerned almost completely with GaAs. The progress in each activity is summarized. (See also PB 161 541)

Radio Corp. of America, Harrison, N. J.
INDUSTRIAL PREPAREDNESS STUDY: LOW-NOISE TRAVELING-WAVE AMPLIFIER, by E. Goldman. Quarterly progress rept. no. 6, 1 Oct-31 Dec 57, on Contract DA 36-039-sc-72733. [1957] 15p.
Order from LC mi$2.40, ph$3.30 PB 137 798

The general purpose of the contract is to provide facilities for the production of a low-noise traveling-wave amplifier, type 6861; and to produce a sample run of 50 tubes. All equipment has been received, installed and is in operation. Type approval subject to satisfactory completion of life test has been granted. The pilot run tubes have been produced.

RCA Victor Div., Radio Corp. of America, Camden, N. J.
INSTRUCTION BOOK FOR HOMING BEACON EQUIPMENT NAVY MODEL YG AND RADIO FREQUENCY MONITOR NAVY TYPE CRV-60047. Rept. on Contract NXss-33086. 28 Mar 45, 238p. NAVSHIPS 900,510.
Order from LC mi$10.20, ph36.30 PB 146 172

Raytheon Co., Waltham, Mass.
STUDY OF PLATINOTRON DEVICES. Quarterly rept. no. 3, 1 May-1 Aug 59, on QKS779/QR814, Contract DA 36-039-sc-78229. [1959] 57p. AD-229 004.
Order from LC mi$3.60, ph$9.30 PB 147 427

The QKS-779 identifies Task 3.1 which calls for a research program aimed at developing a microwave tube capable of producing a minimum of 100 watts CW power and operating in the vicinity of 35 kilomegacycles. The tube should have a minimum bandwidth of 10%. Task 3.6, identified as the QR-814, concerns itself with the investigation of the problem of matching external transmission lines to the platinotron network in an improved manner for better electrical characteristics and greater power handling capability. During this period both of these tasks received considerable attention. The development of the QKS-779 was advanced to the point where the first tube had been pumped and some information obtained. The work on the QR-814 consisted of investigating both a coaxial type of match and a match having more direct physical connection between the waveguide and the platinotron network. The latter arrangement would eliminate the disadvantages of the parallel wire transmission line in current use in the transition of the QK680. (Author)

RCA Defense Electronics Products, Camden, N. J.
MICRO-MODULE PRODUCTION PROGRAM, by Paul K. Taylor. Quarterly rept. no. 1, 1 Apr-30 June 58, on Contract DA 36-039-sc-75968. [1958] 149p. MM-206.
Order from LC mi$7.20, ph$22.80 PB 146 042

The Micro-Module Concept is a new approach to electronic equipment design. The object is to take advantage of the increased component density and improve the volumetric efficiency of the units in order that equipment can be built that will be more easily transportable and still maintain the same or a higher degree of reliability. A screening process using DuPont silver paste that is brushed on, has merit and appears to be quite satisfactory on bodies used thus far. Tantalum electrolytic capacitors have been made using .0015 inch thick foil. Resistors have been built using evaporated metal oxide on glass, quartz and ceramics. An investigation was conducted to examine properties of core material suitable for toroidal construction of tuned circuits. The processing technique, for "in-plastic" sealing of pretested electrically good, drift transistors, was used to fabricate experimental transistor units.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
RESEARCH ON SPEECH SYNTHESIS. Final rept. for 1 Mar 58-31 Oct 59 on Contract AF 19(604)2061. Dec 59, 18p. 14 refs. AFCRC-TR-60-101; AD-232 113.
Order from LC mi$2.40, ph$3.30 PB 146 816

This report contains only a summary of the work, since more detailed descriptions appear in other publications that are listed in Appendix A. Implications of the results as related to possible future work are also discussed.

Rome Air Development Center, Griffiss AFB, N. Y.
DEVELOPMENT AND EVALUATION OF NAVARHO LONG DISTANCE NAVIGATION SYSTEM, by Paul S. Wilson. Jan 60, 143p. 13 refs. RADC-TR-59-107.
Order from LC mi$7.20, ph$22.80 PB 146 842

The NAVARHO Program is the most recent Air Force effort directed toward the development and evaluation of a low frequency, long distance, ground based, radio navigation system. The purpose of the development was to evolve a navigation system combining the advantages of previous systems but eliminating, insofar as possible, the disadvantages. A rhotheta technique was chosen, largely because it was believed that such geometry would provide a circular service area with uniform accuracy in all directions from the ground facility. The program included the development of both airborne receiving equipment and a ground based transmitter facility. While the accuracies required by military specifications were not fully met, it is indicated that, with certain refinements, the system would be fully adequate for worldwide, peacetime applications. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
PROCEEDINGS OF SYMPOSIUM ON DECISION THEORY AND APPLICATIONS TO ELECTRONIC EQUIPMENT DEVELOPMENT, 10-11 MAY 1960, VOLUME I. Apr 60, 146p. 38 refs. RADC TR-60-70A.
Order from LC mi$7.20, ph$22.80 PB 147 166

Contents:
Tutorial paper - An introduction to Bayes decision
The choice of estimation procedure and loss function for radar system synthesis
The decision problem in radar
A sequential multi-decision procedure
Signal detection by adaptive filters
The search and detection efficiency of surveillance and communications devices using sequential probability ratio analysis
The resolvability of point sources

Rome Air Development Center, Griffiss AFB, N. Y.
A SECURE NARROW BAND CLOSED CIRCUIT TELEVISION SYSTEM FOR MILITARY APPLICATIONS (TELEVISION COMMUNICATIONS SYSTEM AN/FXC-1), by Richard C. Benoit, Jr. and Frank Coughlin, Jr. Feb 60, 22p. 5 refs. RADC-TN-60-2; AD-232 767.
Order from LC mi$2.70, ph$4.80 PB 146 111

Television communication system AN/FXC-1 is a voice bandwidth monochrome television system capable of transmitting printed, scenic, graphic briefings and other visual data between two or more distant points. It provides full communications security when used with a standard code generator. Secure duplex audio facilities are also provided when the equipment is used with approved security devices. Transmission media are three standard toll quality voice circuits.

Sperry Gyroscope Co., Garden City, N. Y.
INSTRUCTION BOOK: REPORT ON ELECTRONIC RAY TRACER. Rept. on Contract Nonr-1819(00). Oct 57, 102p. Rept. no. 2264-8086-2
Order from LC mi$5.70, ph$16.80 PB 137 555

The Electronic Ray Tracer is a device to be used as an aid in the study of sonar wave propagation. It computes and plots a family of rays through a medium by solving an approximation of the basic differential equations which govern the propagation of waves through a medium where velocity is a function of depth only. This equipment is well adapted for rapid analysis of a transmission problem of radar and radio wave as demonstrated by the Air Force under a limited set of ambient conditions.

Stackpole Carbon Co., St. Marys, Pa.
IMPROVED CARBON BRUSHES FOR AIRCRAFT ELECTRICAL MACHINES, by Robert E. Nelson. Rept. for 1 Nov 55-1 Nov 58 on Evaluation of Carbon Brushes, Contract AF 33(600)31195. Jan 60, 102p. 4 refs. WADC Technical rept. 57-170.
Order from OTS $2.50 PB 161 760

The primary purpose of this contract was the evaluation of improved carbon brushes for use in aircraft rotating machines at 8,000 RPM from sea level to 80,000 ft. The evaluation was based on bell jar, slip ring, sea level and altitude chamber equipment test results. Specific performance checks were conducted in oil and oil vapor, in high ambient temperature, at very low and very high humidity levels, in dry nitrogen, in high vacuum, on rhodium plated, monel and copper slip rings, as well as on practical machines at sea level and in the Cornell and WADC altitude chambers. Electrical, chemical, physical, densitometer, x-ray fluoroscope, x-ray diffraction, metallograph and mass spectrometer checks were employed in material analyses.

Stanford Electronics Labs., Stanford U., Calif.
A THEORY FOR THE TRANSIENT ANALYSIS OF AVALANCHE TRANSISTOR PULSE CIRCUITS, by D. J. Hamilton. Rept. on Contract Nonr-225(24). 15 June 59, 68p. 17 refs. Technical rept. no. 1701-1; AD-218 575.
Order from LC mi$3.90, ph$10.80 PB 146 426

A simple physical theory is developed which describes the transient behavior of an avalanche transistor in terms of its physical parameters. The consideration of the minority carrier charge stored in the base during the transient process is an important factor in the development of the theory, and major emphasis is placed upon the use of charge variables in describing the model for the transistor. The theory is applied in the analysis of two classes of avalanche transistor pulse circuits: that in which the transistor is used with a capacitive load, and that in which the transistor is used with a resistive load.

Stanford Research Inst., Menlo Park, Calif.
APPLIED RESEARCH IN MICROMINIATURE FIELD EMISSION TUBES, by W. W. Hansen. Quarterly progress rept. no. 1, 1 July-1 Oct 59, on Contract DA 36-039-sc-84526. Oct 59, 26p. 2 refs. AD-231 935.
Order from LC mi$2.70, ph$4.80 PB 146 797

Research concerns a study of microminiature field emission devices which ultimately can be fabricated from thin films of refractory metals and insulators, using electron-activated machining techniques. These techniques involve the use of high resolution electron beams acting on the films in the presence of decomposable gases. Beam induced chemical reactions permit the etching or deposition of films in preselected patterns and may lead to the construction of large assemblies of interconnected electronic components of minute size. Apparatus is being designed for the study of simulated tubes containing field emission cathodes. Principal components are a demountable ultra-vacuum chamber and a micro-manipulator to produce small displacements of tube elements in three dimensions. Field plots were made with the use of an electrolytic tank, and electrode models were constructed, to estimate tube performance and to define optimum conditions of operation. Emitters, filaments, and phosphors were made and tests indicate that they are satisfactory. (Author)

Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF HIGH-POWER FILTER TECHNIQUES, by E. M. T. Jones, S. B. Cohn, and E. D. Sharp. Annual rept. no. 1, 18 Feb 58-18 Feb 60, on Contract AF 30(602)1998. Mar 60, 56p. 27 refs. SRI Proj. 2797; RADC-TR-60-79.
Order from LC mi$3.60, ph$9.30 PB 147 357

A summary is presented of the status of a study program having as its objective the investigation of design techniques for UHF and microwave high-power filters. A brief account is presented of the levels of spurious radiation generated in high-power transmitters, the techniques for measuring the spurious outputs, the present Air Force specifications on tolerable interference levels, and a brief outline of some proposed and prototype high-power filters that can be used to reduce spurious outputs to tolerable levels. A summary is given of the results of a study of the reduced electric gradients within high-power filters with rounded rather than sharp corners. A number of dissipative filters are also described.

Stanford Research Inst., Menlo Park, Calif.
A LEAKY-WAVE ANTENNA WITH A CURVED APERTURE, by R. C. Honey and J. K. Shimizu. Scientific rept. no. 5 on Contract AF 19(604)3502. Feb 60, 28p. 4 refs. AFCRC-TN-60-197.
Order from LC mi$2.70, ph$4.80 PB 147 049

The design and the measured performance of a leaky-wave antenna whose radiating aperture is curved to fit flush with a 30-degree sector of a cylindrical surface are presented. The radius of curvature of the surface is about 46 inches, or 44 wavelengths at the design frequency. The aperture of this antenna is 18 inches in the E-plane with an arc length of 24 inches in the H-plane, and consists of an inductive sheet spaced over a conducting surface. The radiation patterns of this antenna were measured over the frequency range 8 to 13 kMc. At the design frequency, 11.42 kMc, the experimental results check extremely well with the theoretical predictions for a pencil beam 3.8-degrees wide in the H-plane by 3-degrees in the E-plane, tilted 55-degrees in the H-plane from the normal to the surface at the feed end of the antenna. (Author)

Stanford Research Inst., Menlo Park, Calif.
A SINUOUS FLUSH-MOUNTED FREQUENCY-INDEPENDENT ANTENNA, by J. K. Shimizu, E. M. T. Jones, and R. C. Honey. Scientific rept. 3 on Contract AF 19(604)3502. Oct 59, 27p. 8 refs. AFCRC-TN-60-126; AD-232 518.
Order from LC mi$2.70, ph$4.80 PB 146 012

The design and measured performance of a sinuous flush-mounted frequency-independent antenna are described. This antenna is an example of a class of antennas that has constant input impedance and constant pattern shape over an essentially unlimited frequency band. The pattern of the experimental printed circuit antenna is linearly polarized and has an almost constant beamwidth pattern oriented at a fixed direction in space, and operates over a frequency band limited only by the feed, extending from 3.2 to 16kMc. This antenna can easily be scaled to operate over other frequency bands, and even greater bandwidths of operation can be achieved by suitable modification of the feed design. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A STUDY OF THE EMITTING-SOLE LINEAR MAGNETRON AMPLIFIER, by D. Chen. Rept. on Contract Nonr-225(24). 14 July 59, 121p. 37 refs. Technical rept. no. 207-1; AD-220 571.
Order from LC mi$6.30, ph$19.80 PB 147 099

A study of the linear emitting-sole magnetron amplifier is presented. A thick non re-entrant beam under Brillouin flow conditions, with the lower beam boundary in contact with the sole is explored. The transverse normalized susceptance of the beam, R_b, at the upper beam boundary is derived. Computations of the complex R_b as a function of the complex propagation constant, in the region of interest, for 3 typical frequencies are given. Four asymptotic forms of R_b to cover the entire complex plane of the propagation constant are derived. The wave solutions for matching the emitting-sole beam to free space and also to a conducting plate at 3 different distances above the beam are computed in detail through the use of these 4 asymptotic forms of R_b. Some discussions regarding the matching of the emitting-sole beam to a periodic circuit are given. The electronic efficiency of a reentrant-type emitting-sole beam is estimated and compared to that of a thin beam. An experimental amplifier is designed and constructed. It employs a smooth conducting plate as a circuit, facing an emitting-sole beam which fills up three-quarters of the spacing between the circuit and the sole. Results on the dc beam transmission test were satisfactory. (Author)

Sylvania Electronic Systems, Waltham, Mass.
OPTIMUM CODES STUDY, by R. Turyn. Final rept. on Contract AF 19(604)5473. 29 Jan 60, 39p. 9 refs. Rept. F437-1; AFCRC-TR-60-111.
Order from LC mi$3.00, ph$6.30 PB 146 909

This report is concerned with finding sequences whose terms are +1 or -1, or codes, and whose autocorrelation function is relatively small (except at zero). The main interest was in certain optimal codes (autocorrelation function not greater than 1 in absolute value except at zero). The main results are that no such optimum codes exist if of odd length exceeding 13. For even length, we are led to a consideration of certain periodic codes. Some important results are given on these. As a consequence, no optimum codes of even length less than 144 but greater than 4 exist. It thus seems likely no optimum codes other than those known exist. In addition, certain near-optimum codes are discussed. (Author)

Syracuse U. Research Inst., N. Y.
CHARACTERISTICS OF COUNTERWOUND HELICES, by Richard E. Gildersleeve. Task rept. no. 5 on Contract AF 30(602)1640. 15 Oct 58, 29p. 12 refs. SURI Rept. no. EE492-5810T5; RADC-TN-59-5; AD-208 287.
Order from LC mi$2.70, ph$4.80 PB 146 506

Antennas constructed of arrays of helices occupy considerable space when the standard fabrication techniques are used. If circularly polarized waves of either rotational sense are to be transmitted or detected the space requirements for the antennas more than doubles. In an attempt to reduce the space requirements to that of a single array a study was conducted to determine the feasibility of winding two helices, constructed to identical specifications except for rotational sense, coaxially and at the same distance from their common ground plane. Such a configuration of helices has been given the name "counterwound coaxial helices" or, more simply, "counterwound helices."

Syracuse U. Research Inst., N. Y.
DIAGNOSIS OF EQUIPMENT FAILURES, PART 1, by Richard A. Johnson and John D. Brule. Final rept. on Contract AF 30(602)1833. 15 Apr 60, 38p. 8 refs. SURI rept. no. EE-577-604F1; RADC-TR-60-67A.
Order from LC mi$3.00, ph$6.30 PB 146 785

A systematic method of finding efficient (near optimum) diagnostic procedures is discussed in some detail. This systematic method is based on a figure of

merit which insures that in each test of a defective equipment information is gained as inexpensively as possible. This paper summarizes the basic mathematical models and criteria for optimum procedures. Part I of this final report gives some results which indicate the effect of various maintenance procedures on the overall reliability of an equipment. In general, the maintenance procedures depend on the method of fault location (diagnosis) employed so that from this study one can compare the total effect of diagnostic procedures on the reliability of the equipment. The treatment is general in that it includes the treatment of redundant equipments.

Syracuse U. Research Inst., N. Y.
DIAGNOSIS OF EQUIPMENT FAILURES, PART 2, by Earl J. Kletsky. Final rept. on Contract AF 30(602)1833. 15 Apr 60, 82p. 2 refs. SURI rept. no. EE-577-604F2; RADC-TR-60-67B.
Order from LC mi$4.80, ph$13.80 PB 146 786

This portion of the final report deals with applications of the theoretical work. To illustrate this work a diagnostic procedure for a physical piece of electronic equipment has been prepared. A discussion of some practical matters to be considered in the application of the method are included. In addition, a computer program has been developed to establish a possible logical structure for the automatic calculation of diagnostic procedures. This program also demonstrates the feasibility of machine computation. (See also PB 146 785)

Syracuse U. Research Inst., N. Y.
A STUDY OF RECIPROCITY RELATIONSHIPS FOR GYROTROPIC MEDIA, by Alfred T. Villeneuve. Final rept. for 1 Sep 57-31 Aug 58 on Contract DA 30-115-ORD-861. 17 Sep 58, 89p. 17 refs. SURI Rept. no. EE509-589F; AD-205 708.
Order from LC mi$4.80, ph$13.80 PB 147 148

A modified reciprocity theorem is used in deriving a variational principle applicable to inhomogeneous, anisotropic media. Stationary expressions for resonant frequencies of cavities and propagation constants of waveguides are derived from this variational principle. Several examples of their use are included. A stationary expression for the electromagnetic field scattered by conducting obstacles in the presence of anisotropic media is also derived. A modified Green's function technique, applicable to anisotropic media, is discussed. The correct Green's function is that for media with tensor permeabilities and permittivities transposed.

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by John C. Helmer. Final rept. on Contract DA 36-039-sc-73266. Dec 59, 52p. 1 ref. Engineering rept. 218-1F.
Order from LC mi$3.60, ph$9.30 PB 146 790

The goal of the solid state maser program has been to create a ferroelectrically tuned, zero field maser The crystal under study eventually proved to be unsuitable for this application, but the work itself led to a greater understanding of the ferroelectric state and of the influence of the ferroelectric state on magnetic ions within the crystal. The beam type maser program began with a study of noise in molecular beams. This was followed by a components investigation leading to design criteria for millimeter and submillimeter beam type masers. (See also PB 145 234)

Vitro Labs., West Orange, N. J.
PRODUCTION OF A SERIES OF NICKEL-CADMIUM BATTERY TESTERS, by A. W. Speyers, F. J. Keim and R. B. Naugle. Final engineering rept. for 18 Aug 55-30 Nov 58 on Contract DA 36-039-sc-64703. [1958] 72p. 2 refs. KLX-10137; AD-229 195.
Order from LC mi$4.50, ph$12.30 PB 146 788

Efforts were directed toward developing more accurate and convenient procedures and equipment for determining the state of charge of alkaline-type storage batteries and the condition of Le Clanche-type dry cells. A total of 22 battery testers of 4 different types were fabricated; the operating theory, physical description, operation, and performance of each tester type are discussed. One tester utilized the pulse discharge type of test with a maximum discharge current of 10 amp dc. A second tester was designed specifically to determine whether a BB-401/U battery coming from a trickle charge will deliver at least 75% of its rated capacity. A 10-amp discharge for 24 sec to detect imperfect cells is followed by an 84-sec pulsed charge at 5 amp. The increase of battery voltage between 20 and 84 sec of charge is used to indicate the state of charge. A third type is a multi-purpose tester designed for laboratory use; this unit incorporates a 60-sec charge, 60-sec discharge type of test with maximum pulsed charge and discharge currents of 50 amp average dc. A fourth tester was designed for use with higher capacity batteries capable of supplying discharge currents up to 1000 amp. The battery voltage drop free of ohmic voltage drop during discharge is obtained indirectly. The performance of the battery testers was generally satisfactory in indicating the condition or state of charge of batteries.

Washington U., Seattle.
FLUX CONCENTRATOR FOR HIGH-INTENSITY PULSED MAGNETIC FIELDS, by Y. B. Kim and E. D. Platner. Technical rept. on Contract Nonr-477(12). Apr 59, 40p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 146 840

Use of multiturn coil structure in the production of several hundred kilogauss pulsed fields is discussed with specific emphasis on coil life. The magnetic force that shortens the coil life is reduced by introducing a flux concentration device. Into the multiturn coil is inserted a rigid, slotted metal slug that generates induction current in such a way as to shift the magnetic flux from the multiturn to the central vacuum region and serves as a flux concentrator. Electromagnetically and mechanically this scheme is a convenient synthesis of the multiturn and single turn coils.

Westinghouse Electric Corp., Baltimore, Md.
HIGH TEMPERATURE MAGNETIC AMPLIFIERS (400 CYCLES PER SECOND). Rept. on Thermionics and Solid State Electronic Technology, Contract AF 33(616)5686. Feb 60, 121p. WADC Technical rept. 59-753.
Order from OTS $2.75 PB 161 762

Techniques and materials have been developed suitable for use in designing 400 cps magnetic amplifiers capable of satisfactory operation over an ambient temperature range of -65°C to +500°C. Amplifiers designed with these techniques and materials have the capability of withstanding temperature cycling as well as vibration at an intensity of 15 g from 70 to 2000 cps and an amplitude of 0.03 inch from 10 to 70 cps. The units may be operated at ambients of -65°C and +500°C during vibration.

Wiley Electronics Co., Phoenix, Ariz.
RESEARCH DIRECTED TOWARD THEORETICAL AND EXPERIMENTAL INVESTIGATION OF CORRECTED LINE SOURCE FEEDS, by Richard R. MacMillan and A. W. Love. Final rept. on Contract AF 19(604)5718. Feb 60, 182p. 2 refs. WER-93; AFCRC-TR-60-122.
Order from LC mi$8.40, ph$28.80 PB 147 054

This final report contains detailed design, construction, and test data on a K_a-band spherical reflector with a beamwidth of 20 minutes of arc. Problems encountered during the program, together with the engineering approach used for their solutions, are also discussed. Finally, the performance of the antenna is evaluated. (Author)

Ordnance, Missiles, and Satellite Vehicles

Army Chemical Warfare Labs., Army Chemical Center, Md.
INVESTIGATION OF YELLOW DYES FOR USE IN THE M18 COLORED-SMOKE GRENADE, by Woodrow W. Reaves, Kenneth G. Carlon, and John E. Andrews. Jan 60, 11p. CWLR-2336; AD-231 128.
Order from LC mi$2.40, ph$3.30 PB 146 862

The current standard M18 yellow-smoke grenade is unstable and hazardous to load. Production records of the U. S. Army Chemical Corps Materiel Command indicate that loading hazards result from the sensitivity of the smoke formulation, which contains auramine hydrochloride as the dye ingredient, and that operational failures have occurred after the grenades have been stored at 160°F. Previous investigation of the storage characteristics of the grenade at higher temperatures strongly indicate that the operational failures could be attributed to the instability of the dye. It was concluded that a mixture of 35±5% dibenzo[a, h] pyrene-7, 14-dione and 65±5% 7H-benz[d, e] anthracen-7-one produced a colored smoke comparable to that formed by the auramine hydrochloride formulation now in current use. The commercial dye CS2171 also produced a suitable color. (Author)

Army [Rocket and Guided] Missile Agency, Redstone Arsenal, Ala.
EPHEMERIS FOR EXPLORER IV: 1958 EPSILON, by R. M. Adams (Smithsonian Astrophysical Observatory). Issue no. 3 on Orbital Data Series. 16 Sep 58, 393p. AD-202 688.
Order from LC mi$11.10, ph$60.60 PB 147 590

Positions of Explorer IV, 1958 Epsilon at 1-min intervals from 13 August thru noon, 27 August are listed. Baker-Nunn photographs (rough reductions), minitrack, microlock, moonwatch, and a few radar observations were used in preparing the ephemeris. The ephemeris given positions of subsatellite points in geographic latitude and longitude. A subsatellite point is defined as the intersection of the radius Vector with the international ellipsoid. Thus, the heights given are the actual distances between the satellite and the subsatellite points. All longitudes given are degrees east and heights are in kilometers. Positions listed in this report are accurate to better than ±0.25°, using time as the independent variable. Heights are within an accuracy of 10 km.

Arnold Engineering Development Center [Tullahoma, Tenn.]
ANNULAR NOZZLES FOR MISSILE BASE FLOW TESTING, by C. E. Peters. Rept. on ARO, Inc., Contract AF 40(600)800. May 60, 25p. 2 refs. AEDC-TN-60-62.
Order from LC mi$2.70, ph$4.80 PB 147 330

A simplified method of designing axisymmetric annular nozzles is presented. Tabulated supersonic nozzle contours are used, and the centerbody contours are chosen to conform to stream surfaces in the nozzle flow field. Calibration data obtained from 6-in. model nozzles and from a family of 36-in. exit diameter nozzles indicate that a properly contoured centerbody has no adverse effect on flow quality. The use of annular nozzles is a feasible approach to the simulation of supersonic flow past missile model afterbodies. (Author)

Avco [Everett] Research Lab. [Mass.]
PERTURBATIONS OF A TWENTY-FOUR HOUR SATELLITE ORBIT, by Don Lautman. Rept. on Contract AF 04(647)278. Mar 59, 14p. Research rept. 43.
Order from LC mi$2.40, ph$3.30 PB 147 200

An investigation has been started to determine the orbit changes of an artificial satellite which is essentially stationary with respect to the surface of the Earth. The interest in this problem is based on the 24-hour communication satellite. The essential results contained in this paper are tabulated.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMPILED FREE-AIR BLAST DATA ON BARE SPHERICAL PENTOLITE, by H. J. Goodman. Feb 60, 46p. 27 refs. Rept. no. 1092.
Order from LC mi$3.30, ph$7.80 PB 147 051

Free-air blast parameters (peak pressure, positive impulse and positive duration) from the detonation of

spherical 50/50 Pentolite charges fired at sea level conditions have been compiled. Analytic expressions for side-on pressure, side-on positive impulse and normally reflected impulse have been determined by fitting least squares polynomials to the data. The function for side-on pressure extends over all scaled distances where pressure might be of military importance, and is of the asymptotic form given by Krikwood and Brinkley. (Author)

Ballistic Research Lab., Aberdeen Proving Ground, Md.
ON THE ASYMPTOTIC BEHAVIOR OF CERTAIN ONE-DIMENSIONAL FLOWS, by J. H. Giese. Mar 60, 49p. 4 refs. Rept. no. 1098.
Order from LC mi$3.30, ph$7.80 PB 147 485

A theoretical aspect of the efflux of gas from a tube, open at one end, has been studied. Dr. W. C. Taylor has conjectured, loosely speaking, that regardless of the initial state of the gas, the asymptotic behavior for large t is of the known form $u(x,t) \sim f(x)/t$ and $c(x,t) \sim g(x)/t$, u and c being particle velocity and speed of sound. His conjecture was confirmed by fairly elementary means for $\gamma = 3$. Subject to an additional physically plausible monotonicity assumption, it has also been verified for the considerably harder case $\gamma = 5/3$. The latter problem was reduced eventually to determining the asymptotic behavior of the solutions of an integro-difference (or equivalently differential-difference) equation. (Author)

Beechcraft Research and Development, Inc., Boulder, Colo.
HYDROGEN-OXYGEN FUEL ELECTROLYTIC BATTERY CONTAINER STUDY, by James R. DeHaan and Marshall Piccone. Rept. on Contract AF 33(616)5833. Oct 58, 106p. 37 refs. Engineering rept. 6152; WADC Technical rept. 58-542; AD-203 521.
Order from LC mi$5.70, ph$16.80 PB 147 268

This report is a study of various methods of storing oxygen and hydrogen for use in hydrogen-oxygen fuel electrolytic cells in a zero-gravity environment, and to determine analytically the optimum storage techniques for a family of such cells. Various insulation methods were studied and their applicability to specific missions are discussed. Graphs are presented showing storage system weight as a function of duration and fuel cell power output, and watt hours of power obtainable per pound of storage system, also as a function of duration and fuel cell power output. The theoretical basis of a method of phase separation suitable for the operation of the low pressure storage systems in a weightless environment has been derived.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
ADHESION TEST FOR GRADE C GREASEPROOF BARRIER MATERIALS, by Mario E. Gigliotti and John H. Mazzei. Apr 60, 17p. 6 refs. Technical rept. 2679.
Order from LC mi$2.40, ph$3.30 PB 145 518

Experiments demonstrated that an adhesion test of Grade C barrier materials based on the principle of sticking one specimen to another was not desirable. Results of such tests were not reproducible because the surfaces of the Grade C materials were not homogeneous (waxes were dissimilar, thread counts in the cottonscrim were inconsistent, etc.). A test was therefore developed in which a Grade C specimen was adhered to an aluminum panel and the force necessary to separate the specimen from the panel was measured measured. The use of the aluminum panel with its smooth, continuous, homogeneous surface gave reproducible results. A ranking of values obtained in the newly developed adhesion test was compared with a ranking based on the results of a personal opinion survey conducted among packaging personnel at Rossford Ordnance Depot and at Picatinny. The results of this study correlated significantly with the results of the laboratory adhesion test. It was therefore concluded that this adhesion test is completely satisfactory for specification purposes. (Author)

Feltman [Research and Engineering] Labs., Picatinny Arsenal, Dover, N. J.
ANALYSIS OF EXPLOSIVES BY INFRARED SPECTROSCOPY, by Frank Pristera, Michael Halik and others. May 56, 65p. 27 refs. Technical rept. 2254.
Order from LC mi$3.90, ph$10.80 PB 147 594

A compilation of 68 infrared spectrograms covering all common high explosive compounds and many possible explosive ingredients, additives, and related compounds has been prepared. An examination of the prepared spectrograms has made possible the empirical deduction of several new band assignments, notably 9.25 microns for the symmetrical trinitro aromatic configuration and 11.0 microns for the meta dinitro aromatic configuration. These should facilitate the infrared structural investigation of unkown ingredients such as newly synthesized compounds. Extensive detailed descriptions have been presented for the preparation and qualitative use of infrared spectrograms of the explosive ingredients. Considerable information has been presented regarding the qualitative and quantitative analyses of mixtures of explosive ingredients by infrared and/or other methods. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
THE CHEMISTRY OF HEXAMETHYLENETETRAMINE IN AN ACIDIC AQUEOUS MEDIUM, by Thomas C. Castorina, James W. McCahill and others. Apr 60, 37p. 13 refs. Technical rept. 2674.
Order from LC mi$3.00, ph$6.30 PB 144 634

The behavior of hexamethylenetetramine (Hexamine) in an acidic aqueous medium was studied from two aspects. One aspect was the decomposition of the compound to formaldehyde and ammonium ions and the influence of parameters such as concentration, acidity, and added formaldehyde on this decomposition process. The other was the exchange of methylene groups between hexamine and formaldehyde during hydrolysis equilibrium and the effect of concentration, pH, and temperature on the rate of this exchange. It was observed that the addition of formaldehyde to dilute aqueous acidic solutions of hexamine represses the hydrolysis of the material and that the degree of repression is governed by the enhanced basicity of the hexamine-for-maldehyde solution as well as by Le Chatelier's law. The exchange of methylene groups between hexamine and formaldehyde in acid solution was studied with carbon-14 tagged reagents. The rate of exchange was observed to increase proportionately with reagent concentration, acidity, and temperature. The relationship of these results to the behavior of hexamine in the nitrolysis to HMX and RDX is discussed briefly. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF TRACER FOR THE 37mm T324E22 SHELL (VIGILANTE) by Ralph B. Wright. May 60, 8p. 1 ref. Technical notes no. 45.
Order from LC mi$1.80, ph$1.80 PB 146 216

This report describes the development work on a 7-second tracer for the 37 mm T324E22 shell up to the time of acceptance by the user, the developer of the shell. For reasons of urgency, compromises had to be imposed upon this development program. As a result the subject tracer is not considered to be an optimum design. This tracer was developed empirically by varying composition, column size, and types of tracer compositions. The accepted design maintains the exterior configuration of the standard closure plug except that 1/4 inch was added to the rear face. The tracer cavity, 1/2 inch in diameter and 1 inch deep, contains R-45 type tracer composition and K-29 type igniter composition, both of which are consolidated at 100,000 psi. When tested ballistically the tracer produced results that were considered acceptable by the user. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EFFECTS OF MAGNESIUM CONTENT CASE MATERIAL, AND CASE COATING ON BURNING CHARACTERISTICS OF A FLARE SYSTEM, by Anthony F. Taschler and Seymour M. Kaye. Apr 60, 19p. Technical notes no. 42.
Order from LC mi$2.40, ph$3.30 PB 144 829

The luminosity levels of flare systems consisting of magnesium (100/200 mesh) sodium nitrate, and Laminac 4116 increase with increasing magnesium content, up to the 70% fuel level. The burning rates of such compositions also increase with increasing magnesium content, up to the 65-66.7% fuel level, but drop when the fuel level is further increased (up to 70% in this investigation). The above findings are based on the results of evaluations of several magnesium/sodium nitrate/Laminac 4116 compositions conducted at Picatinny in tracking flare tubes of the T131 type. Various coatings - wax, Laminac, and Thiokol - were used on the tubes, and found to have no significant effect on either luminosity or burning rate. Similar evaluations of compositions FY965, FY966, FY976, and FY977 indicated that, when coarser magnesium is used, both the luminosity level and the burning rate are reduced. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EVALUATION OF NEW SOURCES OF NITROCELLULOSE IN M8 PROPELLANT, by Vladimir Mirko. Mar 60, 15p. 9 refs. Technical rept. 2677.
Order from LC mi$2.40, ph$3.30 PB 144 828

The sources of woodpulps suitable for manufacturing nitrocellulose were increased when it was shown that nitration of a sulfate woodpulp and of a sulfite woodpulp containing 15% hardwood produced acceptable military grades of nitrocellulose. Nitrocellulose prepared from these pulps was evaluated in M8 mortar propellant as part of a broader program to determine whether such nitrocellulose is suitable for use generally in standard propellants. Accordingly, lots of 60 mm M3A1 mortar increments were prepared from M8 propellant containing the experimental lots of nitrocellulose and compared, in ballistic and physical properties, with production lots of increments containing nitrated cotton linters. It was found that the characteristics of the experimental propellants were equivalent to those of the production lots. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
MEAN PRESENTED AREA OF SMALL STEEL FRAGMENTS MEASURED BY MEANS OF FREE FALL IN A VISCOUS FLUID; by I. H. Stein. Oct 58, 34p. 9 refs. Technical memo. no. 127A53; AD-207 094.
Order from LC mi$3.00, ph$6.30 PB 147 152

The mean presented areas of small irregular shaped steel fragments, within and beyond the lower limit of the icosahedron gage, were measured by a new method. This technique, based upon the free fall of a fragment in a viscous fluid and the fragment weight, yields results comparable in accuracy to the icosahedron gage; an average deviation of 4.3% and a maximum deviation of 10% from true values were observed. For fragments below 30 grains, an empirical expression for presented area was determined. (Author)

[General Electric Co., Schenectady, N. Y.]
ANALYSIS OF "BOILER" LOX TANK PRESSURIZATION MEANS FOR THE HA-3B, by Henry J. Sneck and W. W. Fischer. 19 Feb 53, declassified. 14p. Proj. Hermes Heat Trans. memo. no. 73.
Order from LC mi$2.40, ph$3.30 PB 147 479

The calculated thermodynamic data are presented as a series of curves.

General Electric Co [Schenectady, N. Y.]
ANALYSIS OF FUEL TANK PRESSURIZATION MEANS FOR THE HA-3B, by W. W. Fischer and Nancy Fitzroy. 28 Apr 53, 15p. Proj. Hermes Heat Trans memo. no. 83.
Order from LC mi$2.40, ph$3.30 PB 146 892

General Electric Co., Schenectady, N. Y.
ANALYSIS OF OXIDIZER TANK PRESSURE FROM END OF LOX EXPULSION TO IMPACT, HERMES A-3B, by W. W. Fischer. 12 Aug 53, 7p. Proj. Hermes Heat Transfer memo. no. 75.
Order from LC mi$1.80, ph$1.80 PB 146 881

General Electric Co. [Schenectady, N. Y.]
BATTERY BOX TEMPERATURE ESTIMATES FOR HA-3A ROUNDS 5 THROUGH 8, by Glen E. McIntosh. 6 Feb 53, 6p. 1 ref. Proj. Hermes Heat Trans. memo. no. 71.
Order from LC mi$1.80, ph$1.80 PB 147 477

[General Electric Co., Schenectady, N. Y.]
COOLING OF FIN SERVO MOTORS FOR HERMES A-3A, ROUNDS 5 THROUGH 8, by Edward C. Archinal and David J. Masson. 26 May 53, 3p. 3 refs. Proj. Hermes Heat Trans memo. no. 80B.
Order from LC mi$1.80, ph$1.80 PB 146 889

[General Electric Co., Schenectady, N. Y.]
COOLING OF 225 INCH-OUNCE DUNCAN-BAYLEY MAGNETIC CLUTCH, by David J. Masson. 22 Oct 52, 3p. Proj. Hermes Heat Transfer memo. no. 57.
Order from LC mi$1.80, ph$1.80 PB 145 986

General Electric Co. [Schenectady, N. Y.]
DESIGN ANALYSIS OF A LOX BUGGY PRESSURIZATION SYSTEM, by Glen E. McIntosh. 5 May 53, 4p. 4 refs. Proj. Hermes Heat Transfer memo. no. 84.
Order from LC mi$1.80, ph$1.80 PB 146 893

[General Electric Co., Schenectady, N. Y.]
ESTIMATION OF HEAT LOSS FROM HA-3A FIN SHIPPING CONTAINER WHEN USED AS A OVEN, by W. W. Fischer. 28 Oct 52, 1p. Proj. Hermes Heat Transfer memo. no. 58.
Order from LC mi$1.80, ph$1.80 PB 145 987

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF OXIDIZER TANK PRESSURES FROM CUTOFF TO END OF LOX EXPULSION, HERMES A-3B, HERMES A-3A, AND FLIP-FLOP TEST, by Nancy Fitzroy and W. W. Fischer. 22 May 53, 23p. Proj. Hermes Heat Transfer memo. no. 74.
Order from LC mi$2.70, ph$4.80 PB 146 880

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE DISTRIBUTION IN DEFLECTOR SKIRT, HA-3A, by W. W. Fischer. 19 Feb 53, 5p. Proj. Hermes Heat Trans memo. no. 78.
Order from LC mi$1.80, ph$1.80 PB 146 884

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE VARIATION OF TELEMETRY EQUIPMENT IN FORE AND AFT COMPARTMENTS DURING FLIGHT. HA-3A ROUNDS #5 - #8, by W. D. Breingan and W. W. Fischer. 31 Oct 52, declassified. 5p. 3 refs. Proj. Hermes Heat Transfer memo. no. 61.
Order from LC mi$1.80, ph$1.80 PB 145 990

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURES OF THE SHAPED CHARGE USED FOR EMERGENCY FLIGHT INTERRUPTION, RV-A-10, by David J. Masson. 13 Nov 52, 1p. Proj. Hermes Heat Trans. memo. no. 64.
Order from LC mi$1.80, ph$1.80 PB 147 468

Conservative estimations of the time constant for the shaped charge show that its temperature during flight should not exceed 170°F when insulated as described by the manufacturer. The temperature of the shaped charge would probably exceed the safe working temperature during flight if ample provisions for thermal insulation were not provided.

General Electric Co. [Schenectady, N. Y.]
LOAD TESTS OF FIN SERVO MOTORS AND CLUTCHES UNDER OPERATING CONDITIONS, by Edward C. Archinal and Glen E. McIntosh. 6 May 53, 11p. Proj. Hermes Heat Transfer memo. no. 80A.
Order from LC mi$2.40, ph$3.30 PB 146 888

General Electric Co. [Schenectady, N. Y.]
PRELIMINARY ESTIMATE OF COOLING REQUIREMENT OF HYDRAULIC PACKAGE SERVO, by David J. Masson. 3 Dec 52, 4p. 3 refs. Proj. Hermes Heat Transfer memo. no. 68.
Order from LC mi$1.80, ph$1.80 PB 147 472

General Electric Co. [Schenectady, N. Y.]
TEMPERATURE-ALTITUDE TEST OF AUTOPILOT FOR HA-3A ROUNDS 1 THROUGH 4, by Robert W. Ottaway and Glen E. McIntosh. 13 Nov 52, 2p. Proj. Hermes Heat Transfer memo. no. 60.
Order from LC mi$1.80, ph$1.80 PB 145 989

General Electric Co. [Schenectady, N. Y.]
TEMPERATURE-ALTITUDE TEST OF HA-3A INVERTER FOR ROUNDS 9 ONWARD, by Robert W. Ottaway and Glen E. McIntosh. 19 Nov 52, 3p. Proj. Hermes Heat Transfer memo. no. 66.
Order from LC mi$1.80, ph$1.80 PB 147 470

General Electric Co. [Schenectady, N. Y.]
TEMPERATURE-LOAD TESTS OF FIN SERVO MOTORS FOR HA-3A, ROUNDS 1 THROUGH 8, by Edward C. Archinal and Glen E. McIntosh. 2 Apr 53, 11p. Proj. Hermes Heat Trans memo. no. 80.
Order from LC mi$2.40, ph$3.30 PB 146 887

[General Electric Co., Schenectady, N. Y.]
TEMPERATURE PREDICTION FOR THE AFT HEAD OF THE THINNED HA-2 118" MOTOR BODY, by Allen E. Galson and W. W. Fischer. 13 Sep 52, declassified. 8p. Proj. Hermes Heat Transfer memo. no. 47.
Order from LC mi$1.80, ph$1.80 PB 145 983

[General Electric Co., Schenectady, N. Y.]
TEMPERATURE PREDICTION FOR THE 31" HA-2 TEST MOTOR WITH 1/4" THICK DIVERGENT SECTION, by Allen E. Galson and William W. Fischer. 27 Aug 52, declassified. 9p. 3 refs. Proj. Hermes Heat Transfer memo. no. 45.
Order from LC mi$1.80, ph$1.80 PB 145 981

General Electric Co. [Schenectady, N. Y.]
TEMPERATURE-RESISTANCE TESTS OF 1N63 AND 1N43 GERMANIUM DIODES, by Glen E. McIntosh. 10 Feb 53, 3p. 2 refs. Proj. Hermes Heat Trans memo. no. 76.
Order from LC mi$1.80, ph$1.80 PB 146 882

[General Electric Co., Schenectady, N. Y.]
TEMPERATURE TEST OF BALLAST RESISTOR UNIT, by Robert W. Ottaway and Glen E. McIntosh. 14 Oct 52, 2p. 3 refs. Proj. Hermes Heat Transfer memo. no. 54.
Order from LC mi$1.80, ph$1.80 PB 145 985

General Electric Co. [Schenectady, N. Y.]
TESTS OF A LIQUID COOLING SYSTEM FOR THE HA-3B AUTOPILOT, by Edward C. Archinal and Glen E. McIntosh. 6 May 53, 2p. Proj. Hermes Heat Trans memo. no. 85.
Order from LC mi$1.80, ph$1.80 PB 146 894

General Electric Co. [Schenectady, N. Y.]
THERMAL CHARACTERISTICS OF GENERAL ELECTRIC MAGNETIC CLUTCH FOR FIN SERVO MECHANISM, by David J. Masson. 11 Mar 53, 5p. Proj. Hermes Heat Trans memo. no. 79.
Order from LC mi$1.80, ph$1.80 PB 146 885

General Electric Co. [Schenectady, N. Y.]
THERMAL CHARACTERISTICS OF GENERAL ELECTRIC MAGNETIC CLUTCH FOR FIN SERVO MECHANISM, by David J. Masson. 14 Apr 53, 3p. Proj. Hermes Heat Trans memo. no. 79A.
Order from LC mi$1.80, ph$1.80 PB 146 886

General Electric Co. [Schenectady, N. Y.]
THERMAL EFFECT OF STIFFENING LOX-ALCOHOL TANK BULKHEAD AND OXIDIZER TANK VENT, by Helen C. Bass and W. W. Fischer. 20 May 53, 2p. Proj. Hermes Heat Transfer memo. no. 86.
Order from LC mi$1.80, ph$1.80 PB 146 895

[General Electric Co., Schenectady, N. Y.]
THERMAL TEST OF BALLAST RESISTOR BOX FOR HA-3A ROUNDS 5 THROUGH 8, by Glen E. McIntosh. 16 Apr 53, 2p. 1 ref. Proj. Hermes Heat Trans memo. no. 82.
Order from LC mi$1.80, ph$1.80 PB 146 891

General Electric Co. [Schenectady, N. Y.]
THERMAL TESTS OF SUBMINIATURE TUBE MOUNTS, by Robert W. Ottaway and Glen E. McIntosh. 13 Feb 53, 5p. Proj. Hermes Heat Trans memo. no. 77.
Order from LC mi$1.80, ph$1.80 PB 146 883

General Electric Co. [Schenectady, N. Y.]
PRELIMINARY ESTIMATION OF FIN ANTENNA TEMPERATURES, HA-3A, by W. W. Fischer. 8 Apr 53, 1p. 1 ref. Proj. Hermes Heat Trans memo. no. 81.
Order from LC mi$1.80, ph$1.80 PB 146 890

General Electric Co. [Schenectady, N. Y.]
PREDICTION OF NECESSARY COOLING OF THE DIGITAL COMPUTER SYSTEM, HA-3, by R. T. Lancet and W. W. Fischer. 12 Jan 53, 27p. 6 refs. Proj. Hermes Heat Transfer memo. no. 59.
Order from LC mi$2.70, ph$4.80 PB 145 988

Naval Ordnance Test Station, China Lake, Calif.
A GEODETIC COORDINATE SYSTEM FOR ASKANIA CINETHEODOLITES, by R. J. Stirton. 1 Feb 60, 36p. 3 refs. NOTS TP-2427; NAVORD rept. 7038.
Order from LC mi$3.00, ph$6.30 PB 147 124

It is proposed to use a geodetic coordinate system (geodetic latitude and longitude, and elevation above sea level) to describe positions of Askania cinetheodolites. For small ranges of say 20 miles extent a plane-grid coordinate system is satisfactory, but if the range is extended to some hundreds of miles or if several ranges are used in conjunction it appears more practical to use geodetic coordinates for cinetheodolite positions. Cinetheodolites measure azimuth and elevation angles with respect to the north and the local vertical. Synthesis of cinetheodolite observations to a position or trajectory requires that the positions of the cinetheodolites and the azimuth and elevation angles be transformed to some common reference frame. The common reference frame used here may be either a geocentric system or a topocentric system centered at a cinetheodolite station or other convenient point on the earth. The necessary transformations for bringing the azimuth and elevation and the cinetheodolite positions into the common coordinate system are developed in detail.

Naval Ordnance Test Station, China Lake, Calif.
A METHOD FOR TESTING MISSILE COMPONENTS IN A CONTROLLED ENVIRONMENT OF HIGH-INTENSITY SOUND, by Eldon Sparrow. 11 Feb 57, 15p. NOTS 1677; NAVORD rept. 5418.
Order from LC mi$2.40, ph$3.30 PB 147 009

High-intensity acoustic noise (intensity greater than 100 db) produced by a missile's propulsion unit can be detrimental to electronic components in the missile and hence result in greatly reduced reliability. To ascertain whether or not the noise level would affect sensitive relays in a particular missile's control unit, the characteristics of the sound from the propulsion unit were recorded and reproduced at the

appropriate intensity, and the relays were subjected to this effect within a closed chamber approximating the control section of the missile. The relays were unaffected and their use was justified. The test setup for this study is described in detail, and a brief report is made on the hazards experienced in working with high-intensity sound. (Author)

Naval Ordnance Test Station, China Lake, Calif.
TECHNIQUES FOR THE STATISTICAL ANALYSIS OF CINETHEODOLITE DATA, by R. C. Davis. 22 Mar 51, declassified 2 Oct 54, 24p. 6 refs. NOTS 369; NAVORD rept. 1299.
Order from LC mi$2.70, ph$4.80 PB 147 269

The problem of obtaining an estimate of missile position from an overdetermined system of cinetheodolite observations subject to error is formulated as a problem in the now classical theory of least squares. Previous methods of data reduction based on the minimization of certain quadratic forms cannot be formulated statistically within the framework of the theory of least squares. Moreover, if the cinetheodolite angles are normally distributed, the least squares estimate obtained coincides with the maximum likelihood estimate of missile position. From the ensemble of angular observations it is possible to obtain unbiased estimates of the terms appearing in the variance-covariance matrix of the three coordinates of missile position. A criterion for the optimum location of cinetheodolite stations is developed. Several illustrative examples of the general theory are given. In particular, the examples of the application of the criterion for the optimum location of stations prove that slant ranges as well as angles of intersections are important. (Author)

Naval Ordnance Test Station, China Lake, Calif.
TELEMETRY FACILITIES AT NOTS GROUND RANGES. 1 Jan 59, 13p. NOTS TP-2203; AD-218 196.
Order from LC mi$2.40, ph$3.30 PB 146 976

Office of Defense Research and Engineering, Washington, D. C.
TECHNICAL RESOURCES DIRECTORY: MISSILE GROUND SUPPORT EQUIPMENT, NO. 2. 1 May 60.
Order from OTS $0.50 PB 161 535

Through its extensive research and engineering programs, the Department of Defense is developing material and equipment designed to meet present and future military requirements. The diverse tasks embraced in these programs range throughout the broad scope of military activities. This directory of military technical resources is intended to encourage communication in the Military Departments and in industry in the area of ground support equipment for missile systems. (Supersedes issue no. 1, 1 Nov 59, PB 161 103)

Pacific Missile Range, Point Mugu, Calif.
PAY LOAD LOSS FOR EQUATORIAL ORBITS DUE TO NON-EQUATORIAL LAUNCHES, by M. M. L. Eaton and M. A. Garcia. 29 July 59, 85p. 3 refs. Technical memo. no. PMR-TM-59-4.
Order from LC mi$4.80, ph$13.80 PB 147 384

In addition to the latitude of the launch site, five key parameters are involved in the calculations. These are: fuel specific impulse, rocket structural factor, altitude of desired orbit, range to apogee of preliminary rocket trajectory, and ratio of the apogee to the circular velocity. Of the two models analyzed the apogee transfer is generally preferable to the circular orbit transfer case. (See also PB 147 383)

Pacific Missile Range, Point Mugu, Calif.
PAY LOAD LOSS FOR EQUATORIAL ORBITS DUE TO NON-EQUATORIAL LAUNCHES, by Max L. Eaton and Manuel A. Garcia. 2 Apr 59, 16p. Pub. no. PMR-MP-59-13.
Order from LC mi$2.40, ph$3.30 PB 147 383

This report estimates a penalty for producing equatorial satellite orbits from launch sites off the equator. The penalty concerns the decrease in pay load compared to launches from the equator. Two methods of obtaining an equatorial orbit from a non-equatorial launch site have been considered; namely, "apogee transfer" and "orbital transfer."

Rock Island Arsenal Lab., Ill.
ALUMINUM ALLOYS FOR RECOIL MECHANISM CYLINDERS, by F. Blessin. 17 Mar 60, 26p. 9 refs. Rept. no. 60-798.
Order from LC mi$2.70, ph$4.80 PB 146 906

Wear and friction tests were conducted with currently used recoil mechanism packing materials sliding on steel and high strength aluminum alloys. It was found that the aluminum alloys were less compatible with the packing materials than was the steel now used for recoil mechanism cylinders. Weight and expansion due to internal pressure were calculated for aluminum cylinders equal in strength to steel cylinders at a temperature of 300F. It was found that no savings in weight would be obtained by the use of aluminum and that expansion of aluminum cylinders would be greater than that of steel cylinders. (Author)

Springfield Armory, Mass.
BASIC SYSTEMS CONCERNING SLIDE ENERGY OF OPEN-SYSTEM, GAS-OPERATED WEAPONS, by F. M. Chakour. Rept. on Design Studies and Evaluation for Weapons and Related Materiel for Ground Roles. 26 Feb 59, 44p. SA-TR20-9000.
Order from LC mi$3.30, ph$7.80 PB 146 837

A study was made in order to determine the relationship of available slide energy to the following parameters: orifice location, orifice diameter, initial cylinder volume, piston diameter, piston stroke, weights of recoiling parts. A test fixture was used to obtain experimental data. Correlation of these data was made. Procedure is described, and results discussed. (Author)

Springfield Armory, Mass.
A DETERMINATION OF THE DISTRIBUTION OF CHROMIUM PLATE IN THE BORES OF SMALL ARMS BARRELS, by M. S. Spivak. Rept. edited by Associated Engineers, Inc., on Contract DA 19-020-504-ORD-4800. 12 Feb 60, 14p. Rept. SA-TR18-1070.
Order from LC mi$2.40, ph$3.30 PB 147 281

Barrels of various calibers were chromium plated, sectioned, and the chromium thickness was measured at the lands and grooves. Graphs were plotted of groove chromium thickness versus land chromium thickness for the various barrels.

Stanford Research Inst., Menlo Park, Calif.
FUNDAMENTAL INVESTIGATION OF ROCKET SLED SLIPPER WEAR, by T. D. Witherly. Rept. on Contract N123(60530s)4591A. Nov 59, 58p. 6 refs. NOTS TP 2381; NAVORD rept. 7018.
Order from LC mi$3.60, ph$9.30 PB 146 758

The basic mechanisms of high-speed wear, friction, and lubrication of rubbing surfaces were studied under conditions simulating those at the interface between the rails of a rocket test track and the shoes which support the rocket sled. Comparative wear data were obtained for eight slide materials at nominal bearing pressures ranging from 150 to 1,590 psi, and at sustained velocities of 1,100 to 1,200 fps. Test distances ranged from 1,500 to 10,600 ft of track. (Author)

University of Southern California. Engineering Center, Los Angeles.
INTERACTIONS OF RAPIDLY MOVING BODIES IN TERRESTRIAL ATMOSPHERE, by K. P. Chopra. Technical note on Contract AF 18(603)95. 31 Mar 60, 153p. 103 refs. USCEC rept. 56-212; AFOSR-TN-60-398.
Order from LC mi$7.50, ph$24.30 PB 147 300

The phenomena concerning the interactions of rapidly moving bodies in an ionized medium pervaded by a magnetic field are described in this report. This study has a special bearing on the motion of artificial earth satellites. The various phenomena are divided into four classes. The first category of phenomena concerns the interaction of the body with neutral particles. These phenomena form a part of the area called 'aerodynamics' and the recent theoretical work in this particular area is reviewed in Chapter II. The second group of phenomena deals with the generation of electrical currents induced in the moving body or the surrounding medium (or both) by the relative motion of the conducting material and the magnetic field. The third class of phenomena is due to the body's acquiring an electric charge due to the accretion of charged particles and the photo-electric effect of the solar radiation, and the consequent Coulomb interactions between the charged body and the charged particles. This class of phenomena forms the subject matter for Chapters III and IV. The motion of the charged body in the terrestrial atmosphere is capable of exciting various wave phenomena. Three kinds of waves are described: plasma oscillations in the wake of the body (Kraus-Watson), extraordinary electromagnetic waves (Chopra-Singer), and magneto-hydrodynamic waves due to the interaction between the induced motion of an ionized column ahead of the body and the transverse component of the terrestrial magnetic field. These wave mechanisms are discussed in Chapter VI. Chapter VII reviews the theoretical studies contained in Chapters II through VI, and the pertinent observational material on the upper atmosphere observed by the artificial earth satellites.

Watertown Arsenal Labs., Mass.
CRACK DEPTH LEAKAGE FLUX CHARACTERISTICS IN FERROMAGNETIC MATERIALS, by Patrick C. McEleney. Apr 60, 47p. 9 refs. Technical rept. no. WAL TR 148.1/1.
Order from OTS $1.25 PB 161 513

Specimens of six fired gun tubes of varied chemistry and heat treatment, with simulated cracks, were examined with a magnetic recording borescope to determine the minimum magnetization level for adequate sensitivity in crack detection. Little improvement in sensitivity is realized by magnetization levels above 1600 ampere turns and no improvement in scatter of data over that of previous data was noted. (Author)

Sanitation and Safety Engineering

Arctic Aeromedical Lab., Ladd AFB, Alaska.
COLD WEATHER TESTS ON PNEUMATIC SHELTER RAFT, (MFG. BY AIR CRUISERS, DIVISION OF GARRETT CORP.), by Harold L. Donley. July 57, 13p. Technical note AAL-TN-57-18.
Order from LC mi$2.40, ph$3.30 PB 147 289

Cold weather habitational suitability tests were conducted on the global shelter-raft, pneumatic, 20-man, under arctic and subarctic conditions. The objectives of the cold weather tests were to determine its suitability as (1) an emergency cold weather shelter for downed airmen; (2) an aerial delivered global item of rescue equipment; (3) an emergency para-rescue shelter; (4) and a temporary shelter for persons doing isolated work in the Arctic.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
TESTING AN INCINERATOR TOILET FOR GROUND USE, by Lester Baribo. Apr 57, 11p. Technical note AAL-TN-57-6.
Order from LC mi$2.40, ph$3.30 PB 147 288

Army Engineer Research and Development Labs., Fort Belvoir, Va.
USE OF CORPS OF ENGINEERS MOBILE WATER PURIFICATION UNIT AND AUXILIARY PROCESSES FOR DESTROYING BACTERIAL SPORES IN COLD WATER, by Paul B. Pruett and Don C. Lindsten. Rept. for Jan-Feb 55. 29 Jan 59, 47p. 3 refs. Rept. 1564-TR; AD-213 126.
Order from LC mi$3.30, ph$7.80 PB 146 246

A series of field experiments were conducted at Camp A.P. Hill, Virginia, to investigate methods of destroying chlorine-resistant bacterial spores when added to a cold surface water supply. Non-pathogenic Bacillus subtilis var. niger was used as the test organism. A field method of superchlorination (100 ppm), acidification to a pH value of less than 7.0, dechlorination with 600 ppm activated carbon followed by normal treatment with the Army's Mobile Water Purification Unit, was found satisfactory for destruction of the bacterial spores. The tests showed that the following treatment methods were ineffective: (1) superchlorination (100

ppm), chlorine-contact period (95 min), and pH greater than 8.5; (2) coagulation and diatomite filtration without chlorination in the Mobile Water Purification Unit; (3) prechlorination (1.0 ppm) and diatomite filtration without coagulation in the Mobile Water Purification Unit; (4) prechlorination (1.0 ppm), coagulation, and diatomite filtration with the Army's Mobile Water Purification Unit; and (5) preheating water from 40° to 97°F, prechlorination to 1.0 ppm, coagulation, and diatomite filtration. (Author)

Ship Building

Bureau of Ships, Washington, D. C.
SHOP PRACTICE SUGGESTIONS. [1959] 31p.
Order from OTS $0.50 PB 161 715

These are employee suggestions that were of sufficient importance to be published in the Bureau of Ships Journal for the benefit of all Bureau of Ships facilities and employees.

Bureau of Yards and Docks, Washington, D. C.
DRYDOCKING FACILITIES. VOLUME 3. DATA BOOK. 1 Feb 55, 284p. Technical Pub. NAVDOCKS TP-Pw-10.
Order from OTS $4.00 PB 161 744

This publication, issued in three volumes, presents the current policies, practices, criteria, and technical data used by military and civilian personnel concerned with the Navy's drydocking facilities. Volume 3 presents technical data in summary form on the principal characteristics and features of existing facilities. (See also PB 151 759)

David Taylor Model Basin, Washington, D. C.
COMPARATIVE RESISTANCE DATA FOR FOUR PLANING BOAT DESIGNS, by Eugene P. Clement and Peter M. Kimon. Jan 57, 27p. 2 refs. Rept. no. 1113.
Order from LC mi$2.70, ph$4.80 PB 146 946

Four existing models of planing craft were retested at the Taylor Model Basin's "standard condition" for planing boat models. The test results for each model are presented in a design data sheet. The data are compared to show the effects of differences in hull form. These comparisons are independent of differences in hull loading, in LCG location, or in size of boat. Auxiliary graphs are included to assist in making estimates of speed and power for new designs. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
DYNAMIC TESTS OF ALUMINUM BEAMS, by J. R. Allgood and S. K. Takahashi. Final rept. 22 Mar 60, 28p. 5 refs. Technical rept. 078.
Order from LC mi$2.70, ph$4.80 PB 147 117

Three built-up 5456-H311 aluminum alloy beams, with a clear span length of 8 ft 1-3/8 in. and restrained ends, were subjected to uniformly distributed static and dynamic loading. One of the members, tested statically to a 21.6 psi sustained load, buckled at the web. The other two members, subjected to blast loads with peak overpressures of 18.2 psi and 18.5 psi, also buckled at the web. Results are given, dynamic response of the members is discussed, and a design criterion based on a limit deflection of L/50 is proposed. According to the suggested criterion, the alloy and section used have inferior blast load resistance. (Author)

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Office of Technical Services, Dept. of Commerce, Washington, D. C.
FOOD PRESERVATION BY IRRADIATION (SUPPLEMENT TO CTR-357). Mar 60, 5p. 57 refs. OTS Selective Bibliography 403.
Order from OTS $0.10 OTS SB-403

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

National Bureau of Standards, Washington, D. C.
DETERMINATION OF A GENERAL INDEX OF EFFORT IN SORTING MAIL BY CONVENTIONAL METHODS, by Seymour Henig. June 60, 9p. 1 ref. Technical note 54.
Order from OTS $0.50 PB 161 555

The conventional method of sorting letters in stages is described. It is shown, through reference to available statistics, that about 90% of letters originating within the areas served by several large post offices will be involved in no more than five stages to be completely sorted to a carrier, firm or section of boxes. A method is presented for the accounting of each stage's individual letter readings which are defined as the units of measurement for the index of sorting effort. It is found that the upper bound average number of readings per letter for three large post offices varies from 3.16 to 2.98 and that these bounds are applicable to 96.2 to 92.4% of the local originating first class letters. It is anticipated that the values of such indexes for all large post offices will be consistently close to the range already determined. (Author)

National Bureau of Standards, Washington, D. C.
MAGNETIC DRUM DIRECTORY AND PROGRAMMING SYSTEM FOR CODESORTING LETTER MAIL, by Peter C. Tosini. June 60, 51p. 2 refs. Technical note 50.
Order from OTS $1.75 PB 151 409

The purposes of this report are: (1) to examine the major concepts involved in designing a magnetic drum directory and programming system for coded-address sorting ("codesorting") letter mail in general; and (2) to develop these through modifications and extensions to accommodate local and outgoing sorting for the Washington, D.C. Post Office in particular. It is restricted to one distributor separating local mail to carriers and "directs" (destinations receiving large volumes of mail), and outgoing mail to cities and "state residues" (alphabetic ranges of cities within a state). The specialized problems encountered in multi machine and multi-pass sorting, sorting to carrier walk, and sorting to time-varying destinations are not discussed.

Stanford Electronics Labs., Stanford U., Calif.
A DYNAMICALLY-ADJUSTABLE CHUCK MOUNTING FOR CENTERING WORK IN A GLASSBLOWING LATHE, by H. A. Meneses and M. D. Hare. Rept. on Contract DA 36-039-sc-73178. 17 Oct 58, 13p. Technical rept. no. 453-2.
Order from LC mi$2.40, ph$3.30 PB 137 915

This report describes a mechanism which fits between the spindle and chuck of a glassblowing lathe and permits centering the work by lateral motion of the chuck with the lathe in operation. It also allows the work to be offset by a small measured amount. (Author)

Engines and Propulsion Systems

Aeronautical Engine Lab., Naval Air Material Center, Philadelphia, Pa.
HIGH TEMPERATURE BEARING LUBRICATION WITH ADDITIVE FUELS, by A. Lockwood. Phase 1 rept. on Project TED-NAM-PP5206. 18 Jan 57, 23p. NAMC-AEL-1487; AD-121 959.
Order from LC mi$2.70, ph$4.80 PB 146 503

A method of providing lubrication for gas turbine engine bearings at operating temperatures up to 650°F is under investigation. This method utilizes as a lubricant JP-5 fuel (for cooling purposes) containing test additives (for lubrication purposes). The additives tested were tricresyl phosphate, dibenzylsulphide and molybdenum disulphide. Satisfactory bearing operation at a no-load and 650°F operating condition was obtained with the use of the tricresyl phosphate additive. (Author)

Air Force Office of Scientific Research, Washington, D. C.
AFOSR CONTRACTORS' MEETING [NO. 3] ON ION AND PLASMA PROPULSION MARCH 22-24, 1960. Co-sponsored by Republic Aviation Corp. [1960] 49p. 8 refs. AFOSR-TN-60-405.
Order from LC mi$3.30, ph$7.80 PB 146 900

Contents: Electromagnetic pinch research; Preliminary design of an integrated space vehicle propulsion system; Ion propulsion at Rocketdyne; Charged colloid propulsion; Surface emission of positive ions; Micron size particles for electric propulsion; Compact charge ionization; Heavy particle propulsion; Ion in rocket combustion; Heat transfer from arc heated gases; Electromagnetic plasma propulsion studies; Design studies on the XE-701 ion engine; Investigation of ion thrust devices; Initial ionization process in gases; Small plasma jet propulsors; Hi intensity plasma jets; Acceleration in channeling of plasma jets by magnetic fields; Pulsed plasma propulsion; Aerodynamic applications of plasma wind tunnels; Studies on propulsion of plasma; Plasma acceleration by non-uniform RF fields; Crossed field acceleration of ions and plasmas; Injection into a linear plasma accelerator; High temperature MHD experiments; Realization of magnetohydrodynamic propulsion; Continuous magnetic acceleration of arc plasma; Low temperature plasma jet; Thermophysical properties of magnetohydrodynamic plasmas; Magnetohydrodynamic waves; Gasdynamics of plasma; Bounday layers in plasma accelerators; Heat transfer from an ionized gas to a gaseous coolant; C_8 solid propellant; Properties of ions in flames; Ion rocket sputtering and neutralization studies.

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER 5. INTERNAL COMBUSTION ENGINES; MAINTENANCE AND OPERATION. 15 Dec 53, 64p. 7 refs. Technical Pub. NAVDOCKS TP-Pu-3.
Order from OTS $1.75 PB 161 743

Chapter 5 deals with stationary internal combustion engines for power purposes. It gives operating instructions; measures for preventive maintenance, including inspection, safety precautions, and trouble shooting; and the log for performance and maintenance data. Fuel and lubricants are discussed, as well as fuel, lubricating, cooling, and starting systems. (See also PB 161 358)

Kennametal, Inc., Latrobe, Pa.
RESEARCH ON TITANIUM CARBIDE TURBINE WHEELS AND FABRICATION OF TWO SLOTTED SPIN TEST WHEELS. Final rept. on Contract Nonr-1680(00). 22 June 59, 15p. AD-220 566.
Order from LC mi$2.40, ph$3.30 PB 146 477

The fabrication of 2 spin test turbine wheels of TiC composition is described. One wheel was of K164B composition throughout, and the other was a composite wheel with K164B at the hub and K162B at the rim containing the blade sections. Ball-milled powders were packed in rubber envelopes, shaped approximately to the over-all shape of the finished part, and hydrostatically pressed with the large explosive pressing chamber. The pressure was about 35,000 psi. The slugs were presintered, machined, sintered, and ground to final dimensions, with adjustments in dimensions to obtain static balance. The composite wheel was made by forming and sintering the hub and rim sections separately, grinding, and furnace welding them together.

Little, Arthur D., Inc., Cambridge, Mass.
ALKALI METALS AS PROPELLANTS, by Alfred Buchler and Joan Berkowitz. Final rept. for 29 Apr 58-31 Aug 59 on Energy Transfer Research, Contract AF 29(600)1625. Nov 59, 99p. 143 refs. AFMDC-TR-59-40.
Order from LC mi$5.40, ph$15.30 PB 146 011

The available thermodynamic data for gaseous LiF, NaF, LiCl, NaCl, Li_2O, LiOH, NaOH, and their

dimers, are critically discussed and tables of thermodynamic functions based on these data are given. There appears to be no advantage in the use of alkali metal solutions or dispersions as propellants.

Poulter Labs., Stanford Research Inst., Menlo Park, Calif.
THE STUDY OF THE ORIGIN AND PROPAGATION OF DISTURBANCES IN THE BURNING OF SOLID PROPELLANTS, by G. A. Agoston. Summary rept. for 1 Feb 59-1 Feb 60 on Contract AF 49(638)565. 17 Feb 60, 28p. 33 refs. SRI Proj. GU-2770; AFOSR-TN-60-336.
Order from LC mi$2.70, ph$4.80 PB 147 312

A program has been undertaken to study the behavior of shock waves in the region of steep temperature gradients close to a burning solid propellant surface. The objective is to reveal underlying mechanisms which play significant roles in solid propellant combustion instability. Attempts have been made to observe photographically the behavior of a shock wave near a burning solid propellant surface, near a burning monopropellant (liquid ethyl nitrate) surface and in the region of a flat ethylene-air flame. The photographs obtained with solid propellants are not revealing. Much more readily interpretable pictures were obtained with the ethyl nitrate and the ethylene-air flames. The schlieren photographs obtained of shock waves introduced in a direction parallel to the surface illustrate the distortion and stretching of the shock wave which occurs. Further tests are recommended to reveal the various effects which may occur and to serve as a basis for a proposed theoretical analysis of the phenomena. (Author)

Machine Parts and Mechanisms

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.
THE EFFECTS OF NUT MATERIALS AND LUBRICANTS ON THE SEIZING AND CALLING CHARACTERISTICS OF TITANIUM BOLT THREADS, by Joseph Viglione. 6 Dec 56, 56p. 1 ref. Project TED NAM AE 6244.3; NAMC-AML-AE-1023; AD-127 166.
Order from LC mi$3.60, ph$9.30 PB 146 502

The effects were determined of various lubricants and surface treatments on the seizing and galling characteristics of titanium bolts assembled with titanium alloy, stainless steel, and aluminum alloy nuts. The relaxation characteristics of 1/4" titanium alloy bolts compared quite favorably with those of similar steel bolts, even at extremely high loads approaching the yield strength.

Naval Engineering Experiment Station, Annapolis, Md.
FRICTION TESTS OF TEFLON BEARING MATERIAL, by W. J. Kommers. 7 June 57, 15p. Research and Development rept. 090017A; AD-206 939.
Order from LC mi$2.40, ph$3.30 PB 147 034

The frictional characteristics of presently used stern tube and strut bearing materials are compared with samples of Teflon impregnated glass cloth laminates. The other materials include phenolic impregnated cotton cloth laminates (plain and with MoS_2) and lignum vitae wood. Static and kinetic sliding friction tests were made under dry and water lubricated conditions, and all bearing samples were tested against both bronze and Monel journal specimens. The tests are limited because of the small size of the Teflon samples provided. The coefficients of friction of the Teflon samples were lower than those of the other materials under the dry running tests and the static tests. With water lubrication, all materials had approximately the same kinetic friction coefficients. Investigations of the abrasive wear resistance and the cold flow characteristics of Teflon are recommended prior to making simulated bearing performance tests. (Author)

Office of Technical Services, Washington, D. C.
BEARINGS 1945-1960. Apr 60, 17p. 294 refs. OTS Selective Bibliography SB-410.
Order from OTS $0.10 OTS SB-410

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports on bearings are arranged in sections as follows: gas lubricated; journal; roller; friction, anti-friction, and ball; bearings, general (includes jewel, sleeve, and thrust bearings).

Manufacturing Equipment and Processes

American Machine and Foundry Co., Chicago, Ill.
STUDY OF THE APPLICATION OF AUTOMATION TECHNIQUES AND EQUIPMENT TO THE MANUFACTURE OF PRECISION LENSES, by J. Des Jardins, H. Ishima and others. Final rept. for Sep 58-Apr 59 on Contract DA 36-034-507-ORD-153. 15 June 59, 155p. MR-1090; AD-220 101.
Order from LC mi$7.50, ph$24.30 PB 146 879

This report summarizes the work completed in a feasibility study to determine how, and to what degree the production methods, processes, and equipment now used in the manufacture of precision lenses (spherical lenses only) for fire control material at Frankford Arsenal Optical Shop can be improved, changed, and supplemented through the application of automation techniques and/or equipment. (Author)

Armour Research Foundation, Chicago, Ill.
BERYLLIUM RESEARCH FOR DEVELOPMENT IN THE AREA OF CASTING, by Frank A. Crossley, Arthur G. Metcalfe, and William H. Graft. Rept. for 15 June 58-14 Oct 59 on Solid State Research and Properties of Matter, Contract AF 33(616)5911. Feb 60, 102p. 33 refs. WADC Technical rept. 59-500....
Order from OTS $2.50 PB 161 754

Various aspects of the casting of beryllium have been investigated: (1) X-ray determination of the direction of columnar growth in cast beryllium; (2) consumable arc melting; (3) reported allotropy by thermal analysis; (4) grain-refining inoculants; and (5) application of vibration to cast beryllium for grain refinement A very pronounced thermal arrest was found 5 to 10°C below the solidification temperature. Also, transformation markings were observed metallographically. No preferred orientation of columnar grains was found. Consumable arc-melting experiments showed grain size from 316 grains/in^2 to 616 grains/in^2. Rust-colored tantalum nitride, WC, and TiB_2 apparently nucleated beryllium solidification to produce grain refinement. Also, an alloying addition of 1 at. % Ge produced grain refinement. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
WELDING (SUPPLEMENT TO CTR'S 324-331). Mar 60, 14p. 272p. OTS Selective Bibliography 402.
Order from OTS $0.10 OTS SB-402

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. The information is arranged in groupings of PB reports, AEC reports, and translations under sections titled welding techniques, equipment, metals and alloys, and evaluation methods. Government-owned inventions available for license and reviews of foreign monographes comprise other sections.

Transport, Traction and Hoist Facilities

Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DRAG COEFFICIENTS OF LOCOMOTION OVER VISCOUS SOILS, PART II, by R. S. Rowe (Duke U.) and Ervin Hegedus. July 59, 32p. 4 refs. Rept. no. 54.
Order from LC mi$3.00, ph$6.30 PB 146 774

A supersaturated viscous mud overlaying a hard bottom material is often critical to locomotion in many areas. To solve the problem of a wheel or track, the familiar concepts of hydro-dynamics pertaining to incompressible viscous fluids may be applied. A correlation between theory and experiment is indicated. The basic problem to be solved is one of viscous flow around a partially submerged object. The variation in pressure resulting from the friction drag causes a bulldozing effect in front of the wheel, and a resulting wake at the back part of the wheel. The pressure drag may be reduced by streamlining the wheel which reduces both the amplitude of the pressure wave and the width of the wake behind the wheel. A comparison between various wheel forms has been made and presented in chart form. A study of the correlation between the boundary layer theory and wheels in viscous fluids is suggested. Contrary to accepted practice the usual boundary layer theory seems to apply to a viscous fluid flowing around a partially submerged object when a turbulent wake is formed. It is further suggested that a series of tests be made with muds of various viscosities and wheel forms to correlate the boundary layer thickness and the pressure distribution in the flow field surrounding the wheel as well as an attempt to solve the Navier-Stokes equations. (Author) (See also PB 134 553)

Midwest Applied Science Corp., Lafayette, Ind.
ON THE BEHAVIOR OF A LINEAR TWO DEGREE OF FREEDOM VEHICLE MOVING WITH CONSTANT VELOCITY ON A TRACK WHOSE CONTOUR IS A STATIONARY RANDOM PROCESS, by J. L. Bogdanoff and Frank Kozin. Rept. no. 2 on Contract DA[33-008]-ORD-1738. July 59, 30p. Rept. no. 59-8; Land Locomotion Lab. Rept. no. 56.
Order from LC mi$2.70, ph$4.80 PB 147 003

This study on the behavior of a linear two degree of freedom vehicle is an extension of the one degree of freedom analysis obtained in Land Locomotion Laboratory Report No. 48 (PB 144 233). Equations 3 & 4 are the general equations of motion for the vehicle. These are simplified in equations 5 & 6 for a symmetrical vehicle. Expressions 13 represent the four relations that must be identical for a model to properly simulate the motion of a prototype. Equations 20 & 21 are the steady state solutions of the vehicle equations of motion for a given random imput. Equations 34 & 35 indicate what time must pass before the steady state solution has reasonable accuracy. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
SPECIAL-PURPOSE VEHICLES: DESIGN FOR MOBILE SYSTEMS, by George Schmidt. Apr 60, 38p. 1 ref. RADC-TR-60-60.
Order from LC mi$3.00, ph$6.30 PB 147 524

The design of special-purpose vehicles employed in mobile systems for military ground-support applications is discussed. Design factors are listed and the more important of these are discussed in detail. Two mobile systems typifying different design concepts are described in order to illustrate specific design problems and to compare World War II approaches with current approaches used to solve these problems. (Author)

MATERIALS

[Aerial] Reconnaissance Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
THE EFFECTS OF NUCLEAR RADIATION UPON PHOTOGRAPHIC FILM, by James S. Moser. Preliminary rept. Jan 53, 9p. 2 refs. Technical note WCLF-53-1.
Order from LC mi$1.80, ph$1.80 PB 147 581

This Laboratory has had for some time the problem of determining the protection required for photographic film in a field of nuclear radiation. This report is a summary of the problem and of the work that has been done.

Aeronautical Chart and Information Center, St. Louis, Mo.
MEASUREMENT OF INK AND PRINTING QUALITIES, by Otto C. Stoessel, Jr. Mar 60, 26p. Technical rept. no. 90.
Order from OTS $0.75 PB 161 664

A means is presented here to list and measure various qualities necessary to implement statistical quality control relative to lithographic printing. This includes consideration of printing qualities from the viewpoint of the purchaser of printed matter who has the responsibility of quality standards and from the viewpoint of the lithographic printer who must establish and maintain qualities in consideration of the requirements given him. It further takes into consideration two basic categories; measurement of base material, i.e., paper, ink, and measurement of printed material, i.e., human, mechanical, and general process of applying the raw material. Special attention is given to establishing standards and measurements which are common to both the purchaser and printer. (Author)

Illinois Inst. of Tech., Chicago.
AN INVESTIGATION ON THE DYNAMIC PROPERTIES OF PLASTICS AND RUBBER-LIKE MATERIALS, by R. A. Eubanks, D. Muster, and E. G. Volterra. Technical rept. no. 1 on Contract N7onr-32911. 14 June 52, 125p. 20 refs. AD-307.
Order from LC mi$6.30, ph$19.80 PB 147 013

Analysis of the results of dynamic tests on a natural rubber of 27 to 30 durometer hardness indicated that the phenomena were essentially viscous and that the rubber displayed only slight hereditary effects. Formulas for the rubber specimens tested and a summary of their physical properties are given in an appendix.

Industrial Test Lab., Philadelphia Naval Shipyard, Pa.
DEVELOPMENT OF IMPROVED MATERIALS AND DESIGN FOR BERTH BOTTOMS (BIAS-CUT CANVAS) by H. A. Kline and E. H. Wadlinger. Dec 56, 32p. 9 refs. Development rept. no. 2268; AD-117 448.
Order from LC mi$3.00, ph$6.30 PB 146 504

Berth bottoms made of bias-cut cotton canvas for pipe-frame berths abroad Navy vessels have been found much sturdier and more durable in simulated service tests than the berth bottoms of No. 4 medium texture canvas now specified in Military Specification MIL-B-3715A. Breakdown of the bias bottoms required hundreds of impacts sufficiently violent to cause failure of No. 4 canvas bottoms on first impact. A proposed specification for a bias canvas berth bottom is included in the report. (Authors)

Inland Testing Labs. [Morton Grove, Ill.]
UNIFORM DUPLICATION OF ENVIRONMENTAL TEST RESULTS. PART III. EVALUATION TEST PROGRAM, by Paul Gottfried, Chester G. Polak, and John McGee. Final rept. on Contract AF 33(616)5413. Nov 58, 92. WADC Technical rept. 58-613, Pt. III; AD-205 772.
Order from LC mi$5.40, ph$15.30 PB 146 954

The results of the evaluation test program were analyzed to determine the validity and applicability of the proposed environmental test procedures to accomplish the objective of the contract, which specifically was to develop uniformity and repeatability of the environment test conditions for the assurance of uniform test results regardless of where or when the tests are performed. From the analysis of the test results, it was determined that the repeatability of the environmental test conditions could be improved by: (1) control of the test parameters and associated tolerances, and (2) clarification of the test procedures to assure uniformity in the testing process, as incorporated in the proposed specification revisions detailed in the Part II report. (See also PB 146 573)

Adhesives and Sealants

Borden Chemical Co., Philadelphia, Pa.
DEVELOPMENT OF A DURABLE ASSEMBLY GLUE FOR WOOD FURNITURE, by G. Kitazawa, M. Peters and others. Final rept. for 3 Apr 57-15 Oct 58 on Contract DA 19-129-qm-902. [1958] 44p. AD-219 385.
Order from LC mi$3.30, ph$7.80 PB 146 896

A laboratory study was conducted in the development of a durable furniture assembly adhesive. The general objectives of the development were that the adhesive be as resistant to moisture changes as the durable resin adhesives and have the application and quick set properties of animal glues. The requirements of a durable assembly adhesive have been partly met. The durability to moisture of the prepared adhesive is better than animal glue. However, the speed-of-set or curing rate is below that of the present non-durable assembly adhesives but probably satisfactory for many assembly applications. Further, it was not possible within the contract period to reduce the consistency to the desired level and to eliminate stringiness. The developed adhesive consists of a tackifier for quick set, a slow curing resinous adhesive for durability, and a separately packaged catalyst. (Author)

Feltman [Research and Engineering] Labs., Picatinny Arsenal, Dover, N. J.
IMPACT STRENGTH OF ADHESIVES AS AFFECTED BY GEOMETRY OF JOINT, by Salvatore Stivala. Feb 58, 8p. Technical notes no. 18; AD-157 635.
Order from LC mi$1.80, ph$1.80 PB 147 133

An investigation was conducted to discover what effect, if any, the shape of an adhesive joint has on its impact resistance. Two distinct phases were studied: (1) geometrically different joints having the same bonding areas, and (2) geometrically similar joints having different bonding areas. The geometrical shapes of the cold-rolled steel specimens included circular, semicircular, square, and rectangular configurations. The impact tests were conducted at 73.5°F and 50% relative humidity in accordance with Spec. MMM-A-175. The adhesive used was prepared from 100 parts Epon 828 mixed with 10 parts diethylene triamine. Curing was conducted at room temperature for 24 hr followed by 4 hr at 85°C. Results showed that circular adhesive joints tend to be more resistant to impact than semicircular adhesive joints of the same bonded area. Rectangular adhesive joints of the same area which were arranged differently showed identical impact resistance. Rectangular adhesive joints of increased bonded area showed a tendency to have increased impact strength, calculated in terms of energy required to rupture per unit bond area.

Material Lab., New York Naval Shipyard, Brooklyn.
REPORT OF INVESTIGATION TO DETERMINE THE LIMITING CONDITIONS OF TEMPERATURE AND HUMIDITY FOR APPLICATION OF "COLD BOND" SHAFT COVERING MATERIALS. Final rept. 13 Mar 58, 12p. 7 refs. Lab. Project 5745-1; AD-205 699.
Order from LC mi$2.40, ph$3.30 PB 147 370

An investigation was made to determine the limiting atmospheric conditions (temperature and relative humidity) under which a "cold bond" shaft covering may be applied. These conditions were determined on the basis of conformity of the covering with the adhesion requirements of Specification MIL-S-15058D. Conformity of adhesion with the specification requirements was obtained at 44°F and 78% relative humidity only when the substrate was heated prior to and during coating application. At 74°F adhesion was satisfactory only when the sheet material was solvent cleaned and scrubbed with a wire brush. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
ADHESIVES (SUPPLEMENT TO CTR-300). Apr 60, 8p. 98 refs. OTS Selective Bibliography 406.
Order from OTS $0.10 OTS SB-406

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations.

Ceramics and Refractories

Bell Aircraft Corp., Buffalo, N. Y.
MECHANICAL PROPERTIES OF SELECTED ALLOYS AT ELEVATED TEMPERATURES. PART II. DESIGN CRITERIA OF SILICON CARBIDE, by Harry A. Pearl, John M. Nowak, and Harry G. Deban. Rept. for July 58-Sep 59 on Materials Application, Contract AF 33(616)5760. Mar 60, 134p. 38 refs. WADC Technical rept. 59-702, Pt. 2.
Order from OTS $2.75 PB 161 723

A study was made of nondestructively testing silicon carbide by density uniformity, dynamic modulus by sonic technique, X-ray diffraction under transverse load, electrical resistivity, and internal friction. Dynamic modulus of silicon carbide was experimentally determined at 80 F and 2200 F. Modulus of rupture tests were conducted at 80 F, 2200 F and 2400 F. The variability of the properties of the silicon carbide and the lack of simple correlations between the properties and geometry require the use of a statistical approach to correlate mechanical properties and geometry. A theoretical analysis is presented on the effect of specimen size, surface finish, and methods of loading on the strength properties of silicon carbide. Available literature and manufacturer's property data for various types and forms of commercially available silicon carbide are tabulated. Various areas of possible application of silicon carbide in aircraft and missiles and design parameters for leading edge applications are given. (Author)

Bell Aircraft Corp., Buffalo, N. Y.
REFRACTORY INORGANIC MATERIALS FOR STRUCTURAL APPLICATIONS, by Harry A. Pearl, John M. Nowak, and others. Rept. for June 58-June 59 on Ceramic and Cermet Materials, Contract AF 33(616)5930. Feb 60, 151p. 24 refs. WADC Technical rept. 59-432.
Order from OTS $2.75 PB 161 737

Thirty-five refractory inorganic material systems were evaluated in exploring possible techniques to prepare refractory inorganic materials into high temperature aircraft structural elements. The fabrication techniques were evaluated by the results of room temperature modulus of rupture, impact and thermal shock tests. The best over-all Bell Aircraft system was based on .003" alumina-silica paper impregnated with alumina-silica cement. Specimens of this system were tested at elevated temperature (2000 F) for modulus of rupture, compressive strength and compressive shear. A state of the art survey on foamed ceramics was also conducted as part of this study. (Author)

Minerals Research Lab., U. of California, Berkeley.
DUCTILE CERAMICS, by E. R. Parker, J. A. Pask and L. Himmel. Final rept. on Contract AF 49(638)56. Feb 60, 8p. 7 refs. Series no. 109, issue no. 3; AFOSR-TR-60-26.
Order from LC mi$1.80, ph$1.80 PB 146 841

A brief summary of research work accomplished and reports prepared on the ductility of some ceramic single crystalline materials.

Naval Research Lab., Washington, D. C.
EFFECT OF RADIATION UPON CERAMIC-BONDED STRAIN GAGES, by N. J. Rendler and R. C. Smith. Interim rept. 20 Apr 60, 18p. 1 ref. NRL rept. 5450.
Order from OTS $0.50 PB 161 307

The study of the effect of nuclear radiation upon ceramic-bonded strain gages indicates that strain gages must be radiation compensated in a manner analogous to temperature compensation. Electrical resistance of gage elements varies with reactor power, exhibiting both a partial recovery and a permanent damage effect. The radiation-resistance characteristic of gages can be matched, thus extending the promise that with proper compensation the gages will operate satisfactorily as transducers in a nuclear environment. Instrumentation should include provision for a dry, noncorrosive atmosphere and monitoring of insulation resistance. (Author)

Stanford Research Inst., Menlo Park, Calif.
SYNTHESIS OF NEW HIGH TEMPERATURE MATERIALS, by J. L. Engelke, F. A. Halden, and E. P. Farley. Rept. for June 58-June 59 on Ceramic and Cermet Materials, Contract AF 33(616)5888. Feb 60, 44p. 24 refs. WADC Technical rept. 59-654.
Order from OTS $1.25 PB 161 720

A number of mixed transition metal carbides, borides, and nitrides were prepared and examined in terms of melting point, structure, and oxidation resistance. None of the measured melting points was higher than the value reported for HfC-4TaC (3940°C). The melting point for a series of solid solutions between HfC and HbC increased regularly with hafnium content. A material with the composition Mo_2 BC, when heated in an air stream, was found to lose weight rapidly without loss of metallic character, suggesting its possible use as an ablation material. A cubic modification of hafnia was obtained in material sprayed from a plasma arc. A low coefficient of thermal expansion and high melting temperature makes this a material of interest. An implosive-shock technique for compound synthesis, which subjects materials to extremely high temperature-pressure conditions for short periods of time, was developed. The method was used successfully to synthesize boron phosphide. (Author)

Fuels, Lubricants, and Hydraulic Fluids

Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain).
COMBUSTION OF SPRAYS IN AN OXIDIZING ATMOSPHERE, by Gregorio Millan, Segismundo Sanz, and Ignacio Da Riva. Rept. on International Congress on Combustion Engines no. 5, 1959, Contract AF 61(514)734C. [1959] 38p. 24 refs. AFOSR-TN-59-818; AD-225 647.
Order from LC mi$3.00, ph$6.30 PB 147 142

The mathematic representation of the statistical size distribution of droplets injected into the combustion chamber of Diesel engine and a gas turbine, is discussed. After consideration is given to some of the distributions proposed by other Technical Sciences (Meteorology - Gravimetrology, etc), the Mugele Evans [Ind. Eng. Chem. 43:1317-1324, 1951] distribution is selected as the most adequate for the problem. The combustion of a spray under ideal conditions is analyzed. It is assumed for it that each droplet burns in accordance with a theoretical law whose validity has been experimentally verified for a few simple cases--isolated droplets at rest or in motion, set of droplets in motion whose relative positions remain invariable, etc. The particular cases considered are the following: combustion at the beginning and end of the injection. Combustion at an instant sufficiently far in time from both the above cases. Combustion of a volume injected instantaneously as approximately occurs in a Diesel engine and, finally, superposition of isolated successive injections. The scaling of atomizers and combustion chambers is analyzed. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PRESSURE BOMB FOR THE PHOTOGRAPHY OF BURNING STRANDS OF SOLID PROPELLANT, by David R. Margetts and Benjamin V. Connor. Rept. on Contract DA 04-495-ORD-18. 25 July 58, 25p. 8 refs. Rept. no. 20-119; AD-205 357.
Order from LC mi$2.70, ph$4.80 PB 147 390

A pressure bomb and associated control circuitry has been constructed for the photography of burning strands of solid propellant. The system enables high-speed black and white and color photographs of strands, ranging from 0.15 to 0.35 in. in diameter, to be take at pressures from atmospheric to 2000 psi. Different propellants were photographed. The bomb system and techniques described are capable of yielding useful data on burning surface detail, flame structure, and propellant burning instability over a wide range of propellant luminosity and burning rates.

Naval Propellant Plant, Indian Head, Md.
TALIANI TESTS FOR ASSESSMENT OF STABILITY OF SOLID PROPELLANTS, by Carl Boyars, Kermit Atlas and others. 20 Nov 58, 31p. 8 refs. Technical rept. no. 106; NAVORD rept. no. 5688.
Order from LC mi$3.00, ph$6.30 PB 138 271

The nitrogen Taliani test provides a method for determining the gassing rate of a propellant at a particular temperature and yields information about the nature of the decomposition taking place within the propellant when diffusion of atmospheric oxygen into the propellant is not significant. The oxygen Taliani test, however, can be used for estimating the residual safe storage life of propellants based on nitrate esters, and also for indicating the relative affinity of stabilizers for nitrogen dioxide and the efficiency of antioxidants in composite systems. Both manual- and automatic-recording apparatuses, as modified at the Naval Propellant Plant, are described in detail. (Author)

Ordnance Fuels and Lubricants Research Lab., Southwest Research Inst., San Antonio, Tex.
CORRELATION OF A CLR TEST PROCEDURE WITH THE CRC FL-2 TEST TECHNIQUE, PRELIMINARY STUDIES FOR, by John V. Moffitt. Preliminary studies on Contract DA 23-072-ORD-1144. June 58, 78p. 1 ref.
Order from LC mi$4.50, ph$12.30 PB 138 267

A cursory study was made to investigate use of the CLR engine for low-duty tests comparable to FL-2 and EX-3 procedures. A Chevrolet engine was used to provide data for comparison with CLR results. The CLR engine produced heavier sludge deposits under EX-3 cyclic conditions than under constant FL-2 conditions. CLR correlation with the Chevrolet EX-3 technique was also better. On the other hand, the relatively large thermal inertia of the CLR engine caused prolonged temperature stabilization periods during cycle changes, thus making the EX-3 technique less attractive from an operational standpoint. It is tentatively concluded that either type of technique could be developed for the CLR engine. (Author)

Princeton U., N. J.
FURTHER STUDIES ON THE LIGHT SCATTERING TECHNIQUE FOR DETERMINATION OF SIZE DISTRIBUTIONS IN BURNING SPRAYS. II. WIDE RANGE PHOTOGRAPHIC PHOTOMETRY, by R. A. Dobbins. Technical rept. on Contract AF 18(600)1527. 10 Feb 60, 55p. 15 refs. Aeronautical Engineering Lab. rept. no. 498; AFOSR-TN-60-353.
Order from LC mi$3.60, ph$9.30 PB 146 902

The quantitative measurement by photographic photometry of the angular variation of luminous intensity due to a group of suitably illuminated particles is discussed. Methods of developing a photosensitive film to a high degree of uniformity are shown to depend upon the effectiveness of the mixing of the developing solution and the disruption of the formation of a concentration boundary layer. By careful selection of developing technique and by use of film and microphotometer calibration procedures based on a primary standard of measurement, it was found possible to extend the useful range of a film for photometric purposes to a density of over 2.5. These methods permit the use of photographic photometry to make measurements of irradiance varying over a wide range with good accuracy. Preliminary results indicate that a range of over 100 to one can be achieved with an accuracy of better than 10% over the entire range. Photographic instrumentation applied to the measurement of a diffraction pattern yielded results which were at least as good as electronic photometry with a photomultiplier as a transducer. (Author) (See also PB 143 022)

Leather and Textiles

Cook Research Labs., Morton Grove, Ill.
ANALYSIS OF WEBBING IMPACT DATA AND DETERMINATION OF OPTIMUM INSTRUMENTATION TO BE USED IN CONJUNCTION WITH THE IMPACTING OF WEBBING, by R. B. Williams and R. J. Benjamin. Rept. for May-Sep 59 on Air Force Textile Materials, Contract AF 33(616)6440. Mar 60, 71p. 5 refs. WADC Technical rept. 59-694.
Order from OTS $2.00 PB 161 756

The basic aims of this investigation are: (1) to evaluate and analyze the methods used to obtain data acquired during nylon webbing impact tests conducted at Edwards Air Force Base, California; (2) to interpret these data and to judge their reliability; and (3) to recommend, if necessary, improved or modified testing methods and instrumentation techniques which would result in obtaining data of greater value in future tests. Analysis and interpretation of the test data indicated that these data were of intermediate reliability. Certain trends were apparent, but relatively large experimental scatter existed. Possible causes of the scatter were investigated and recommendations were made for improvement of testing methods, equipment, data reduction technique, and data interpretation. (Author)

Manchester Coll. of Science and Technology (Gt. Brit.)
TENSILE PROPERTIES OF TWISTED SINGLE FIBRES, by R. W. Dent and J. W. S. Hearle. Final technical rept. for Oct 58-Oct 59 on Contract DA 19-591-EUC-931. 30 Oct 59, 146p. 55 refs. AD-233 181.
Order from LC mi$7.20, ph$22.80 PB 146 833

It has been shown that increasing the twist in single fibres or monofilaments causes the tenacity at break and the breaking extension to decrease more rapidly at higher twists, and this decrease appears to be similar for all fibres. Two types of twisting have been used: at constant tension, and at constant length. A connection between the two is suggested. The parameters of pure torsional rupture have been considered and compared with the values obtained by Koch [Textil-Rundschau 3:111; 6:199 and 281]. The effect of the various arbitrary experimental constants has been investigated and related to the work of Breuer and others [Kunstseide u. Zellwolle 202 and 242, 1939]. Snarling in constant tension twisting has been considered. A mathematical treatment of the results is given and a criterion for the fracture of a single fibre or monofilament under combined stresses is suggested. Photomicrographs of the fibres under various combinations of stress are included. (Author)

Textile Research Inst., Princeton, N. J.
LOAD-DEFORMATION BEHAVIOR OF ELASTIC FILAMENTS WITH ARBITRARY INITIAL CONFIGURATION, by Ricardo Chicurel. Technical rept. no. 19 on Contracts Nonr-(09000, 09001). June 59, 154p. 30 refs.
Order from LC mi$7.50, ph$24.30 PB 146 509

The relation between load and deformation for an elastic filament whose axis is an arbitrary curve is examined. The type of loading which is emphasized consists of forces and moments at the ends but some cases of distributed loadings along the length of the filament are also considered. The analysis is divided in two parts: The first discusses filaments whose axes lie in one plane. The effects of bending and direct tension are included but that of shear is ignored. The second part of the analysis concerns itself with filaments whose axes are curves in space. Only bending and twisting effects are considered. (Author)

Textile Research Inst., Princeton, N. J.
THERMAL CHARACTERISTICS OF COATED TEXTILE FABRICS, by Irvin M. Gottlieb, John C. Whitwell and others. Summary rept. no. 2 for 23 Apr 57-30 June 58 on Contract N140(132)57442B. 1 July 58, 129p. 13 refs.
Order from LC mi$6.30, ph$19.80 PB 137 782

Prototype coated fabric systems were prepared in the laboratory in order to study the interactions at high temperatures of three fabrics (cotton, nylon and Orlon) and of three elastomer coatings (butyl rubber, Hypalon and neoprene). In a statistical program of testing and analysis, loss in weight, flammability,

melting and differential thermal data were obtained so as to determine those factors which contributed significantly to the high temperature fabric-coating interactions. The magnitudes of the effects of temperature, coating and fabric type, and method of application on the thermal stability of the coated fabric systems were quantitatively estimated. Significant differences were found in the thermal response, melting and flammability characteristics of the three fabrics and of the three coatings. Marked departures were noted in the thermal behavior of the coated fabric systems from that predicted from the behavior of their components. The high temperature characteristics of eighteen natural, synthetic, regenerated, and derivative fiber types of different chemical composition, and of blends of these fibers with cotton were determined. A broad spectrum of flammability and thermal stability values was obtained. The thermal behavior of the blends (measured by loss in weight), their flammability (measured by minimum temperature for ignition), and their melting characteristics differed from those anticipated from the behavior of their components. The formation of a bead due to the melting of the synthetic fibers was eliminated in the blends with cotton. (Author)

Paints and Finishes

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.
STUDIES OF ORGANIC COATINGS EXPOSED TO GAMMA RADIATION, by Jack Ohr. Partial rept. on Proj. TED NAM AE 42204. 2 July 59, 18p. 4 refs. Rept. no. NAMC-AML-AE 1089; AD-225 022.
Order from LC mi$2.40, ph$3.30 PB 147 218

Twenty experimental and specification aircraft coating systems were exposed to 1.2 mev gamma radiation. Periodic examinations were made for changes in color and film properties. Many coating systems show significant degradation changes in color and film properties after exposures of only 8.0×10^7 roentgens. The radiation stability of the various coatings is explained in terms of polymer structure and chemical groupings. (Author)

Battelle Memorial Inst., Columbus, Ohio.
CHEMICAL SURFACE TREATMENT OF TITANIUM, by H. A. Pray, P. D. Miller, and Richard A. Jefferys. Final rept. on Contract DA 33-019-ORD-215. 30 Oct 53, 33p. WAL 401/45-33.
Order from LC mi$3.00, ph$6.30 PB 147 158

Development of two types of baths that produce adherent, continuous coatings on titanium and its alloys; a 5 per cent sodium hydroxide anodic bath and the fluoride-phosphate and the fluoride-borate immersion baths. The coatings minimize greatly the severe galling tendency of titanium. Certain treatments produced coatings that provided good service for various types of reciprocating and rotary wear. These treatments involved coating the titanium in an immersion bath to produce an adherent, continuous crystalline coating, followed by (1) a heat treatment in air at about 800 F for 3 hours or by (2) application of a MoS_2-Epon resin mixture. The wear resistance is comparable to that for carbonized or nitrided surfaces which require high-temperature treatments, resulting in damage to the core properties.

Naval Civil Engineering Lab., Port Hueneme, Calif.
DECK COATING TESTS, by W. R. Nehlsen. 15 Dec 58, 12p. Technical rept. R-020.
Order from LC mi$2.40, ph$3.30 PB 138 265

A coating made with cement powder, boiled linseed oil, and lead naphthenate dryer was proposed as a superior protective coating for deck surfaces. Tests were made using this coating and a similar formula with pumice replacing the cement powder. The effectiveness of the coatings in providing adhesive, nonslip, wear resistant and corrosion resistant qualities was tested; and the standard Navy paint coating was judged to be superior.

Plastics

Aerojet-General Corp., Azusa, Calif.
A STUDY OF THE KINETICS OF SOLID-PHASE REACTIONS, by D. L. Armstrong. Technical status rept. no. 8, 16 June-15 Sep 58, on Contract AF 18(603)74. 15 Sep 58, 7p. 3 refs. Rept. no. 1282-8 (Quarterly).
Order from LC mi$1.80, ph$1.80 PB 137 819

Rates of linear pyrolysis of ammonium chloride were obtained. In general, the rate data are consistent with the isothermal vacuum-sublimation data of Spingler and Fehl, and fit the rate equation $B = 120 \exp(-13500/RT_s)$ cm/sec. It is apparent that strand loading force is an important parameter in extending the rate data to high gasification rates. Polymethylmethacrylate samples were synthesized in preparation for further investigation of the mechanism of surface decomposition of this polymer. (Author) (See also PB 144 571)

Army Prosthetics Research Lab., Washington, D. C.
POROUS EPOXY LAMINATE EVALUATION. PART VII. EFFECT OF CURING TIME ON LAMINATE PROPERTIES, by James T. Hill and William C. Wiedmann. [1959] 6p. Rept. no. TR-5928; AD-216 382.
Order from LC mi$1.80, ph$1.80 PB 147 026

The impact resistance like bearing and compressive strength is controlled by effective porosity rather than curing conditions over the range tested. As a result of these tests it is concluded that the laminates may be completely cured at a temperature of 70°C or higher after a minimum precure of 60 minutes. The best conditions for curing, taking into affect effect porosity and physical properties, appear to be 70°C for 120 minutes. Longer or higher temperatures tend to cause discoloration of the laminates.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
PLASTICS-POLYMER RESEARCH (FIVE YEAR BIBLIOGRAPHY). Oct 59, 27p. 504 refs. OTS Selective Bibliography 400.
Order from OTS $0.10 OTS SB-400

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations. The information is arranged in groupings of PB reports, AEC reports, and translations under the following sections, which are intended as rough guides only: acrylics; cellulosics; fluoroplastics; phenolics; polyesters, polyurethanes, epoxides; polyethylenes; polystyrene; silicon-base; vinyls; adhesives; coatings and impregnants; fibers and textiles; foams, sealants, interlayers; laminates; radiation effects; general and miscellaneous. While synthetic rubber research has not been included, a few reports have been listed; these are either in borderline or overlapping areas or of sufficient pertinence or interest for inclusion. A large number of plastic reports involve several categories and in some instances two or more categories have received almost equal attention. Many polyethylene-base plastics, for example, have been placed under polyethylene. Numerous monomeric studies have been grouped with the nearest polymer.

Springfield Armory, Mass.
INTERACTION OF PLASTICS WITH VOLATILE CORROSION INHIBITORS: THIRD AND FINAL PARTIAL, by R. L. Keleher and A. Hitchins. Partial rept. no. 3 (Final) 12 Apr 57, 20p. SA-TR20-2309; AD-141 810.
Order from LC mi$2.40, ph$3.30 PB 146 992

The interaction of six thermo-plastic materials with four volatile corrosion inhibitor formulations qualified under MIL-P-3420 was observed over a nine-month period. Plastic samples were wrapped with VCI paper, enclosed in heat-sealed MIL-B-131 barrier envelopes, and exposed at 100°F and 95 percent relative humidity. Examinations showed that "CODE NL" and "CODE BH-3" were not affected by any of the four inhibitors. The other plastics tested were adversely affected to varying degrees. Delamination of the vinyl film of the barrier material was caused by two of the VCI's. (Author)

Victory Plastics Co., Hudson, Mass.
INVESTIGATION OF MATERIALS AND METHODS OF OBTAINING SUITABLE SURFACE COATING FOR GLASS FIBER REINFORCED PLASTIC STOCKS. Final summary rept. on Contract DA 19-020-ORD-3794. May 58, 66p. AD-160 047.
Order from LC mi$3.90, ph$10.80 PB 147 021

An investigation was made of materials and methods for obtaining optimum surface properties on glass fiber reinforced plastic stocks. Results of the investigation demonstrated that by the proper application of suitable materials, improvements are realized in low temperature impact properties, abrasion resistance, appearance and gripping qualities. At the same time, satisfactory resistance to weathering, heat at 250°F, water, oils, gasoline, and trichlorethylene was maintained.

Wood and Paper

Naval Civil Engineering Lab., Port Hueneme, Calif.
HARBOR SCREENING TESTS OF MARINE BORER INHIBITORS, II, by Harry Hochman and Thorndyke Roe, Jr. Interim rept. 16 Mar 60, 33p. 7 refs. Technical rept. 077.
Order from LC mi$3.00, ph$6.30 PB 147 116

This report studies more effective methods and materials for preserving wooden structures exposed to marine boring organisms. It reports the results of treated and untreated test panels which are harbor-exposed to heavy Limnoria attack or to weakening by Martesia or teredine attack. (Author) (See also PB 143 053)

Naval Radiological Defense Lab., San Francisco, Calif.
THERMAL RADIATION DAMAGE TO CELLULOSIC MATERIALS. PART IV. INFLUENCE OF THE MOISTURE CONTENT AND THE RADIANT ABSORPTIVITY OF CELLULOSIC MATERIALS ON THEIR IGNITION BEHAVIOR, by S. Martin, K. A. Lincoln, and R. W. Ramstad. 30 Dec 58, 28p. 13 refs. Research and Development Technical rept. USNRDL-TR-295; AFSWP-1117; AD-216 545.
Order from LC mi$2.70, ph$4.80 PB 146 845

Measurements of the radiant exposure required for the ignition of alpha-cellulose at controlled levels of humidity and for various radiant absorptances show that the influence of the moisture content and the absorptivity of the material on its ignition behavior can be accounted for by the appropriate modification of the correlation moduli. Data were obtained for dark cellulosic sheet fuel in the relative humidity range 10 to 87 percent and for sheet cellulose having a broad range of absorptance values. The data for all but the white cellulose correlate well to a single ignition behavior pattern. Limited experimentation with white cellulose indicates that for materials in the low range of absorptivity, the absorptance multiplier in the irradiance modulus should be raised to a power less than unity. (See also PB 142 177)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
WOOD (1950-1960). Apr 60, 18p. 276 refs. OTS Selective Bibliography 408.
Order from OTS $0.10 OTS SB-408

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations. Reports and translations are arranged in sections as follows: wood, general; cutting tools; wood preservation; wood pulp; and forests and forestry.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
A MULTIPLICATIVE MODEL FOR ANALYZING VARIANCES WHICH ARE AFFECTED BY SEVERAL FACTORS, by Robert Bechhofer. Technical rept. no. 40 on Contracts N6onr-251(26) and AF 49(638)230. 10 July 59, 43p. 24 refs. AD-220 443.
Order from LC mi$3.30, ph$7.80 PB 147 062

A new way is proposed for looking at multifactor experiments which are conducted to study the effect of changes in the levels of the factors on the variance of a chance variable. A mathematical model is proposed which assumes that the effect of changing a factor from level 1 to level 2 is to multiply the original variance of the chance variable by a positive constant. This is in contrast to a model which assumes that the effect of changing a factor from level 1 to level 2 is to add a constant to the original variance of the chance variable. Thus a multiplicative model allows one to speak of relative (percentage) changes; an additive model allows one to speak of absolute changes. The univariate multiplicative model for variances is introduced and its experimental interpretation in classical terms is given. Factorial experiments, experimental designs, and the concept of an approximating multiplicative response surface for variances are also described. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE OPTIMALITY OF (S, s) POLICIES IN THE DYNAMIC INVENTORY PROBLEM, by Herbert Scarf. Technical rept. no. 11 on Contract Nonr-225(28). 10 Apr 59, 13p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 146 052

This paper considers the dynamic inventory problem with an ordering cost composed of a unit cost plus a reorder cost. It is shown that if the holding and shortage costs are linear then the optimal policy in each period is always of the (S, s) type. More general conditions on the holding and shortage costs are given which imply the same result. A similar result is also given in the case of a time lag in delivery. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
SLIPPAGE PROBLEMS, by Samuel Karlin and Donald Truax. Technical Rept. no. 28 on Contract Nonr-225(21). 8 June 59, 62p. 11 refs.
Order from LC mi$3.90, ph$10.80 PB 146 425

Roughly, the problem is as follows: We wish to compare n populations which have density functions $f(x, \theta_1)$, $f(x, \theta_2)$, ..., $f(x, \theta_n)$. On the basis of a sample from each population we want to decide if all the θ_i are equal or if not, which is the largest. Actually a more restricted problem is considered in this paper in which either all parameter values are equal, or all but one are equal and the exceptional one is larger. If the i^{th} one is larger we will say it has slipped to the right.

Applied Mathematics and Statics Lab., Stanford U., Calif.
SUFFICIENT CONDITIONS FOR UNCONSTRAINED OR CONSTRAINED MAXIMIZATION OF A QUASI-CONCAVE FUNCTION by Kenneth Arrow. Technical rept. no. 75 on Contract Nonr-225(50). 30 June 59, 20p. 7 refs. AD-219 877.
Order from LC mi$2.40, ph$3.30 PB 146 427

The sufficiency is investigated for the vector variable x assuming that the function f(x) is quasi-concave, i.e., for each real number c, the set $[x:f(x) \geqq c]$ is concave. Assume that the vector x can be partitioned into vectors x^1, x^2 such that $\bar{f}_{x^1} > 0$, $\bar{f}_{x^2} > 0$, $\bar{x}^2 = 0$. (The bar denotes evaluation at x; x will be a column vector, and f_x a row vector.) The function $f(x^1, 0)$ is shown to be maximum at $\bar{x}^1$ under certain (essentially local) regularity conditions. Theorems are presented which bear on the duality between constrained maxima and minima. From these theorems, a sufficient condition is derived for the maximization of a quasi-concave function. The relation between constrained maxima and the saddle point of the Lagrangian, L(x, y), is also discussed.

Brown U. [Div. of Applied Mathematics] Providence, R. I.
A NOTE ON REVEALED PREFERENCE, by David Gale. Technical rept. no. 4 on Contract Nonr-562(15). 1959, 11p. 2 refs. AD-220 052.
Order from LC mi$2.40, ph$3.30 PB 147 089

An economy is considered in which there are n goods and a single consumer with a fixed income which is assumed to be unity. For each set of unit prices, $p_1, \ldots, p_n$ which is assigned to the n goods it is assumed that the consumer chooses certain quantities $x_1, \ldots, x_n$ of these goods subject to the condition that the total cost of the goods does not exceed his income. The consumer's demand function D is defined as a mapping from non-negative (price) vectors $p = (p_1, \ldots, p_n)$ into non-negative (goods) vectors $x = (x_1, \ldots, x_n) = D(p)$ which satisfies the budget inequality, $pD(p) \leqq 1$, where juxtaposition of vectors stands for scaler product. The demand function D comes from a preference function if there exists a real valued function ϕ defined on non-negative (goods) vectors x such that $D(p) = \max_{px \leqq 1} \phi(x)$. A necessary condition that D come from a preference function is that it satisfy the weak axiom of revealed preference: If p and q are price vectors and $pD(q) \leqq 1$ and $qD(p) \leqq 1$ then $D(p) = D(q)$. An example is given of a demand function which satisfies the weak axiom but does not come from a preference function. (Author)

California U., Berkeley.
THE ANALYTIC EMBEDDING OF ABSTRACT REAL-ANALYTIC MANIFOLDS, by Charles B. Morrey, Jr. Technical rept. no. 21 on Contract Nonr-222(37). Jan 58, 67p. 13 refs.
Order from LC mi$3.90, ph$10.80 PB 138 282

H. Whitney (Ann. of Math. 37(1936) 645-680) ν-dimensional manifold of class C^n or C^ω can be mapped onto a real-analytic manifold situated in the real Euclidean space $E_{0,\ 2\nu+1}$ of $2\nu+1$ dimensions by a map of class C^n or C^ω respectively. The question of whether or not an abstract real-analytic compact manifold can be mapped analytically onto such a manifold in $E_{0,\ 2\nu+1}$ was left open. Bochner (Duke Math J. 3(1937)339-354) answered this question in the affirmative in the case where the manifold possesses an analytic Riemannian metric; this result was extended by Malgrange (Boll. Soc. Math. France 85(1957)101-113) to the case of non-compact manifolds. The present paper answers this question in the affirmative for compact manifolds without assuming the existence of an analytic Riemannian metric.

California U., Berkeley.
ASYMPTOTIC STABILITY OF SOLUTIONS OF PARABOLIC EQUATIONS UNDER VARIOUS BOUNDARY CONDITIONS, by Avner Friedman. Technical rept. no. 6 on Contract Nonr-222(62). Apr 59, 66p. 19 refs. AD-219 328.
Order from LC mi$3.90, ph$10.80 PB 146 045

The asympotic stability is established for the second mixed boundary problem $Lu = f(x, t) + K(x, t, u)$, $\partial u/\partial T + g(x, t, u) = h(x, t)$ where $|\partial k/\partial u|$ is small and $\partial g/\partial u$ is positive and tends to a function g(x) as $t \to \infty$. L is the general parabolic operator of the second order, and f is a sum of a linear function g(x, t) and a nonlinear function k(x, t, u) with $|\partial k/\partial u|$ sufficiently small. The second mixed boundary condition is: u is a given function on the base of a domain D, and $\partial u/\partial T = g(x, t, u)$ on the lateral boundary of D, g being monotone decreasing in u and $g(x, t, 1) = 0$. A proof is presented of a theorem on the asymptotic expansion of u and strong results are derived.

Colgate U., Hamilton, N. Y.
AN ALGORITHM FOR THE FACTORIZATION OF POSITIVE MATRICES, by Dante C. Youla. Rept. on Contract AF 30(602)2018. Apr 60, 19p. 4 refs. RADC-TN-60-4.
Order from LC mi$2.40, ph$3.30 PB 147 302

The solutions to many practical problems in electrical engineering depend on the factorization of a positive, real, rational matrix of the complex variable, p. The object of this report is to prove the basic result. The method employed is based on a technique developed by Oono Yosiro in conjunction with the problem of equivalent n-ports. (Author)

Columbia U., New York.
ON THE GEOMETRICAL MOMENTS OF SKEW-REGULAR SIMPLICES IN HYPERSPHERICAL SPACE, WITH SOME APPLICATIONS IN GEOMETRY AND MATHEMATICAL STATISTICS, by Harold Ruben. Rept. on Contract Nonr-266(59). [1959] 37p. 11 refs CU-2-59-Nonr-266(59) MS; AD-216 328.
Order from LC mi$3.00, ph$6.30 PB 146 429

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
A SIMPLIFIED PROCEDURE FOR FINDING LAPLACE TRANSFORMS, by Martin Blumberg. Rept. on Contract DA 36-039-sc-73170. 13 May 58, 18p. 5 refs. Technical memo. no. EDL-M141; AD-203 548.
Order from LC mi$2.40, ph$3.30 PB 147 019

A method is given for obtaining quickly the Laplace transform of certain functions. The procedure utilizes successive differentiations until delta functions are reached as a result of differentiation at a discontinuity. The Laplace transform of the original function is then found from the Laplace transform of the delta functions. The method is particularly easy to apply to functions possessing a finite number of non-zero derivatives; it is also applicable to functions possessing an infinite number of non-zero derivatives. Several examples are given. The relation between the Laplace transform and the exponential form of the Fourier Series is also indicated. (Author)

Flight Control Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
AN ITERATIVE PROCEDURE FOR OBTAINING FRACTIONAL ROOTS OF REAL NUMBERS, by Eugene M. Romer. Apr 59, 16p. WADC Technical note 59-116; AD-214 428.
Order from OTS $0.50 PB 161 085

An iterative procedure is derived to obtain any integral root of a number. The method is valid for any initial estimate greater than zero. Since the fractional root of a number can be expressed as the integral root of another number, this method can be used to find fractional roots. Two formulae are obtained, and the criteria for the use of each are established. Since only the use of the square root process is required in addition to the 4 basic arithmetic operations, this procedure is suitable for use on desk calculators and can esily be adapted for digital computer applications. (Author)

Hebrew U. (Israel).
RESEARCH IN THE AREA OF MATHEMATICAL ANALYSIS, by S. Agmon, A. Dvoretzky, and others. Annual summary rept. on Contract AF 69(052)187. Oct 59, 20p. AFOSR-TR-59-100; AD-232 061.
Order from LC mi$2.70, ph$4.80 PB 146 099

Contents:
Elliptic partial differential equations and related boundary value problems, by S. Agmon
Rearrangement of series and comparison of densities of sequences, by A. Dvoretzky
Initial value problems and differential algebra, by A. Robinson
Univalent functions, by E. Netanyahu
Tauberian theorems and summability, by A. Jakimowski
The Bergman kernel, by M. Maschler

Institute for Advanced Study, Princeton, N. J.
THE BACKWARD CAUCHY PROBLEM FOR PARABOLIC DIFFERENTIAL INEQUALITIES, by Milton Lees. Rept. on Contract AF 49(638)253. Jan 60, 6p. 5 refs. AFOSR-TN-60-112; AD-232 949.
Order from LC mi$1.80, ph$1.80 PB 146 085

An elementary proof is given of the uniqueness of the Cauchy problem for second order parabolic equations and inequalities. (Author)

Institute for Advanced Study, Princeton, N. J.
A NONLINEAR TWO-POINT BOUNDARY VALUE PROBLEM, by Milton Lees. Rept. on Contract AF 49(638)253. Jan 60, 15p. 17 refs. AFOSR-TN-60-140; AD-232 948.
Order from LC mi$2.40, ph$3.30 PB 146 090

Existence, uniqueness, and finite-difference approximation theorems are obtained for a 2-point boundary value problem for the differential equation $u'' = f(x,u,u')$. The results require that the function $f(x,z,p)$ be such that $\partial f/\partial p$ is uniformly bounded and that $\partial f/\partial z$ be bounded from below by zero and from above by a continuous function of z alone. (Author)

Institute for Advanced Study, Princeton, N. J.
ON THE GEOMETRY OF MINKOWSKI PLANES, by E. Asplund and B. Grünbaum. Rept. on Contract AF 49(638)253. Apr 60, 10p. 8 refs. AFOSR-TN-60-436.
Order from LC mi$1.80, ph$1.80 PB 147 517

For any centrally symmetric, strictly convex set $K \subset E^2$ with smooth boundary B, the following theorem is established: If three translates of K cover B, they cover K too. This, and related propositions known for Euclidean circles, are proved for Minkowski planes. Some properties of convex curves which characterize centrally symmetric ones, or ellipses, are also discussed. (Author)

Institute for Advanced Study, Princeton, N. J.
PARTITIONS OF MASS-DISTRIBUTIONS AND OF CONVEX BODIES BY HYPERPLANES, by B. Grunbaum. Rept. on Contract AF 49(638)253. Jan 60, 6p. 8 refs. AFOSR-TN-60-110; AD-232 950.
Order from LC mi$1.80, ph$1.80 PB 146 086

Each half-space of E^n which contains the centroid of a convex body K, i.e., $K \subset E^n$, is shown to contain more than $1/e = 0.3678...$ of the volume of K. Related results are provided for arbitrary mass-distributions in E^n. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
A MAXIMUM PROPERTY OF CAUCHY'S PROBLEM IN THREE-DIMENSIONAL SPACE-TIME, by H. F. Weinberger. Rept. on Contract AF 49(638)228. Apr 60, 17p. 19 refs. Technical note BN-205; AFOSR-TN-60-464.
Order from LC mi$2.40, ph$3.30 PB 147 309

Cauchy's problem for the operator $Lu \equiv \frac{\partial^2 u}{\partial t^2} - Mu$

where M is a two-dimensional elliptic Beltrami operator is considered. It is shown that if the Gaussian curvature corresponding to M is non-negative and satisfies a differential inequality and if Lu and the initial value of $\partial u/\partial t$ are non-positive, the maximum of u is attained on the initial plane $t = 0$. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
POINCARÉ CYCLES AND ERGODIC BEHAVIOUR OF A LINEAR DIATOMIC CHAIN, by Leopoldo S. Garcia-Colin. Rept. on Contract AF 18(600)1315. Apr 60, 28p. 8 refs. Technical note BN-206; AFOSR-TN-60-466.
Order from LC mi$2.70, ph$4.80 PB 147 167

The ergodic behavious of a linear diatomic chain is shown to be analogous to that of a linear monoatomic chain. Starting with the expressions for the time relaxed correlation functions between any two particles in the chain, we show that the existence of Poincaré cycles is not inconsistent with the development of an equilibrium state. Also, we show that those dynamical variables which are ergodic for the linear monoatomic chain remain ergodic in the diatomic chain. It is shown that the auto correlation functions for particles with equal or different masses decay in time as $t^{-1/2}$. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
SOME ISOPERIMETRIC INEQUALITIES FOR MEMBRANE FREQUENCIES AND TORSIONAL RIGIDITY, by L. E. Payne and H. F. Weinberger. Rept. on Contract AF 49(638)228. Feb 60, 13p. 11 refs. Technical note BN-194; AFOSR-TN-60-292.
Order from LC mi$2.40, ph$3.30 PB 146 422

It is shown that among all membranes of given area fixed on an outer boundary of given perimeter and free along any inner holes the annular membrane has the highest fundamental frequency. A similar result is derived for membranes that are elastically supported on the outer boundary. The method also leads to a lower bound for the torsional rigidity of a solid beam in terms of its area and perimeter. (Author)

Israel Inst. of Tech., Haifa.
EIGENVALUE PROBLEMS OF NONHOMOGENEOUS STRINGS, by Binyamin Schwarz. Technical (final) rept. on Contract AF 61(052)194. Jan 60, 5p. AFOSR-TR-60-57.
Order from LC mi$1.80, ph$1.80 PB 147 107

Technical note no. 1. Bounds for sums of reciprocals of eigenvalues. Technical note no. 2. On the extrema of the frequencies of nonhomogeneous strings with equimeasurable density.

Israel Inst. of Tech., Haifa.
ON THE EXTREMA OF THE FREQUENCIES OF NONHOMOGENEOUS STRINGS WITH EQUIMEASURABLE DENSITY, by Binyamin Schwarz. Technical (scientific) note no. 2 on Contract AF 61(052)194. Dec 59, 45p. 9 refs. AFOSR-TN-60-281
Order from LC mi$3.30, ph$7.80 PB 146 424

Laboratory of Statistical Research, U. of Washington, Seattle.
SMALL SAMPLE DISTRIBUTIONS FOR MULTI-SAMPLE STATISTICS OF THE SMIRNOV TYPE, by Z. W. Birnbaum and R. A. Hall. Technical rept. no. 33 on Contract Nonr-477(11). 1 July 59, 20p. 6 refs. AD-219 994.
Order from LC mi$2.40, ph$3.30 PB 147 075

Consider c samples of sizes n_i, $i = 1, 2, \ldots, c$, from c independent univariate random variables X^i with continuous cumulative distribution functions F^i. Under the null hypothesis, $F^i = F^j$ for all $i, j = 1, 2, \ldots, c$, the exact small sample distribution of the statistics defined by $D(n_1, n_2, \ldots, n_c) = \sup_{x,i,j} |F^{*i}(x) - F^{*j}(x)|$, and $D^+(n_1, n_2, \ldots, n_c) = \sup_{x,i,j} [F^{*i}(x) - F^{*j}(x)]$, $i < j$ for any number c of samples and for any sample sizes $n_1, n_2, \ldots, n_c$ is obtained by solving simple difference equations. Using this procedure, tables are computed for values of $P[D(n,n,n) \leq r]$, $P[D(n,n) \leq r]$, and $P[D^+(n,n) \leq r]$ for selected values of n between 1 and 40, and of $r = k/n$, $k \leq n$.

Marsh, Richard W.
TABLE OF IRREDUCIBLE POLYNOMIALS OVER GF(2) THROUGH DEGREE 19. 24 Oct 57, 185p. 1 ref.
Order from OTS $3.00 PB 161 693

The tables contain all irreducible polynomials over GF(2), with the periods of their roots, through degree 19. For each degree the polynomials are exhibited as sequences of their coefficients, which are provided in order of descending power of X.

Massachusetts Inst. of Tech., Cambridge.
FUNDAMENTAL GROUPS ON A LORENTZ MANIFOLD, by J. Wolfgang Smith. Technical note on Contract AF 49(638)42. [1960] 34p. 8 refs. AFOSR-TN-60-357.
Order from LC mi$3.00, ph$6.30 PB 147 165

In the present paper we shall study certain conformal global properties which are described by means of an infinite collection of groups.

Massachusetts Inst. of Tech., Cambridge.
GENERALIZED TOPOLOGIES FOR STATISTICAL METRIC SPACES, by Edward Thorp. Technical note on Contract AF 49(638)42. [1959] 23p. 7 refs. AFOSR-TN-60-356.
Order from LC mi$2.70, ph$4.80 PB 147 164

Mathematics Research Center, U. of Wisconsin, Madison.
THE USE OF INTEGRAL TRANSFORMS FOR OBTAINING SERIES EXPANSIONS IN TERMS OF CERTAIN HIGHER TRANSCENDENTAL FUNCTIONS, I. FOURIER AND BESSEL TRANSFORMS OF FINITE TYPE, by F. Oberhettinger. Rept. on Contract DA 11-022-ORD-2059. Aug 58, 48p. 19 refs. MRC Technical summary rept. no. 38; AD-203 844.
Order from LC mi$3.30, ph$7.80 PB 147 023

The following investigations are based on the finite Fourier (or Bessel) integral transorm combined with some special Fourier (or Schloemilch) series expansions. The connection between infinite series of a particular type and integral transforms as described above admits the summation of a large number of series expansions involving higher transcendental functions. Many of the results obtained this way and listed here are believed to be new and some of them are generalization of known cases. Part I of this report is based upon the connection between Fourier series and Fourier integral of finite type by means of the interpolating property of the cardinal series. Part II is based upon Poisson's summation formula applied to functions whose Fourier cosine transforms are different from zero within a finite interval. The results in Part III are obtained by a generalization of the procedure used in Part I such that instead of Fourier series and integrals their generalizations i.e. Schloemilch series and Bessel transforms of finite type are used.

Minnesota U., Minneapolis.
A FAMILY OF INTEGRALS SERVING TO CONNECT THE WIENER AND FEYNMAN INTEGRALS, by R. H. Cameron. Technical rept. no. 12 on Contract AF 18(603)30. 23 Nov 59, 27p. 7 refs. AFOSR-TN-59-1272.
Order from LC mi$2.70, ph$4.80 PB 146 440

This paper gives a sequential definition of a family of integrals depending on a "variance parameter" σ^2. If σ^2 is real this reduces under reasonable conditions to the ordinary Wiener integral. If σ^2 is pure imaginary, the integral can be considered as a Feynman integral. For certain analytic functionals, it is shown that the Feynman integral reduces to an ordinary Wiener integral. (Author)

Minnesota U., Minneapolis.
A GENERAL CLASS OF LINEAR TRANSFORMATIONS OF WIENER INTEGRALS, by D. A. Woodward. Technical rept. no. 11 on Contract AF 18(603)30. 21 Apr 60, 38p. 4 refs. AFOSR-TN-60-36.
Order from LC mi$3.00, ph$6.30 PB 147 168

This paper is an extension of the linear transformation theorem of Cameron and Martin (Trans. Amer. Math. Soc. vol. 58). Let C be the space of continuous functions on [0, 1] which vanish at zero. A transformation formula is found for Wiener integrals under transformations carrying C onto C of the type $y(t) = x(t) + \int_0^1 L(t, s)dx(s)$. (Author)

Minnesota U., Minneapolis.
PROPERTIES OF MAXIMUM LIKELIHOOD ESTIMATORS IN NONSTABLE STOCHASTIC DIFFERENCE EQUATIONS, by Malempati Madhusudana Rao. Technical rept. no. 7 on Contract Nonr-2582(00). 31 July 59, 112p. 26 refs. AD-220 126.
Order from LC mi$6.00, ph$18.30 PB 147 087

The asymptotic properties are studied for estimators of parameters in the unstable processes. Processes satisfying a kth order, homogeneous (without constant terms), linear stochastic difference equation are studied in detail. For the general stochastic processes, hypotheses are formulated in terms of restrictions on the derivatives of the likelihood function. The

arbitrary finite order k are then considered. The results deal with a certain (first order least squares) estimator of the maximal (in absolute value) root of the difference equation, and the least squares estimators of the coefficients in the difference equation

Minnesota U., Minneapolis.
RELATIVE INTERPRETATIONS, by Steven Orey. Rept. on Contract AF 49(638)617. 2 Mar 60, 23p. 9 refs. AFOSR-TN-60-373.
Order from LC mi$2.70, ph$4.80 PB 147 122

The existence of relative interpretations of an elementary theory B into an elementary theory A are studied. New results are proved connecting the existence of such interpretations and syntatical assertions about B provable in the number theory of A. A by-product is an arithmetization of Gödel's first undecidability theorem. The existence of relative interpretations which preserve also non-provability is investigated. (Author)

North Carolina U., Chapel Hill.
STOCHASTIC BOUNDS ON THE "F" STATISTIC WHEN DATA ARE INCOMPLETE: ONE-WAY CLASSIFICATION, by Bernard S. Pasternack and Junjiro Ogawa. Technical rept. no. 11 on Estimation and Testing of Parameters by Order Statistics, Contract DA 36-034-ORD-2184. 26 Jan 60, 20p. 1 ref. OOR rept. 1597.15-M.
Order from LC mi$2.40, ph$3.30 PB 146 091

The present paper is concerned with obtaining analogous stochastic bounds on the F - statistic, when data are incomplete, for the case of one-way classification.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
LINEAR PROGRAMMING (1950-1960). Apr 60, 4p. 50 refs. OTS Selective Bibliography 407.
Order from OTS $0.10 OTS SB-407

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations.

Ohio State U. Research Foundation, Columbus.
ON REGULAR AND SINGULAR HARMONIC FUNCTIONS OF THREE VARIABLES, by Erwin Kreyszig. Technical rept. no. 2 on Contract AF 49(638)362. May 60, 28p. 12 refs. AFOSR-TN-60-456.
Order from LC mi$2.70, ph$4.80 PB 147 358

The present paper considers properties of regular and singular solutions of Laplace's equation

$$\Delta\phi = \phi_{xx} + \phi_{yy} + \phi_{zz} = 0$$

by means of function theoretical methods.

Purdue U. [Lafayette, Ind.]
A SPACE OF MULTIPLIERS OF TYPE $L^p(-\infty, \infty)$, by G. L. Krabbe. Technical note no. 1 on Contract AF 49(638)505. 20 Nov 59, 14p. 11 refs. AFOSR-TN-59-176; AD 211 316.
Order from LC mi$2.40, ph$3.30 PB 146 009

RIAS, Baltimore, Md.
BEHAVIOR OF SOLUTIONS NEAR INTEGRAL MANIFOLDS, by J. K. Hale and A. P. Stokes. Rept. on Contract AF 49(638)382. Mar 60, 65p. 23 refs. Technical rept. 60-10; AFOSR-TN-59-1222.
Order from LC mi$3.90, ph$10.80 PB 147 319

RIAS, Baltimore, Md.
EXISTENCE THEOREMS FOR PERIODIC SOLUTIONS OF NON-LINEAR DIFFERENTIAL SYSTEMS, by L. Cesari, Rept. on Contract AF 49(638)382. Mar 60, 36p. 26 refs. Technical rept. 60-8; AFOSR-TN-60-227.
Order from LC mi$3.00, ph$6.30 PB 147 317

The main idea is given which underlies a recent approach to existence theorems for periodic solutions of nonlinear differential systems, and a number of applications and results are summarized.

RIAS, Baltimore, Md.
FORCED OSCILLATIONS IN 3-SPACE, by Courtney Coleman. Rept. on Contract AF 49(638)382. Feb 60, 16p. 9 refs. Technical rept. 60-4; AFOSR-TN-60-57.
Order from LC mi$2.40, ph$3.30 PB 146 431

RIAS, Baltimore, Md.
ON AUTOMATIC CONTROLS, by S. Lefshetz. Rept. on Contract AF 49(638)382. Mar 60, 12p. Technical rept. 60-9; AFOSR-TN-60-230.
Order from LC mi$2.40, ph$3.30 PB 147 318

The problem of automatic controls has been treated more or less linearly by a number of Soviet authors (Lurye, Letov, Yacubovich). A treatment is presented taking account of the nonlinearity of the regulated system. Certain consequences of this nonlinearity are also made clear.

RIAS, Baltimore, Md.
PIECEWISE CONTINUOUS DIFFERENTIAL EQUATIONS, by J. Andre (Technische Hochschule, Braunschweig) and P. Seibert. Rept. on Contract AF 49(638)382. Mar 60, 13p. 2 refs. Technical rept. 60-6; AFOSR-TN-60-232.
Order from LC mi$2.40, ph$3.30 PB 147 315

A brief survey of the local properties of solutions of systems of piecewise continuous differential equations near the surfaces of discontinuity is given. Some properties of the corresponding systems with retardation [time-lag, switching delay] are discussed with emphasis on the so-called after-endpoint motions. (Author)

RIAS, Baltimore, Md.
ULTIMATE BOUNDEDNESS AND STABILITY UNDER PERTURBATIONS, by P. Seibert. Rept. on Contract AF 49(638)382. Mar 60, 22p. 8 refs. Technical rept. 60-7; AFOSR-TN-60-231; AD-233 733.
Order from LC mi$2.70, ph$4.80 PB 147 316

The first half of the paper concerns the preservation of ultimate boundedness of a dynamical system under perturbations. The results are centered around a general principle, according to which the motions of the unperturbed and of a perturbed system with the same initial point remain within a certain fixed maximal distance from each other for all time, if they do so for a small length of time and if, in addition, the unperturbed system is ultimately bounded. This result is then applied to the problem of preservation of stability under perturbations and a necessary and sufficient condition for the latter is obtained. (Author)

Rutgers State U., New Brunswick, N. J.
THE SPHERICAL SUMMABILITY TO CONJUGATE MULTIPLE FOURIER-STIELTJES SERIES, by Victor L. Shapiro. Rept. on Contract AF 18(600)1595. 16 Feb 60, 60p. 13 refs. AFOSR-TN-60-213.
Order from LC mi$3.60, ph$9.30 PB 146 445

Rutgers State U., [New Brunswick, N. J.]
SURFACE SPHERICAL HARMONIC EXPANSIONS, by Victor L. Shapiro. Rept. on Contract AF 18(600)1595. 18 Mar 60, 29p. AFOSR-TN-60-339.
Order from LC mi$2.70, ph$4.80 PB 146 908

Statistical Lab., Case Inst. of Tech., Cleveland, Ohio.
THE USE OF SAMPLE QUASI-RANGES IN SETTING CONFIDENCE INTERVALS FOR THE POPULATION STANDARD DEVIATION, by F. C. Leone, Y. H. Rutenberg, and C. W. Topp. Rept. on Contract AF 49(638)361. Mar 60, 20p. 8 refs. AFOSR-TN-60-408.
Order from LC mi$2.40, ph$3.30 PB 146 872

The problem is the choice of an optimal selection method of quasi-ranges for setting one sided confidence bounds and confidence intervals for the standard deviation from a given distribution. The proposed methods of optimal selection are applied to random ordered sample from the normal, exponential and rectangular distributions. Tables of confidence bounds for the standard deviation of these distributions are given for confidence levels commonly used in statistical work. These are compared with the results of standard procedures. (Author)

Statistical Techniques Research Group, Princeton U., N. J.
PERMUTATION SUPPORT FOR MULTIVARIATE TECHNIQUES, by Harvey J. Arnold. Technical rept. no. 14 on Contract DA 36-034-ORD-2297. [1951] 96p. 17 refs. OOR rept. 1715-....; AD-208 613.
Order from LC mi$5.40, ph$15.30 PB 147 147

The multivariate generalization of the t test is investigated. The first four permutation cumulants are determined for a statistic which is a simple function of the commonly used Hotelling's T^2. In the univariate situation T^2 simply becomes the square of t, and tests based on T^2 are identical with tests based on t. The derived permutation cumulants are applied to data obtained from a sampling experiment. The samples are from bivariate normal and rectangular populations. A discussion of various ways of adjusting the test criterion is included when one suspects that the data does not come from a normal distribution.

Syracuse U., Ithaca, N. Y.
RADIAL DISTRIBUTION AND DEFICIENCIES OF THE VALUES OF A MEROMORPHIC FUNCTION, by Albert Edrei, Wolfgang H. J. Fuchs, and Simon Hellerstein. Rept. on Contract AF 49(638)571. Mar 60, 23p. 5 refs. AFOSR-TN-60-337.
Order from LC mi$2.70, ph$4.80 PB 146 926

Let f(z) be a meromorphic function and let $\delta(\tau, f)$ denote the deficiency, in the sense of R. Nevanlinna, of the value τ. The authors show that certain simple behaviors of the arguments of the zeros and of the poles of f(z) are almost sufficient to induce the inequalities

$$\delta(0, f) > 0 \qquad \delta(\infty, f) > 0.$$

Technion Research and Development Foundation, Ltd. (Israel).
INTEGRAL TRANSFORMS WITH TWO REPRODUCING PROPERTIES, by Jacob Steinberg. Final technical rept. on Contract AF 61(052)192. Oct 59, 56p. 8 refs. AFOSR TR-60-13; AD-232 066.
Order from LC mi$3.60, ph$9.30 PB 146 096

A constructive definition is given of the integral transforms J whose kernel depends on a real parameter $b > 1$, and possess the 2 properties: (1) $Jp = p$, for every polynomial p, and for each fixed $b > 1$; and (2) $Jf \longrightarrow f$, when $b \longrightarrow 1 + 0$, for every function f which is regular in a strip containing the real axis and which decreases exponentially at infinity. A new type of expansion of functions regular in an angle is considered the case where all derivatives of such a function vanishes at the corner of the angle is connected with our J - transforms is also studied. Elementary eigenfunctions of Weierstrass' singular integral are studied. Every real number, not zero, is found to be an eigenvalue of infinite multiplicity. (Author)

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
RECURRENCE FORMULAE AND TABLES FOR HEMISPHERICAL HARMONICS, by Choong Yung Cho. Rept. on Contract N7onr-285(11). 15 July 59, 42p. 3 refs. Technical rept. WIS-ONR-37; AD-225 590.
Order from LC mi$3.30; ph$7.80 PB 147 085

Recurrence formulas and numerical tables are provided for A^m_{nk} and B^m_{nk}, coefficients of expansion of the associated Legendre polynomials in terms of the hemispherical harmonics.

$$P^m_n(\mu) = \sum_{k=0}^{n-1} A^m_{nk} \sqrt{1-\mu^2}\, \bar{P}_k(\mu) \quad \text{(m: odd)}$$

$$\sum_{k=0}^{n+1} B^m_{nk} \frac{1}{\sqrt{1-\mu^2}} P_k(\mu) \quad \text{(m: odd)}$$

where $2\mu = 1 - x$. (Author)

Washington U., St. Louis, Mo.
MEAN SUMMABILITY ULTRASPHERICAL POLYNOMIALS, by Richard Askey and I. I. Hirschman, Jr. Rept. on Contract AF 49(638)218. Apr 60, 20p. 12 refs. AFOSR-TN-60-396.
Order from LC mi$2.40, ph$3.30 PB 146 783

The results of the present paper apply to ultraspherical polynomials. However for reasons of notational simplicity we confine ourselves here to the special case of Legendre polynomials.

Washington U., St. Louis, Mo.
MULTIPLIER TRANSFORMATIONS, II, by I. I. Hirschman, Jr. Rept. on Contract AF 49(638)218. Apr 60, 18p. 8 refs. AFOSR-TN-60-31.
Order from LC mi$2.40, ph$3.30 PB 146 780

This paper contains several different topics relative to multiplier transformations on spaces of functions over n dimensional Euclidean space E_n defined by weighted quadratic norms with positive definite weight functions.

Washington U., St. Louis, Mo.
ROOTS OF INNER AUTOMORPHISMS, by F. Haimo. Rept. on Contract AF 49(638)218. Apr 60, 13p. 2 refs. AFOSR-TN-60-32.
Order from LC mi$2.40, ph$3.30 PB 146 784

M. Auslander has proposed the problem of finding a group with an outer automorphism α with n-th power inner and n^2 - power trivial. Further, he requires that the fixed points of α lie in the center of the group. Starting with any group H, we form $H \oplus (H/H')$, reducing this direct sum by a suitable subgroup. If the reducing subgroup is properly chosen, the quotient group has a normal automorphism with a power which is inner. Examples are more readily obtained if H is of class 2.

Wayne State U., Detroit, Mich.
CONFORMAL MAPS OF ALMOST KAEHLER MANIFOLDS, by S. I. Goldberg. Rept. on Contract AF 49(638)14. Jan 60, 20p. 8 refs. AFOSR-TN-60-95; AD-232 556.
Order from LC mi$2.40, ph$3.30 PB 146 087

Groups of conformal maps of almost Kaehler manifolds are studied. The following theorem is proved: The largest connected Lie group of conformal transformations of a compact almost Kaehler manifold M^{2n} $(n>1)$ coincides with the largest connected group of automorphisms of the almost Kaehler structure. This generalizes a corresponding theorem established by Lichnerowicz for Kaehler Manifolds. By restricting the conformal maps to those whose associated 1-forms are closed, a much wider class of manifolds may be considered. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
PROGRAMMING AN IDEALIZED GENERAL-PURPOSE COMPUTER TO DECIDE QUESTIONS OF TRUTH AND FALSEHOOD, by Irving M. Copi and Robert W. Beard. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Apr 59, 17p. 5 refs. Rept. no. 2144-402-T; AD-214 305.
Order from LC mi$2.40, ph$3.30 PB 146 244

Routines are formulated and explained for the programming of a general-purpose digital computer to decide the validity or invalidity of 3 kinds of logical formulas: formulas of the propositional calculus containing up to 2000 variables, the equality formulas, and formulas of the monadic predicate calculus. Results show that the routines contain improvements over the usual decision procedures from the point of view of computational facility.

Computing Devices

General Electric Microwave Lab., Palo Alto, Calif.
MICROWAVE COMPUTER RESEARCH, by M. P. Forrer. Quarterly progress rept. on Contract Nonr-2127(00). 31 Oct 57, 31p. 1 ref. Rept. no. R57ELM79-1.
Order from LC mi$3.00, ph$6.30 PB 137 719

The present report represents a continuation of the analysis of millimicrosecond pulse transmission, which was discussed in the previous report. Specifically, the problems occurring in the presence of losses are studied, and some simple criteria are found which define the limitations on the validity of the present theory. (See also PB 136 999)

Naval Ordnance Test Station, China Lake, Calif.
NODAC: THE NAVAL ORDNANCE DATA AUTOMATION CENTER, by R. V. Herman, H. V. Hilker, and J. B. Moffett. Jan 60, 22p. NOTS TP-2394; NAVORD rept. 7027.
Order from LC mi$2.70, ph$4.80 PB 147 433

NODAC is a data-reduction machine that, by means of plug-in logic packages and patchboards, can be adapted to any data-reduction problem in a very short time. The machine is designed to take full advantage of the capabilities of the IBM-709 computer. It consists of analog and digital sections interconnected by a converter unit through which conversions can be made in either direction at a current rate of 25,000 samples per second. It is currently in use on Naval Ordnance Test Station data-reduction programs, and, as various units are added to bring its capabilities up to the design standard, it will be able to handle these programs on decreasing time scales. (Author)

Systems Technology, Inc., Inglewood, Calif.
SURVEY OF ANALOG CROSS-SPECTRAL ANALYZERS, by Lester J. Seltzer and Duane T. McRuer. Rept. on Contract AF 33(616)5822. Dec 59, 74p. 28 refs. WADC Technical rept. 59-241.
Order from OTS $2.00 PB 161 704

This report presents a survey of analog devices which have been used to compute cross-spectra in the processing of data from human response experiments. The machines described have been analyzed to show the principles upon which they depend. Where available, the results of calibration experiments have been included as a measure of specific performance. Correlation and spectral measurement are discussed, introductory to consideration of measurement fundamentals for closed loop human response tests. Theoretical ways of calculating cross-spectra are presented and referred to the mechanization of the cross-spectral machines. The effect of nonideal elements on the performance theoretically attainable is considered, together with a discussion of the accuracy of spectral estimates. (Author)

MECHANICS

Brown U. Div. of Applied Mathematics, Providence, R. I.
ON PRAGER'S HARDENING RULE, by R. T. Shield and R. Ziegler. Technical rept. no. 30 on Contract Nonr-562(10). Jan 58, 26p. 10 refs. Rept. C11-30.
Order from LC mi$2.70, ph$4.80 PB 137 961

Bureau of Ships, Washington, D. C.
MECHANICAL IMPEDANCE, by Robert Plunkett (General Electric Co.). Nov. 58, 35p. 24 refs. Rept. no. 375-N-31; AD-214 656.
Order from LC mi$3.00, ph$6.30 PB 147 586

David Taylor Model Basin, Washington, D. C.
THE GRAPHICAL SOLUTION OF 45-DEGREE STRAIN-ROSETTE DATA AND DETERMINATION OF ERROR IN THE CALCULATED STRESSES DUE TO ERRORS IN MEASURED STRAINS, by Margaret E. Duke and Edward Wenk, Jr. Nov 49, 22p. 20 refs. Rept. 600.
Order from LC mi$2.70, ph$4.80 PB 147 270

The state of stress in a biaxial field can be determined experimentally by measurement of strains along any three gage lines. The reduction of data by orthodox computation is generally so laborious, however, that various mechanical and graphical systems have been devised to simplify solutions. A number of these methods are described and discussed in this report. The graphical system found to be most satisfactory is reproduced in chart form for use in determining, from 45-degree strain-gage rosettes, principal stresses, maximum shear stresses, and orientation of principal axes.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
EXPERIMENTAL INVESTIGATIONS OF THE INTERACTION BETWEEN A SHOCK AND A MAGNETIC FIELD, by John Paul Barach. Rept. on Contract AF 49(638)401. Mar 60, 31p. 12 refs. Technical note 8N-203; AFOSR-TN-60-439.
Order from LC mi$3.00, ph$6.30 PB 147 005

A magnetic interaction has been observed with flows of Mach number about 15 in krypton and inhomogeneous magnetic field of about 50,000 gauss. The loss of momentum flux in the gas flow is proportional to the magnetic impulse taken up to a point, where there seems to be a sudden adjustment of flow velocity. The position of this point is determined by the parameter $\sigma v B^2/P$. The higher this parameter, the earlier the interaction and the less its total effect. Moderately low values of the parameter produce the largest effects. (Author)

Institute of Engineering Research, U. of California, Berkeley.
ON THE STRUCTURE OF THE BOUSSINESQ-PAPKOVICH STRESS FUNCTIONS AND THE RELATED COMPLETENESS PROOF, by P. M. Naghdi and C. S. Hsu. Technical rept. no. 4 on Contract Nonr-222(69). July 59, 21p. 17 refs. Series no. 131, issue no. 4; AD-230 632.
Order from LC mi$2.70, ph$4.80 PB 147 097

Lubrication Lab., Mass. Inst. of Tech., Cambridge.
FRICTION AND WEAR AT ELEVATED TEMPERATURES, by Ernest Rabinowicz. Rept. on The Structure and Properties of Interfaces, Contract AF 33(616)5963. Jan 60, 25p. 11 refs. WADC Technical rept. 59-603.
Order from OTS $0.75 PB 161 719

A new high-temperature friction apparatus has been constructed which allows sliding experiments to be carried out at temperatures to 2000 F. in controlled atmospheres, and at speeds varying over a wide range. Tests have been run on this machine and on an older machine. These and other results are discussed theoretically in terms of the surface energy --- hardness ratio and of the wear coefficient. From the experimental results, it appears that the main influence of temperature on the friction and wear results is through changes of hardness, of surface energy, and of tensile strength. (Author)

Minnesota U., Minneapolis.
ON THE UTILIZATION OF THE CONCEPT OF BOUNDARY IMPEDANCE IN VIBRATIONS OF BARS, by F. J. Wilmers and R. F. Lambert. Rept. for 5 Sep 58-15 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. Feb 60, 44p. 11 refs. WADC Technical rept. 59-545.
Order from OTS $1.25 PB 161 740

This report deals with the utilization of boundary impedance in describing conditions at the extreme boundaries of a bar and its measurement by employing techniques derived from electrical transmission line theory. Important similarities and differences between a mechanical and electrical transmission lines are discussed. The concepts are applied to the measurement of a reactive termination and to the development of a "complex conjugate" matching section. These concepts also present a convenient specification of boundary conditions in applications involving random vibrations and fatigue. (Author)

Minnesota U., Minneapolis.
STEADY STATE DAMPED VIBRATIONS AND STABILITY OF A CLASS OF NONLINEAR DISCRETE SYSTEMS, by S. T. Chow and P. R. Sethna. Rept. for Oct 58-July 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. Mar 60, 52p. 7 refs. WADC Technical rept. 59-543.
Order from OTS $1.50 PB 161 748

A class of nonlinear discrete systems with an arbitrary number of degrees of freedom are studied for their steady state vibrations. The coordinates are first transformed to the principal coordinates corresponding

to the linear part of the system. An iteration scheme is used to obtain the desired solutions. Some special effects of the relations between the linear natural frequencies on the qualitative nature of the solutions are demonstrated. It is shown that if the linear natural frequencies do not possess certain relations, the system can be treated in a manner similar to that for a system of a single degree of freedom. In other cases the procedure gets more complicated. The various solutions are then examined for their stability. Poincare's theory of singularities in the phase plane is used to study the stability of those problems that can be treated in a manner similar to that for a single degree of freedom system. In all other cases the stability is examined by applying the Routh-Hurwitz criterion to a transformed set of equations. Solution for one specific problem is obtained and checked against those obtained from an analog type computer. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
APPLICATION OF AN ASYMPTOTIC NUMERICAL METHOD TO A PROBLEM OF BEAM BENDING, by J. R. M. Radok and Marie Wolfson. Rept. on Contract Nonr-839(26). July 59, 13p. 5 refs. PIBAL rept. no. 499; AD-220 071.
Order from LC mi$2.40, ph$3.30 PB 147 065

With a view to later applications to problems of shell theory, an iterative numerical method based on a system of parabolic equations has been applied to a problem of beam bending. The various stages of the process are given in detail and the numerical results are discussed in relation to the exact solution.

Polytechnic Inst. of Brooklyn, N. Y.
EFFECTS OF COMPRESSIBILITY ON CREEP, by Sharad A. Patel, B. Venkatraman and William P. Vafakos. Rept. on Contract Nonr-839(23). July 59, 15p. 4 refs. PIBAL rept. no. 496; AD-220 050.
Order from LC mi$2.40, ph$3.30 PB 147 064

An elementary device for including compressibility effects on the creep behavior of materials in presented. A hollow sphere subjected to uniform pressures is analysed to illustrate these effects. The stress solution is presented in closed parametric form. (Author)

Purdue U. Div. of Engineering Sciences, Lafayette, Ind.
THE ELASTIC HALF-PLANE SUBJECTED TO SURFACE TRACTIONS WITH RANDOM MAGNITUDE OR SEPARATION, by A. Cemal Eringen and J. W. Dunkin. Technical rept. no. 15 on Contract Nonr-1100(02). June 59, 35p. 2 refs. AD-205 781.
Order from LC mi$3.00, ph$6.30 PB 146 476

First and second order moments of the stress tensor are obtained for the elastostatic problem concerning the half-plane subjected to random boundary tractions. The cases treated include the following types of applied surface tractions: (a) a purely random Gaussian load (white noise); (b) concentrated loads of random magnitudes separated by equal intervals; (c) a concentrated load acting at a random location; and (d) concentrated loads of equal magnitudes separated by random intervals. (Author)

Stanford U., Calif.
A LARGE-DEFORMATION BENDING THEORY FOR THIN CYLINDRICAL SHELLS, by W. Flügge and B. R. Baker. Rept. on Contract Nonr-225(16). 1 June 59, 60p. 7 refs. Div. of Engineering Mechanics Technical rept. no. 117; AD-220 388.
Order from LC mi$3.60, ph$9.30 PB 146 515

A nonlinear bending theory is developed to study the stresses and deformations of a cylindrical shell in and near a zone in which the bending effect is very pronounced. (Author)

Watertown Arsenal Labs., Mass.
RESPONSE OF BEAMS TO DYNAMIC PRESSURE LOADING WITH MEMBRANE EFFECTS INCLUDED, by E. W. Ross, Jr. Mar 60, 25p. 9 refs. Technical rept. no. WAL TR 834.12/1.
Order from LC mi$2.70, ph$4.80 PB 147 280

The plastic-rigid model of beam behavior is used to calculate the response of either simple or clamped beams to rapidly applied transverse loads which are symmetrically distributed about the midpoint of the beam. The effects of membrane force are included in the analyses. A specific example is worked out to show the effect of including membrane force in the analysis of a beam. (Author)

Aerodynamics and Pneumatics

Aeronautical Research Lab., Wright Air Development [Division] Wright-Patterson AFB, Ohio.
AN EXPERIMENTAL STUDY OF VORTEX CHAMBER FLOW, by Jack P. Holman and George D. Moore. Oct 59, 35p. 8 refs. WADC Technical note 59-388.
Order from OTS $1.00 PB 161 700

It is shown that a relatively simple analysis predicts the functional variation of temperature and pressure in a vortex chamber with radius and inlet velocity. The predicted variation is in good agreement with experimental observations. By assuming that the flow at the outside of the chamber occupies some effective flow area, which is essentially independent of flow rate, the inlet velocity may be expressed in terms of the chamber dimensions and the fluid properties at entrance. The effective flow area assumption is verified experimentally for two chamber exit configurations using air. It was found that the velocity in a five-inch diameter chamber, four inches long, could be represented by the expression

$$Vr^{n} = \text{Const.}$$

with $n = 0.68$. The pressure and temperature were related through

$$Tp^{\frac{1-n_1}{n_1}} = \text{Const.}$$

with $n = 1.28$. It is shown that, given either n or n_1, one may calculate the other with a simple relationship. (Author)

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ON THE USE OF QUATERNIONS IN SIMULATION OF RIGID-BODY MOTION, by Alfred C. Robinson. Rept. on Flight Dynamics Research and Analysis Facility. Dec 58, 97p. 7 refs. WADC Technical rept. 58-17.
Order from OTS $2.25 PB 161 732

The theory of the four-parameter method is developed with specific application to coordinate conversion in aircraft simulations. This method is compared with the direction cosine method both in a theoretical error analysis and in an example simulation on an analog computer. It is shown that the quaternion method is no more sensitive to multiplier errors than is the direction cosine method, and it requires nearly 30 per cent less computing equipment. In addition, the multiplier bandpass requirement in the four-parameter method is only half as severe as for direction cosines. By every important criterion, the quaternion method is no worse than, and in most cases, better than the direction cosine method. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
STUDIES ON DYNAMICS AND INSTRUMENTATION OF THE HOLLOMAN TRACK. Rept. for 1956-1958. Apr 59, 584p. 90 refs. AFMDC-TR-59-8; AD-210 870.
Order from LC mi$11.10, ph$89.40 PB 146 771

Contents:
Calculation of the flexural rigidity of the Holloman track
A method of the experimental determination of the parameters of the Holloman track
The experimental determination of the fundamental parameters of the high-speed test track (supplementary report)
Calculations pertaining to a moving load on a beam on an elastic foundation
Dynamic analysis of a high-speed track
The Timoshenko beam on an elastic foundation
Deflection of the Holloman track under static load
The relation between the bending strain and the load for a beam on an elastic foundation
Vibrations set up by moving load in track on elastic foundation
Track vibration study in controlled excitation
Vibration level measurements in the supersonic test track
Transverse beam vibrations in accelerated rocket sleds
Recommendations for the strain measurement program at the Holloman track
Statistical analysis of markings: sled run of 12 July 1956
High accuracy velocity measurements
Notes on design of sled slippers for the high-speed track
Some considerations concerning lubrication of slippers for the high-speed track
Performance characteristics of lubrication for high-speed tracks
A study of the aerodynamics of high-speed sleds
Some remarks on the optimum speed attainable with a two-stage sled
Ram wind tunnel
Preliminary investigation of the aerodynamic effects of linear acceleration as related to the high-speed track
Parameters for rocket sled propulsion systems

Arnold Engineering Development Center, [Tullahoma, Tenn.]
AERODYNAMIC HEATING FACILITIES, by J. Leith Potter. Rept. on ARO, Inc., Contract AF 40(600)-700 S/A 13(59-1). July 58, 17p. 10 refs. AEDC-TR-58-7; AD-161 033.
Order from LC mi$2.40, ph$3.30 PB 147 145

This is a discussion of ground test facilities providing simulation, to some degree, of the aerodynamic heating and loading encountered by aircraft or spacecraft operating within the earth's atmosphere. The ranges of speed, stagnation conditions and their time derivatives corresponding to typical missile trajectories are used to demonstrate the problem of flight simulation. Means for achieving partial simulation in laboratories are described, with consideration given to the advantages and disadvantages of most of the methods currently used or being studied. (Author)

Arnold Engineering Development Center [Tullahoma Tenn.]
DETERMINATION OF OPTIMUM OPERATING PARAMETERS FOR THE 1-FOOT TRANSONIC TUNNEL UTILIZING CONE-CYLINDER BODIES OF REVOLUTION, by William L. Chew, Jr. Rept. on ARO, Inc. Contract AF 40(600)800. Apr 60, 45p. 7 refs. AEDC-TN-60-69.
Order from LC mi$3.30, ph$7.80 PB 146 764

Tests were conducted in the 1-Foot Transonic Tunnel to determine optimum operating parameters which minimize tunnel interference effects with the 60-deg inclined hole, 6-percent open-area test section configuration. Pressure distributions on a 20-deg cone-cylinder model having a blockage ratio of 1.86 percent were used to determine optimum test section wall angle positions. A similar cone-cylinder model with 1-percent blockage ratio was used to investigate the effects of tunnel pressure ratio and support interference on base pressure measurements at various axial locations of the model in the test section. Minimum tunnel interference on the pressure distribution of the 20-deg cone-cylinder model resulted by varying the wall angle from 40-min convergence to 30-min divergence to 30-min divergence for a Mach number range from 1.10 to 1.50. Below Mach number 1.10 the effect of varying wall angle on the pressure distribution was negligible. Base pressure coefficients on the 1-percent blockage model as affected by the axial position in the tunnel and variations in tunnel pressure ratios are presented. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn].
PRESSURE MEASUREMENTS IN AN ARC-DISCHARGE WIND TUNNEL, by M. R. Mulkey, W. T. Earheart, Jr., and E. E. McAdams, Jr. Rept. on ARO, Inc., Contract AF 40(600)700 Sup. 6(58-1). Apr 58, 31p. 2 refs. AEDC-TN-58-16; AD-152 048.
Order from LC mi$3.00, ph$6.30 PB 147 008

The pressure instrumentation for a 16-in. arc-heated hypervelocity wind tunnel is described. The tunnel has a Laval nozzle for expansion to supersonic speeds, a test section of uniform area, and a vacuum tank. Upstream of the Laval nozzle is a high-pressure reservoir in which the air is energized by arc-heating. Depending on the specific initial conditions, the run times varied from 25 to 40 msec. Commerical transducers and equipment were investigated, and the problem of electrical interference was studied. Low-impedance transducers and data-recording systems are discussed.

Arnold Engineering Development Center [Tullahoma, Tenn.]
WIND TUNNEL TESTS ON AN AERIAL TARGET MODEL AT TRANSONIC AND SUPERSONIC SPEEDS, by W. L. Chew and W. E. Carleton. Rept. on ARO, Inc., Contract AF 40(600)800. July 59, 110p. 3 refs. AEDC-TN-59-84; AD-219 990.
Order from LC mi$5.70, ph$16.80 PB 147 375

Static stability characteristics of the 0.22-scale aerial target model with attached launching lugs were investigated in the 1-ft transonic and supersonic tunnels. Test data were obtained at M = 0.8, 1.0, 1.2, 1.4 and 1.5 through an angle-of-attack range from 13^{o} to $+12^{o}$ in the transonic tunnel and M = 1.5 and 2.0 through an angle-of-attack range from -3^{o} to $+8^{o}$ in the supersonic tunnel. Reynolds numbers, based on maximum body diameter, were in the range from 0.52 to 0.68 million. Data showing the aerodynamic characteristics of the basic model and with launching lugs attached are presented as well as a comparison of the transonic and supersonic tunnel data at M = 1.5. The data show that the static stability characteristics of the aerial target model were only slightly affected by the attachment of launching lugs. Forebody axial force coefficients of the body-wing-tail configuration were increased by 38 to 48% with the launching lugs attached. Slight changes in normal force-curve slope, model stability, and in the roll-control effectiveness were indicated as the model was rolled from 0^{o} to $\pm 45^{o}$. (Author)

Avco-Everett Research Lab., Mass.
HALL EFFECTS IN A LAMINAR BOUNDARY LAYER OF THE HARTMANN TYPE, by James A. Fay. Rept. on Contract AF 49(638)659. Dec 59, 11p. Research rept. 81; AFOSR-TN-60-291.
Order from LC mi$2.40, ph$3.30 PB 147 434

The motion in a laminar boundary layer on an infinite flat plate with an applied magnetic field normal to the wall and current flow parallel to the wall is studied for the case of $\omega\tau$ (electrical cyclotron frequency times mean free time) not necessarily small. It is found that a cross flow is induced normal to both magnetic field and free stream flow. The net electrical power loss in the boundary layer is determined assuming constant transport properties. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BOUNDARY LAYER TRANSITION ON THE NOL STANDARD CONE IN THE BALLISTIC RESEARCH LABORATORIES' SUPERSONIC WIND TUNNELS, by J. C. McMullen. Feb 60, 23p. 1 ref. Technical note no. 1303.
Order from LC mi$2.70, ph$4.80 PB 147 105

Boundary layer transition Reynolds numbers on the Naval Ordnance Laboratory 5^{o} standard cone model were obtained in the Ballistic Research Laboratories' Supersonic Wind Tunnels No. 1 and No. 3. The transition point was determined photographically. Transition Reynolds numbers were computed and are compared with data from other wind tunnels. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
TABLES FOR DETERMINATION OF FLOW VARIABLE GRADIENTS BEHIND CURVED SHOCK WAVES, by Nathan Gerber and Joan M. Bartos. Jan 60, 29p. 11 refs. Rept. no. 1086.
Order from LC mi$2.70, ph$4.80 PB 146 770

The shock wave relations and the equations of isoenergetic two-dimensional or axisymmetric flows can be combined to yield expressions for various useful quantities behind a shock wave if the curvature is known in addition to the position and slope. Tables are presented here of computations, for $\gamma = 1.4$, of seven functions of Mach number and shock wave slope, from which the following are easily computed: (1) streamline curvature, (2) velocity gradient along streamline, (3) angle between streamline and density contour, and (4) angle between streamline and Mach number contour. In addition, the Mach number and angle of inclination of streamline are listed. A Mach number range from 1.1 to 10 is covered by these computations. A derivation of the shock gradient functions is presented; and several applications of the calculations are given, including a set of tables for determining the slope of the sonic line. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
NON-UNIFORM SHOCK PROPAGATION IN A STRATIFIED ATMOSPHERE, by R. E. Meyer and D. V. Ho. Technical rept. no. 20 on Contract Nonr-562(07). July 59, 32p. 4 refs. Rept. 562(07)/20; AD-220 292.
Order from LC mi$3.00, ph$6.30 PB 147 094

To test an hypothesis of Whitham (J. Fluid Mech., 4, 1958, 337) an approximate solution is developed for the gas motion behind a very strong shock travelling into a perfect gas with density varying rapidly in the direction of shock propagation. The approximation is valid for arbitrary density variation for heavy gases with ratio of specific heats sufficiently close to unity, and it furnishes reliable (and quite simple) results for air for density ratios of up to about 3 and down to about 0.2. As far as the evidence collected here supports Whitham, it shows his hypothesis to be a small (entropy) variation approximation; but the approximation obtained from the interaction of the shock with a contact discontinuity turns out to be at least as good. (Author)

Brown U. Div. of Engineering, Providence, R. I.
A STUDY OF CONFIGURATIONS COMPOSED OF A BODY UNDER A LIFTING WING IN SUPERSONIC FLOW, by C. F. Chen and Joseph H. Clarke. Rept. on Contract AF 49(638)444 and Subcontract to Applied Physics Lab., Contract NOrd-7386. Jan 60, 66p. 18 refs. AFOSR-TN-59-1276.
Order from LC mi$3.90, ph$10.80 PB 146 437

An investigation is made of supersonic aircraft configurations composed of a cambered body positioned a certain distance beneath an arbitrary lifting wing. The geometry of the wing is regarded as given and the geometry of the body may be given or optimum. Expressions for the drag and lift are obtained from reverse-flow considerations; these greatly implement such a study when interference cross-flows must be cancelled. The drag advantage to be gained when a given body and wing assume a given orientation is studied.

Brown U. Div. of Applied Mathematics, Providence, R. I.
SUPERSONIC FLOW PAST FINITE DOUBLE WEDGE WINGS OF VARIABLE THICKNESS. PART I. LINEAR VARIATION, by Maurice Holt and Bohyun Yim. Rept. on Contract AF 49(638)232. May 60, 37p. 4 refs. AFOSR-TN-60-431.
Order from LC mi$3.00, ph$6.30 PB 147 403

The pressure distribution and associated flow field is calculated on a finite span wing of double wedge section in a uniform supersonic stream. The wing is of constant chord and the leading edge is normal to the incident stream direction. The maximum thickness of the wing varies slowly in the spanwise direction so that the disturbed flow field is a small departure from plane flow. In this paper a wing with maximum thickness varying linearly with span is considered.

Brown U. Div. of Engineering, Providence, R. I.
TESTS OF A CONFIGURATION COMPOSED OF A BODY UNDER A LIFTING WING IN SUPERSONIC FLOW, by C. F. Chen. Rept. on Contract AF 49(638)444. Feb 60, 13p. 5 refs. Technical rept. WT-31; AFOSR-TN-59-1275. AD-233 944.
Order from LC mi$2.40, ph$3.30 PB 146 438

Tests were made on an arrangement consisting of a Sears-Haack body located under a lifting rectangular diamond profile wing. The Mach number was 1.6 and the Reynolds number was 9.17×10^{5} based on the body length. The experiments were suggested by a previous theoretical study of such arrangements. It is found that the measured lift developed on the wing due to the flow field of the body agrees very well with the theoretical value. Downstream of the impinging shock from the wing, flow separation was observed on the exterior side of the body but not on the interior side. The separation is attributed not to the pressure rise across the shock but to the pressure field arising from the reflection from the body of the shock-induced cross flow. Further observations suggest that the separation can be avoided by pitching the body or by kinking the body at the shock wave to accommodate the shock-induced cross flow. (Author)

California Inst. of Tech., Pasadena.
SUPERSONIC FLUTTER ANALYSES INCLUDING AERODYNAMIC HEATING EFFECTS, by R. L. Harder, K. Lock and others. Rept. for June 58-Aug 59 on Dynamic Problems in Flight Vehicles, Contract AF 33(616)5767. Feb 60, 281p. 4 refs. WADC Technical rept. 59-559.
Order from OTS $4.00 PB 161 716

The purpose of this report is to study the effect that aerodynamic heating has upon the flutter calculation of a high speed wing. A short straight wing was analyzed in the Mach number range from one to five to see which parameters are the important ones to include in flutter calculations. Flutter results are given for several specific maneuvers and show that neglecting the effects of heating in the calculation may lead to unconservative results. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
BOUNDARY-LAYER TRANSITION AND HEAT TRANSFER IN SHOCK TUBES, by R. A. Hartunian, A. L. Russo, and P. V. Marrone. Rept. on Contract AF 18(603)141. Dec 59, 37p. 33 refs. Rept. no. AD-1118-A-3; AFOSR-TN-59-564; AD-216 759.
Order from LC mi$3.00, ph$6.30 PB 146 973

An experimental study is made of the wall boundary layer in a shock tube operated over a wide range of shock Mach numbers and pressure levels in air, including those for which real gas effects exist. Transition distances are determined, and correlated in terms of the transition Reynolds number based on a characteristic length for this boundary layer. Data from independent shock-tube studies are also included in this correlation.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
PRELIMINARY RESEARCH ON A MOLECULAR BEAM FOR THE 1-10 ev RANGE, by G. T. Skinner and C. E. Treanor. Rept. on Contract AF 18(603)141. Dec 59, 66p. 23 refs. Rept. no. AD-1118-A-9; AFOSR-TN-59-1086.
Order from LC mi$3.90, ph$10.80 PB 147 406

This report presents an interim discussion of the design and construction of a molecular-beam apparatus for the production of atomic and molecular beams in the 1-10 ev energy range. A shock tube is used as the source of high-temperature, high-pressure gas, and a hypersonic expansion is used to obtain a high-energy, nearly-mono-energetic beam. Use of a two-center potential for the treatment of atom-molecule collisions is discussed. (Author)

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
THE RESPONSE OF LAMINAR BOUNDARY LAYER TO IMPULSIVE MOTIONS, by Martin L. Rosenzweig. Rept. on Contract AF 18(600)1523. Feb 59, 104p. 26 refs. AFOSR-TN-59-92; AD-210 182.
Order from LC mi$5.70, ph$16.80 PB 146 843

The main body of the present work is concerned with the response of the laminar boundary layer in 2 dimensional, incompressible flow to impulsive

changes in velocity. In particular, the problem of stagnation-point flow against a wall which moves impulsively in its own plane is considered. A method is developed for the solution of this problem. Applications of this method are then made to the case of linearized, unsteady, laminar boundary-layer flow. Detailed calculations are carried out to determine the oscillatory response of the laminar boundary layer when the basic steady flow is that given by the potential velocity distribution. The results of these calculations are then used to find the response to impulsive changes of velocity.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
BOUNDARY-LAYER TRANSITION INDUCED BY A VIBRATING RIBBON ON A FLAT PLATE, by Francis R. Hama. Rept. on Contract AF 49(638)645. Feb 60, 34p. 18 refs. Technical note no. BN-195; AFOSR-TN-60-290.
Order from LC mi$3.00, ph$6.30 PB 146 423.

Flow patterns associated with the boundary-layer transition induced by a vibrating ribbon are investigated on a flat plate by means of visual observation of dye in a water tank. When amplified, the perturbation wave rolls up to form discrete vortices in the region near the critical layer. Transition never takes place before the discrete vortices are formed. The initially straight discrete vortices deform into three-dimensional vortex loops by picking up pre-existing disturbances and amplifying their effects. When the two-dimensional vortices become stronger, regularity in the transverse direction in forming the vortex loops is quite marked.

James Forrestal Research Center, Princeton, U, N. J.
EXACT SOLUTIONS FOR THE ONE-DIMENSIONAL VISCOUS FLOW OF A PERFECT GAS, by Gerald Rosen. Rept. on Contract Nonr-1858(25). July 59, 26p. 4 refs. Proj. Squid Technical rept. PR-93-P.
Order from LC mi$2.70, ph$4.80 PB 147 066

Velocity-free equations are derived for the unsteady one-dimensional real fluid flow of a perfect gas. These equations admit a pressure-time symmetry, a stress symmetry, and a displacement symmetry. Fundamental solutions associated with each of the three symmetries are reported. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STABILITY OF A SUPERSONIC LAMINAR BOUNDARY LAYER ON A FLAT PLATE, by John Laufer and Thomas Vrebalovich. Rept. on Contract DA 04-495-ORD-18. 1 Dec 58, 60p. 26 refs. Rept. no. 20-116; AD-216 343.
Order from LC mi$3.60, ph$9.30 PB 147 482

Self-excited oscillations have been discovered experimentally in a supersonic laminar boundary layer along a flat plate. By the use of appropriate measuring techniques, the damping and amplification of the oscillation amplitudes were studied and the stability limits were determined at free-stream Mach numbers 1.6 and 2.2. The wave nature of these disturbances was demonstrated and the wave velocities were measured using a specially designed "disturbance generator." The amplitude distribution across the boundary layer of the various fluctuating quantities associated with the oscillations revealed large temperature fluctuations that were approximately twice the velocity fluctuations. In general, the experiments confirmed the predictions of the existing stability theory. (Author)

Laboratoire Mediterranéen de Recherches Thermodynamiques (France).
REALISATION OF A MOLECULAR GUN OR COSMIC WIND TUNNEL, by F. Marcel Devienne. Technical note on Contract AF 61(052)296. Oct 59, 60p. 11 refs. AFOSR-TN-59-1292.
Order from LC mi$3.60, ph$9.30 PB 146 134

This report describes the building conditions of a molecular gun, that is to say an apparatus by means of which it is possible to reproduce conditions to which a solid body, moving at a cosmic speed, in a rarefied gas, is submitted. The apparatus is based on the exchange momentum between two crossed beams, one of these being a molecular beam corresponding to an ordinary temperature, and the other an ion beam in which the ions are accelerated by voltages included between a few volts and a few hundred volts.

Massachusetts Inst. of Tech., Cambridge.
FORCES AND MOMENTS ON OSCILLATING SLENDER WING-BODY COMBINATIONS AT SUPERSONIC SPEED. PART II. APPLICATIONS AND COMPARISON WITH EXPERIMENT, by Haim Kennet, Holt Ashley, and Robert L. Stapleford. Rept. on Contract AF 18(600)961. Dec 57, 74p. 8 refs. Fluid Dynamics Research Group rept. no. 57-5; AFOSR-TN-58-114; AD-152 022.
Order from LC mi$4.50, ph$12.30 PB 147 041

Several applications and extensions are described of a theoretical method for estimating aerodynamic loads on slender wing-body configurations performing small oscillations of limited reduced frequency in a supersonic main stream. This procedure involves an iterative technique in ascending orders of aspect ratio and frequency, to similar shapes in transonic flow. The theory is moderately successful as compared against experimentally determined lift-and moment-curve slopes for a family of delta-wing-body combinations in steady flow. It provides reasonable estimates of the damping in pitch measured on a particular rocket model over a range of supersonic Mach numbers. When applied to a series of possible missile shapes with systematically varied wing planforms, it reveals a strong influence of planform geometry on damping in pitch which cannot be calculated by the conventional slender-body approximation. (Author)

Minnesota U., Minneapolis.
DAMPING OF RECTANGULAR PLATE VIBRATIONS, by T. S. Lundgren, C. C. Chang, and Y. C. Whang. Rept. for 11 June-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. Mar 60, 25p. 1 ref. WADC Technical rept. 59-544.
Order from OTS $0.75 PB 161 755

In Part A an analysis is made of the effect of an impact type damping mechanism on a vibrating square plate. The force which the damping mechanism exerts on the plate is idealized as a series of impulses acting at the center of the plate. It is found that the device analyzed does not make a very effective damper. In Part B an analysis is made of the effect of a damping device on the vibrations of a rectangular plate. The damper considered is a free piston in a closed cylinder which is attached to the center of the plate. When the leakage through the gap between the piston and the cylinder is small, the piston is caused to oscillate on the "spring" of air in the cylinder. It is found that this device can effectively damp out the resonant mode of the plate vibration. (Author)

National Research Corp., Cambridge, Mass.
MEASUREMENT OF GAS VELOCITY BY PULSED IONIZATION TECHNIQUE, by Robert A. Stauffer and Richard B. Lawrance. Final rept. on Contract N7onr-478. 31 May 51, 54p. 7 refs. ATI-108 550.
Order from LC mi$3.60, ph$9.30 PB 146 953

The report gives the results of a research program covering the application of electrification-marker techniques to the measurement of streaming gas velocity.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
BLOCKING IN THE OPEN-JET WIND TUNNEL, by Harold A. Mehaffey. Master's thesis. Oct 59, 57p. 4 refs. Technical rept. 388.
Order from LC mi$3.60, ph$9.30 PB 147 833

Criteria were established for the NSL, M = 4.80 open-jet wind tunnel. Two limits on model size and shape were found; (1) a maximum model frontal area; and, (2) a maximum bow shock strength independent of model frontal area. Additional factors affecting blocking were found to be stagnation pressure, stagnation temperature and diffusor efficiency. No method of evaluating these additional effects was found. The blocking criteria should be applicable for any continuous flow open-jet wind tunnel, with the limits determined by the particular tunnel circuit. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
DESIGN, CALIBRATION AND ANALYSIS OF A HELIUM CONCENTRATION METER, by J. Richard Brown. Rept. on Contract AF 49(638)245. Dec 59, 32p. 7 refs. Technical rept. 416; AFOSR-TN-60-39.
Order from LC mi$3.00, ph$6.30 PB 147 782

The mass transfer investigation is concerned with the consequences of binary-mixture flow in the high speed boundary layer. Measurement of the boundary layer composition using a sound-speed concentration meter is an important part of the program. This report concerns the design, calibration and analysis of a helium concentration meter. It consists of the theory of operation and methods of calibration as well as the analysis and operational results obtained from a redesigned instrument.

Polytechnic Inst. of Brooklyn, N. Y.
THE INFLUENCE OF THE SHOCK CURVATURE ON THE BEHAVIOR OF HYPERSONIC BOUNDARY LAYER, by Antonio Ferri. Rept. on Contract AF 49(638)445. Feb 60, 47p. 15 refs. PIBAL rept. no. 542; AFOSR-TN-60-301.
Order from LC mi$3.30, ph$7.80 PB 147 044

For moderate values of Reynolds numbers the entropy gradients in the flow field affect the boundary layer in the region far from the nose. These effects are important for heat transfer, especially for a turbulent boundary layer. For moderate values of Reynolds numbers good results can be obtained by analyzing the boundary layer with correct local stagnation conditions and by neglecting the effect of velocity gradients outside the boundary layer. For lower Reynolds numbers, boundary layer type analysis can still be used; however, the effects of velocity gradients must be taken into account in stating the boundary conditions. The effect of vorticity in this case appears to be important.

Polytechnic Inst. of Brooklyn, N. Y.
SOME SIMILAR SOLUTIONS FOR INCOMPRESSIBLE LAMINAR BOUNDARY LAYER PROBLEMS, by Koon-Sang Wan. Rept. on Contract AF 49(638)445. Dec 59, 34p. 20 refs. PIBAL rept. no. 538; AFOSR-TN-59-1303.
Order from LC mi$3.00, ph$6.30 PB 146 768

Similar solutions to three types of laminar boundary layer problems are given in terms of known solutions The first problem pertains to unsteady laminar boundary layer when the external irrotational flow is inversely proportional to a linear function of time, and varies linearly in the direction of the main flow. The related heat transfer solution with isothermal heated surface is indicated. The second problem is the classical steady laminar boundary layer problem, but with the external irrotational flow given by $u_o (1+bx)^m$. The last problem is concerned with similar solutions for the boundary layer interacting with external inviscid rotational flow. A similar solution is obtained when the external vorticity is constant, large or small, and the external velocity varies as $U_o(1+bx)^{\frac{1}{3}} + \omega y$ or $U_o x^{\frac{1}{3}} + \omega y$. The latter case may be considered as a simple shear flow over a wedge with half wedge angle . (Author)

Princeton U., N. J.
INTERACTION OF A TURBULENT BOUNDARY LAYER WITH A STEP AT M = 3.85, by L. E. Vas and S. M. Bogdonoff. Rept. on Contract AF 18(600)498. Apr 55, 64p. 5 refs. Rept. no. 295; AFOSR-TN-55-200; AD-201 645.
Order from LC mi$3.90, ph$10.80 PB 146 008

Rensselaer Polytechnic Inst., Troy, N. Y.
AN INVESTIGATION OF THE COANDA EFFECT FOR SUPERSONIC FLOWS, by Kuo-Tai Yen. Rept. on Contract AF 18(600)992. 18 Mar 54, 35p. 8 refs. TR AE5405; OSR-TN-54-130; AD-45 023.
Order from LC mi$3.00, ph$6.30 PB 147 012

The purpose of this work is to study the feasibility of utilizing the Coanda Effect to improve the mixing and induction of supersonic flows. The problem studied here is the flow phenomenon of two supersonic streams as the result of inserting a curved surface into the primary stream. An approximate theory based on the Prandtl-Meyer flow is developed for the determination of the contact discontinuity between the two streams. The laminar mixing along the contact discontinuity is then studied. It is shown that the mixing of the two streams can be improved appreciably provided certain temperature and Mach Number conditions for these two streams are satisfied. (Author)

Southampton U. (Gt. Brit.)
THE CHOICE OF AN OPTIMUM SET OF MEASUREMENTS TO STUDY ATOMIC RECOMBINATION IN NOZZLES, by K. N. C. Bray and J. P. Appleton. Technical (scientific) note no. 1 on Contract AF 61(052)250. Nov 59, 45p. 16 refs. USAA Rept. no. 120.
Order from LC mi$3.30, ph$7.80 PB 146 915

This note is concerned with the accuracy of experiments designed to study the process of atomic recombination in a hypersonic wind tunnel nozzle. Three types of experiment are considered: (i) to determine whether a given flow is closer to the equilibrium or the frozen state, (ii) to determine the dissociation fraction in the test section of the nozzle, and (iii) to determine the recombination rate constant. It is shown that the overall accuracy of all these experiments, particularly the first one, is greatly affected by the choice of the various quantities to be measured, and in some cases errors of several thousand per cent are predicted. Recommendations are made for the choice of optimum measurements for recombination experiments.

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
LINEARIZED THEORY OF AIRFOILS IN FLUIDS OF LOW ELECTRICAL CONDUCTIVITY, by S. I. Pai. Rept. on Contract AF 04(647)269. Dec 59, 28p. Technical Information Series R60SD311.
Order from LC mi$2.70, ph$4.80 PB 147 298

A uniform steady flow of compressible fluid of low electrical conductivity past thin magnetized bodies has been studied. Because of the thinness of the body and the small electrical conductivity of the fluid, the fundamental equations of magnetogasdynamics may be linearized. The external electromagnetic fields are under the control of the designer of the aircraft and independent of the flying conditions. Hence we may use the electromagnetic fields as a control device for the aircraft flying in a fluid of low electrical conductivity. The effectiveness of this device is proportional to the magnetic parameter R_M. (Author)

Stanford Research Inst., Menlo Park, Calif.
AERODYNAMIC CHARACTERISTICS OF TRAILING-WIRE ANTENNAS AT SUPERSONIC SPEEDS, by F. B. Harris, Jr. Technical rept. 68 on Contract AF 19(604)3458. Mar 60, 88p. 12 refs. AFCRC-TN-60-198.
Order from LC mi$4.80, ph$13.80 PB 147 050

Severe difficulties associated with the design of satisfactory flush-type HF transmitting antennas for supersonic aircraft have prompted a reconsideration of trailing-wire antennas for such vehicles. The aerodynamic instabilities which caused mechanical failure of the trailing-wire type of antenna and led to its abandonment except in low-speed applications are carefully examined in this report.

University of Southern California. Engineering Center, Los Angeles.
A SEMI-AUTOMATIC McLEOD GAUGE, by Herbert R. Pass. Rept. on Contract AF 18(603)95. 31 Mar 60, 42p. 2 refs. USCEC rept. 56-211; AFOSR-TN-60-399.
Order from LC mi$3.30, ph$7.80 PB 147 299

A semi-automatic McLeod gauge has been designed and built for use in the USC low-density wind tunnel. The gauge is mounted inside the tunnel and is remotely controlled and remotely read. Control is obtained by means of an electro-pneumatic circuit using electrodes that are inserted through the glass walls; the reading is obtained electrically using a circuit consisting of, in part, a constant-current generator, tungsten wires that are placed in the bores of the capillaries, and a strip-chart recorder. The design is relatively simple, inexpensive, and reliable; although, operationally it is somewhat unwieldy. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

AER, Inc. [Pasadena, Calif.]
THE DESIGN OF THREE HORIZONTAL MOMENTUM EXCHANGE WATER BRAKES FOR THE U. S. NOTS 'SNORT' LIQUID ENGINE SLED, by R. E. Oliver. Rept. on Contract N123(60530)11868A. Dec 59, 114p. 5 refs. NOTS TP-2390; NAVORD rept. 7024.
Order from LC mi$6.00, ph$18.30 PB 146 921

Three momentum exchange water brakes were designed to produce decelerations of 10.0g ±1.0g, 5.0g ±0.5g, and 2.5g ±0.25g for sled weights of 4, 254, 4, 254 and 10, 800 lb_w respectively, and water-contact velocities of 1, 250, 1, 250 and 636 ft/sec respectively. These decelerations were to be maintained until the sled velocity decreased to 300 ft/sec. The water surface profile was not specified beforehand, but was determined in conjunction with the design of the scoop shapes. One water surface profile was to be used for all three brakes. A primary consideration in the structural design of the brakes was simplicity. The stress analysis was carried out on the basis of a design stress of one-half the ultimate stress of the material (i.e., a safety factor of 2.0 based on ultimate strength). In order to provide an experimental check on the predicted forces on the brakes, force-measuring mounts were included in the design. (Author)

Aeronautical Accessories Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
DEVELOPMENT OF AGENT FLOW MEASUREMENT METHODS, by Ralph L. Hough and William R. Kane. Mar 60, 46p. 8 refs. WADC Technical note 59-183.
Order from OTS $1.25 PB 161 726

Instrumentation for measuring the rapidly changing flow of agent in fire-extinguishing systems was very limited, unrefined, or nonexistent. Highly transitory discharge, with abrupt beginning and end, occurs in these systems. Total discharge time covers only a few seconds. Methods were needed for measuring the average flow rate and the instantaneous velocity of the agent. Several instrument ideas were developed, instrument design engineering explored, and resultant techniques tested. A highly refined phase-change indicator was developed, capable of measuring initial agent velocity as well as average agent flow rate. Of the techniques examined for determining instantaneous velocity, using phosphor-decay rates appears most promising. Methods devised pertain not only to resolving problems in relation to fire-extinguishing systems, but to other problems concerning transient flow in hydrodynamic systems. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
SPHERICAL EXPLOSIONS IN SEA WATER, by S. A. Berger and M. Holt. Technical rept. no. 19 on Contract Nonr-562(07). Apr 59, 158p. 60 refs. Rept. 562(07)/19.
Order from LC mi$7.50, ph$24.30 PB 146 053

In this report the field of disturbance due to the detonation of a bared spherical charge of PETN in sea water is calculated. The equations of unsteady motion of a compressible fluid with spherical symmetry are written in Eulerian form and integrated numerically by the method of characteristics. Three distinct regions have to be considered, the compressed water region behind the main blast wave, the region of expansion of the detonation products, and the explosive gas region between the outer boundary of this expansion, which develops into a second shock wave, and the boundary of the gas bubble. Special attention is given to fitting the boundaries of these regions, the outer boundary of the detonation region, the second shock wave, gas-water contact discontinuity and main blast wave. A Jones equation of state is used in the product gases and a Tait equation of state is used in sea water.

Grumman Aircraft Engineering Corp., Bethpage, N. Y.
STUDY OF HYDROFOIL SEACRAFT. Phase I technical rept. on Contract MA-1730. 3 Oct 58, 451p. 51 refs.
Order from OTS $6.00 PB 161 759

Contents:
Part 1. Subcavitating hydrofoils
Part 2. Supercavitating hydrofoils
Part 3. Struts and bodies of revolution
Part 4. Hydrofoil and strut weight estimation
Part 5. Hydrofoil configurations
Part 7. Main power plant
Part 8. Propulsion devices and transmissions
Part 9. Hull structural design
Part 10. Operational aspects
Part 11. Determination of optimum craft characteristics
Part 12. Preliminary designs
(See also PB 151 475)

Hydrodynamics Lab., Mass. Inst. of Tech., Cambridge.
RESISTANCE COEFFICIENTS FOR ACCELERATED FLOW THROUGH ORIFICES, by James W. Daily and Wilbur L. Hankey, Jr. Technical rept. no. 10 on Contract N5ori-07826. Oct 53, 23p. 10 refs. AD 28 572.
Order from LC mi$2.70, ph$4.80 PB 147 157

The investigation of fluid friction in unsteady motion was extended to include the frictional resistance caused by orifices in accelerated flow. Two different orifices were investigated, each located in a region of fully developed conduit boundary layer and velocity profile. Orifices of area ratios 0.5 and 0.7 were installed 38.5 diameters from the entrance nozzle in a 1-in. -diam tube, and the velocity and acceleration of flow were programmed by a servomechanism controlling the pressure difference between the supply and receiving tanks of the water tunnel. The tests covered a conduit Reynolds number range from 5×10^4 to 3×10^5 and accelerations up to 35 ft/sec/sec. The results showed that (1) the coefficient of head drop is independent of the Reynolds number and is a function of the acceleration parameter; (2) the frictional resistance for a given instantaneous velocity of

flow through an orifice is appreciably less than for steady flow at the same velocity; and (3) the frictional resistance for a given instantaneous velocity of accelerated flow through an orifice decreases with increasing acceleration. A reanalysis was made of previous measurements with a clear conduit, and this analysis indicated that (1) the coefficient of head drop is a function of the Reynolds number as well as the acceleration parameter; and (2) the frictional resistance for a given instantaneous velocity of accelerated flow through a uniform diameter smooth tube is equal to or possibly slightly greater than that for steady flow at the same velocity.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
CYLINDRICAL SHOCK WAVES PRODUCED BY INSTANTANEOUS ENERGY RELEASE IN MAGNETOGAS DYNAMICS, by S. I. Pai. Rept. on Contract AF 18(600)993. Feb 58, 32p. 4 refs. Technical note BN-120; AFOSR-TN-58-215; AD-154 116.
Order from LC mi$3.00, ph$6.30 PB 147 454

The behavior of a cylindrical shock wave produced by instantaneous energy release along a straight line of infinite extent in a conducting gas subjected to a mag netic field with circular lines of force has been analyzed. Initially the gas is at rest and has constant temperature. Both the initial density and the initial magnetic field H_{Θ_e} are assumed to be inversely proportional to some power of the radial distance r. It was found that similar solutions exist only if H_{Θ_0} is proportional to 1/r. Similar solutions for various initial density distributions have been obtained. Numerical examples are given for constant initial density. The magnetic field has great influence on the pressure distribution but little influence on the density distribution within the shock. The pressure near the shock front is increased by the magnetic field while that near the center of the region is decreased. In general, the magnetic field increases the flow velocity within the cylindrical shock. (Author)

Jet Propulsion Center, Purdue U., Lafayette, Ind.
A STUDY OF THE MEAN THICKNESS OF THE LIQUID FILM AND THE CHARACTERISTICS OF THE INTERFACIAL SURFACE IN ANNULAR, TWO-PHASE FLOW IN A VERTICAL PIPE, by D. A. Charvonia. Interim rept. no. 59-1 on Contracts Nonr-1100(14) and N6ori-105(03). May 59, 266p. 35 refs. Proj. Squid Technical rept. PUR-39-T-R.
Order from LC mi$11.10, ph$41.10 PB 145 908

An experimental investigation of annular, two-phase flow was conducted in a vertical tube, 2.498 in. ID and 28 in. long, employing water and air at ambient temperatures and pressures as the liquid and gaseous media respectively. An analysis of downward, annular, two-phase flow is presented and the results of that analysis are compared graphically with those from the experimental investigations. The experimental studies were concerned with extremely thin liquid films. The results of the investigation indicate that the amplitudes and frequencies of the interfacial waves are related by definite spectra. The analysis provides a method for predicting the mean liquid film thickness and pressure gradient in the gas stream in downward, annular, two-phase flow if the rates of flow of the two fluid media, their physical properties, and the pipe diameter are known.

Naval Ordnance Test Station [China Lake, Calif.]
ON THE MOTION OF VORTICES BEHIND A CIRCULAR CYLINDER, by I. Michelson. 29 Oct 51, 26p. 9 refs. Technical memo. 377.
Order from LC mi$2.70, ph$4.80 PB 146 945

The flow of a uniform stream of perfect (i.e., incompressible and inviscid) fluid past a circular cylinder and two nearby complex, vortex-line singularities is considered. For the most part, interest is confined to the flow in which the singularities are symmetrically situated downstream of the cylinder. The classical methods of potential theory are applicable to the study of the resulting unsteady motion, and a large amount of information is thus obtained concerning the kinematics of the entire motion as well as the forces and pressures which act on the cylinder.

METALLURGY

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF PARTIALLY VOLATILE BRAZING FILLER ALLOY FOR HIGH-TEMPERATURE APPLICATION AND RESISTANCE TO OXIDATION, by William M. Lehrer and Harry Schwartzbart. Rept. for 1 Apr 58-31 Mar 59 on Metallic Materials, Contract AF 33(616)5654, continuation on Contract AF 33(600)33406. Dec 59, 45p. 7 refs. WADC Technical rept. 59-404; AD-232 969.
Order from OTS $1.25 PB 161 746

Experimental brazing filler alloys have been developed containing temperature depressants which have been volatilized during the brazing of stainless steel, leaving joints of high remelt temperature. The mechanisms by which remelt temperature is increased have been studied for the range of alloys investigated which contained nickel, chromium, germanium, iron, lithium, and phosphorus. The two main mechanisms are (i) dissolution of the base metal in the filler metal and diffusion of constituents of the filler metal into the base metal and (ii) volatilization of the filler metal constituents. It has been shown theoretically and experimentally that in order for remelt temperature to increase there must be solid solubility of the diffusing or volatile element in the filler alloy. (Author)

Bell Aircraft Corp. [Buffalo, N. Y.]
MECHANICAL PROPERTIES OF SELECTED ALLOYS AT ELEVATED TEMPERATURES, PART I, by Harry A. Pearl, George F. Kappelt, and Edmund J. King. Rept. for July 58-Sep 59 on Materials Application, Contract AF 33(616)5760. Mar 60, 268p. WADC Technical rept. 59-702, Pt. 1.
Order from OTS $4.00 PB 161 761

Six materials in plate and bar form were subjected to tension, compression, bearing, and shear stresses at various temperatures after exposure times of 1/2, 10, 100, and 1000 hours at selected test temperatures. The materials studied and the temperature range of testing were: AM 355 - R. T. - 1000°F, PH 15-7M° - R. T. - 1000°F, HK31-H24 - R. T. - 600°F, A 286 - R. T. - 1200°F, Udimet 500 - R. T. - 1700°F and Inconel X - R. T. - 1500°F. In general the test results show that most of the material properties regardless of the type of stress imposed decrease with temperature and time. Time of exposure was not as effective in lowering the properties as the temperature. The A 286 alloy did show mechanical properties higher after prolonged exposure due to aging at some temperatures. The sharp drop off in properties that the other alloys exhibited at the higher temperatures was not characteristic of the A 286 alloy. Comparisons between alloys are made only where the temperature range of operation is common to both. (Author)

Cloud Physics Lab., U. of Chicago, Ill.
RANDOMIZED SEEDING OF OROGRAPHIC CUMULUS, 1957: PART I, by Louis J. Battan and A. Richard Kassander (U. of Arizona). Rept. on Contracts AF 19(604)1388 and NSF Grant G-4175. 15 Feb 58, 22p. 3 refs. Cloud Physics Lab. Technical note no. 12.
Order from LC mi$2.70, ph$4.80 PB 137 727

This report deals with a description of the design of the experiments and a summary of the analysis of the rain gage data. During the summer of 1957 there were 16 pairs of days studied. The analysis suggests that seeding had a positive effect, but statistical tests show that the differences between the rainfall on seeded and non-seeded days could not be shown to be statistically significant at an acceptable confidence level.

General Mills, Inc., Minneapolis, Minn.
ELECTRON MIRROR MICROSCOPY IN MAGNETIC AND METALLURGICAL STUDIES, by Ludwig J. Mayer. Final rept. for 1 Oct 57-30 Sep 59 on Contract AF 33(616)3852. Oct 59, 81p. 46 refs. WADC Technical rept. 59-640.
Order from OTS $2.25 PB 161 710

Electron mirror microscopy (EMM) can be utilized for the observation of magnetic patterns recorded on magnetic tapes. EMM reveals magnetic domain patterns in magnetic materials with a uniaxial direction of easy magnetization and in materials with several directions of easy magnetization exhibiting basically flux closure domain configurations. On silicon-iron three types of domain manifestations were observed. Motion pictures photographed directly from the screen of the electron mirror microscope portray quite adequately the domain patterns set in motion by applied magnetic fields. EMM is particularly well suited for direct visual observation of magnetic stray fields at grain boundaries. It is also possible to observe domain and domain movement in the different types of thin magnetic films. A method of magnetic writing is possible which is based on a local reversal of the direction of magnetization in suitable premagnetized film by temporarily elevating the temperature above the Curie point. By utilizing the dissipation energy of a focused electron beam for this purpose quite well defined traces of reversed magnetization could be recorded on MnBi films. These traces were magnetically erasable. Writing speeds of 3×10^4 bits/sec and information densities of 10^5 bits/cm^2 could be achieved. With a newly designed vacuum hot stage, the formation of MnBi films was observed by means of the Kerr magneto-optic effect, thus achieving for the first time visual observation of the nascent state of ferromagnetism. Experiments showed that uniform MnBi films grow from only a few randomly distributed nucleation spots.

Grumman Aircraft Engineering Corp., Bethpage, N. Y.
EVALUATION OF TITANIUM SHEET ALLOYS, by Francis X. Drumm. Quarterly progress rept. no. 3, 1 July-30 Sep 58, on Contract NOas-58-100C. 30 Oct 58, 31p. Rept. R 82053013.3.
Order from LC mi$3.00, ph$6.30 PB 137 867

Progress consisted of preliminary manufacturing evaluation, which included bend testing, adhesive bonding, dimpling and resistance spot welding. The effect of elevated temperatures upon solution heat treated material was investigated.

Illinois U., Urbana.
PROTECTIVE COATINGS FOR REFRACTORY METALS, by Clifton G. Bergeron, Arthur L. Friedberg and others. Rept. for June 58-Aug 59 on Ceramic and Cermet Materials, Contract AF 33(616)5734. Jan 60, 50p. 45 refs. WADC Technical rept. 59-526.
Order from OTS $1.25 PB 161 739

Tests with tungsten wire encapsulated in evacuated fused silica tubes demonstrated the impermeability of oxygen at temperatures above 3000°F. for several hours, as evidenced by the non-oxidation of the encased tungsten. Preliminary experiments showed that oxygen-free atmospheres, but not high vacuum conditions, were required for successful application of ceramic coatings on tungsten. Vitreous-bonded coatings, consisting of zircon and a low expansion refractory glass, protected tungsten wire specimens at temperatures of 3600°F. for 3-1/2 hours using a direct resistance heating test. Combinations of silicide and vitreous-bonded coatings, SiO coatings, and flame-sprayed coatings were investigated. (Author)

Naval Engineering Experiment Station, Annapolis, Md.
INVESTIGATION OF HIGH-TEMPERATURE NOTCH SENSITIVITY IN A LOW-CARBON CR-MO-V PIPING STEEL, by R. B. Niederberger. 24 Mar 59, 22p. 16 refs. Research and Development rept. 910038E; AD-215 987.
Order from LC mi$2.70, ph$4.80 PB 147 483

Notched and smooth bar rupture data, at temperatures of 1000° and 1100°F and times up to several thousand hours, are presented for a low-carbon Cr-Mo-V steam piping steel. It was found that notch sensitivity was dependent on stress as well as rupture time and temperature.

New York U. Coll. of Engineering, N. Y.
DEVELOPMENT OF PROTECTIVE COATINGS FOR REFRACTORY METALS, by C. G. Goetzel, P. S. Venkatesan, and R. F. Bunshah. Rept. for 1 June 58-31 May 59 on Ceramic and Cermet Materials, Contract AF 33(616)5735. Feb 60, 57p. 44 refs. WADC Technical rept. 59-405.
Order from OTS $1.50 PB 161 736

A preliminary study of the feasibility of protecting tungsten against oxidation at 1650°C (3000°F) was undertaken. Rhodium was selected from the noble metal group as the most promising metallic type of coating. It was applied by electrolytic deposition, either directly onto thoriated or pure tungsten wires, or onto intermediate coats containing the elements rhenium, chromium and silicon. These sub-coats served several purposes, such as: (1) providing a layer of intermediate expansion characteristics between those of the substrate and the rhodium coat; (2) modifying the oxides formed on the surface of the substrate; or (3) promoting the formation of liquid phases at the surface that would freely flow and seal exposed areas of the substrate.

Ferrous Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
WELDING OF HIGH-STRENGTH STEELS FOR AIRCRAFT AND MISSILE APPLICATIONS, by H. W. Mishler, R. E. Monroe, and P. J. Rieppel. Rept. on Contract AF 18(600)1375. 12 Oct 59, 93p. 43 refs. DMIC rept. 118; AD-228 629.
Order from OTS $2.25 PB 151 074

This report summarizes the materials and procedures currently being used in the aircraft and missile industry to arc and resistance weld high-strength steels. The steels discussed are (1) low-alloy martensitic steels, (2) hot-work die steels, (3) martensitic stainless steels, and (4) precipitation-hardening stainless steels. For each class of steel, welding techniques and procedures are discussed, arc-welding filler materials are described, and mechanical properties of arc and resistance welds are listed. A discussion is included of design, testing, and inspection techniques as applied to weldments made from these high-strength steels. (Author)

Naval Research Lab., Washington, D. C.
CRACK PROPAGATION TESTS OF HIGH-STRENGTH SHEET MATERIALS. PART IV. THE EFFECT OF WARM PRE-STRAINING, by J. E. Srawley and C. D. Beachem. 18 Apr 60, 20p. 5 refs. NRL Rept. 5460.
Order from OTS $0.50 PB 161 355

Evidence is presented that the weakening effect of the cracks provided in crack-propagation test specimens of high-strength sheet steels may be substantially mitigated by straining at moderately elevated temperatures, where the mode of fracture is entirely shear, before testing at lower temperatures. The improvement in load-bearing capacity of the specimens resulting from the pre-straining treatment is greater the lower the testing temperature. The effect is believed to be mainly a result of blunting of the crack fronts in the vicinity of the specimen surfaces by plastic flow and shear cracking during pre-straining. It might be of some practical value in reducing the effective severity of undiscovered cracks in certain thin-walled structures, thus improving the integrity of such structures. (Author) (See also PB 151 770)

Nonferrous (except light) Metals

Army Signal Research and Development Lab., Fort Monmouth, N. J.
INVESTIGATION OF COLUMBIUM AS AN ELECTROLYTIC CAPACITOR ANODE, by Clyde Peabody and Albert Lunchick. 15 Aug 59, 17p. 1 ref. USASRDL Technical rept. 2069; AD-226 038.
Order from LC mi$2.40, ph$3.30 PB 146 935

The metal columbium was studied as an electrolytic capacitor anode. Samples of columbium anodes both in unetched foil and sintered pellet form were anodized and compared with tantalum controls. Higher capacitance values for the columbium electrolytics were observed, but the capacitance gain promised by the higher dielectric constant of columbium oxide was not fully realized due to the thicker columbium oxide films. For similar density ratios of columbium and tantalum sintered pellets, however, better than 80% capacitance gain per unit volume was realized with columbium. Wet dissipation factors of columbium specimens were similar to those for tantalum. The d. c. leakages of the former were higher, although still well within practical limits. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
OXIDATION BEHAVIOR AND PROTECTIVE COATINGS FOR COLUMBIUM AND COLUMBIUM-BASE ALLOYS, by W. D. Klopp. Rept. on Contract AF 18(600)1375. 15 Jan 60, 97p. 63 refs. DMIC Rept. 123.
Order from OTS $2.25 PB 151 080

Available information on the oxidation behavior of and protective coatings for columbium and columbium-base alloys is summarized and discussed. Unalloyed columbium forms a tarnish film and reacts parabolically with air or oxygen up to about 450 C. In this temperature range the protective film blisters and unprotective, white Cb_2O_5 forms. Oxidation behavior is linear after formation of Cb_2O_5, the rate increasing appreciably with increasing temperature. Cb_2O_5 is solid to 1500 C. Binary additions which improve the oxidation resistance include Ti, Zr, Mo, W, Cr, and V. Ti and Zr also improve the contamination resistance of columbium. Ternary and higher alloying produces further significant improvements in oxidation behavior by promoting formation of complex oxide scales. Several of the best systems are Cb-Cr-Al, Cb-Fe-Al, Cb-Mo-Al, Cb-Ti-Al, and Cb-Ti-Cr. Improvements up to 1000-fold over unalloyed columbium are possible, but the most oxidation-resistant alloys are unfabricable. Information on protective coatings for columbium is limited. The best coatings to date appear to be a duplex LM-5 coating and a modified Ni-C coating. (Author)

Armour Research Foundation, Chicago, Ill.
A STUDY OF TERNARY PHASE DIAGRAMS OF TUNGSTEN AND TANTALUM, by W. Rostoker. Rept. for 1 Apr 58-31 July 59 on Metallic Materials, Contract AF 33(616)5678. Mar 60, 93p. 41 refs. WADC Technical rept. 59-492.
Order from OTS $2.25 PB 161 709

Phase relationships in 36 ternary refractory metal systems were investigated. Some 28 related binary systems were first established by reviewing the literature and doing whatever supplementary experimental work necessary to assure a valid basis for the ternary studies. Nearly 200 ternary alloy compositions were prepared from high-purity alloying ingredients by nonconsumable electrode arc-melting procedures. These alloys were studied metallographically in the as-cast condition as well as after annealing at and quenching from 1500 and 1000°C. The main purpose of this effort was to scan the solid solubility limits of ternary systems based on tungsten and/or tantalum and involving the following metals: molybdenum, niobium, vanadium, chromium, osmium, and rhenium. The diagrams presented herein are intended to serve as a foundation for future alloy development. Because none of the systems presented is completely detailed, definitive work can and should be done as the specific need arises. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN INVESTIGATION OF THE STRUCTURE OF COPPER AFTER EXPOSURE TO VERY INTENSE STRESS WAVES, by G. Moss and C. Glass. Feb 60, 19p. 12 refs. BRL memo. rept. 1248.
Order from LC mi$2.40, ph$3.30 PB 147 490

X-ray diffraction techniques were used to examine an explosively loaded copper single crystal for presence of macro-twins and kink bands. The results did not indicate the presence of mechanical macro-twins, but instead kink bands which are commonly found in slowly deformed copper. (Author)

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE PROPERTIES OF TANTALUM AND ITS ALLOYS, by Frank F. Schmidt, William D. Klopp and others. Rept. for 1 May 58-31 Dec 59 on Metallic Materials, Contract AF 33(616)5668. Mar 60, 112p. 53 refs. WADD Technical rept. 59-13.
Order from OTS $2.50 PB 161 758

The reactions of unalloyed tantalum with air, nitrogen, and oxygen were studied. Vacuum sintering of high-purity and high-impurity-content tantalum powders was investigated to determine the conditions required for purification. The effects of alloying on the oxidation behavior of tantalum were determined. Several alloying elements were found to be effective in reducing both scaling and contamination. Interstitials were studied for their effects on mechanical behavior at low and elevated temperatures. Screening studies were conducted on the effects of substitutional alloying on mechanical properties at room temperature and at 2200°F. References are included. (Author)

Birmingham U. (Gt. Brit.)
THE MIGRATION OF GRAIN BOUNDARIES IN METALS UNDER THE INFLUENCE OF A TEMPERATURE GRADIENT, by R. W. Cahn and R. W. Lucas. Technical summary rept. for Oct 56-Oct 58 on Contract AF 61(514)1020. [1958] 40p. 11 refs. AFOSR-TN-58-1056; AD-206 941.
Order from LC mi$3.00, ph$6.30 PB 146 844

Columbia U., New York.
CREEP AND PLASTIC DEFORMATION IN CYLINDRICAL SHELLS, by Alfred M. Freudenthal and Maciej P. Bieniek. Rept. for Dec 58-May 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)6112. Mar 60, 21p. 2 refs. WADC Technical rept. 59-399.
Order from OTS $0.75 PB 161 706

In the first part of this report, the problem of creep deformation and bending moments in the vicinity of a freely supported or fixed end of a long, cylindrical shell is solved under conditions of stationary (second stage) creep, using an approximate method based on extremum principles of dissipative media which are valid for the assumed uni-axial and non-linear creep-law $\dot{\varepsilon} = K\sigma^n$. The results of analysis are checked by experiment. In the second part of this report results of tests of steel cylinders under internal pressure, producing large plastic deformation, are given, illustrating the relation between problems of non-linear creep and plastic deformation. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ALUMINUM ALLOY CORROSION EVALUATION, by Franklin J. Gillig. Final rept. on Contract NObs-72056. 30 Sep 58, 26p. 1 ref. Rept. no. KC-1042-M-11; AD-213 449.
Order from LC mi$2.70, ph$4.80 PB 147 018

Five aluminum alloys 5154, 5356, 6063, 6061 and 5083 were evaluated to determine the effects of possible aircraft carrier deck environments on their mechanical properties and corrosion resistance. The environments included intermittent and continuous exposures to temperatures between 100°F and 1000°F. Mechanical property, intergranular corrosion, and stress corrosion data are given. No difference in the effect of intermittent and continuous exposures to a given temperature was found as long as the cumulative time at temperature was the same. Stress corrosion failures were encountered only in the 5083 alloy exposed to 300°F for 150 hours. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
INVESTIGATION OF THE COMPRESSIVE, BEARING, AND SHEAR CREEP-RUPTURE PROPERTIES OF AIRCRAFT STRUCTURAL METALS AND JOINTS AT ELEVATED TEMPERATURES, by Luke A. Yerkovich.

Rept. for 1 June 58-31 July 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5772. Mar 60, 111p. 6 refs. WADC Technical rept. 59-572.
Order from OTS $2.50 PB 161 717

This report summarizes in tabular and chart form the high temperature short time deformation properties of 16 V- 2.5 Al titanium alloy and Vascojet 1000 alloy steel in tension, compression, bearing and shear. In addition, correlations of the tensile creep-rupture properties with corresponding compression, bearing and shear creep-rupture properties are presented. The creep-rupture characteristics of single-rivet lap type joints and two-rivet doubler type joints prepared from the test alloys are presented. Correlations between measured joint creep-rupture and predicted joint creep-rupture are included. (Author)

Dayton U. Research Inst., Ohio.
FURTHER INVESTIGATION OF THE EFFECTS OF MOLTEN BORON OXIDE ON HIGH TEMPERATURE MATERIALS, by Joseph W. Rosenbery. Rept. on Aviation Fuels, Contract AF 33(616)3898. Jan 60, 102p. 11 refs. WADC Technical rept. 59-205.
Order from OTS $2.50 PB 161 703

The corrosion resistance of a group of high temperature materials, typical of those available for use in aircraft power plants, was evaluated in a boron oxide environment. Exposure consisted of cyclic immersion in B_2O_3 at temperatures of 1750° - 2200°F. for periods up to 145 hours in an air atmosphere. The results indicate aluminum, manganese, and carbon as alloy constituents are detrimental to corrosion resistance, while Si appears to produce beneficial effects. Several possible mechanisms of attack by molten boron oxide are postulated to explain the data.

Denver Research Inst., Colo.
DEVELOPMENT OF A COPPER-BASE CERMET BY THE MELT-SATURATION METHOD, by Leonard E. Olds. Summary rept. for 5 Dec 56-5 Aug 57 on Subcontract MOSD 60145 to Contract AF 04(645)24. 15 Aug 57, 33p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 147 737

The melt-saturation method is a process of forming a ceramic compound in a metal by precipitating the compound from a liquid solution. This report describes the preparation by this method of copper alloys nominally containing 0.5, 1, 2, and 4 percent ThB_4. Significant improvements were obtained in elevated temperature strengths, the Cu-4% ThB_4 alloy having almost four times the strength of pure copper at 1800°F. The ductility loss associated with this strengthening was approximately 30 to 40 percent. Metallographic and X-ray diffraction examinations indicated that both the ThB_4 and the ThB_6 phases were precipitated from the copper melt. The strengthening of the alloys by these phases appears to be associated with the formation submicroscopic borides even though all of the alloys prepared for this study contained massive borides with variable amounts of segregation. Attempts were made to measure the thermal diffusivity of the alloys; however, the tests were made under conditions which led to unreliable results. Some evidence was obtained to indicate an unbalance in alloy composition with a resulting excess of either boron or thorium in solid solution. Under such conditions the thermal conductivity of the alloys would be low. (Author)

Digital Computer Lab., U. of Illinois, Urbana.
CALCULATION OF ORDER PARAMETERS IN A BINARY ALLOY BY THE MONTE CARLO METHOD, by Lloyd D. Fosdick. Rept. on Contract Nonr-1834(27). 7 Apr 59, 27p. 12 refs. Rept. no. 87.
Order from LC mi$2.70, ph$4.80 PB 146 033

A sampling scheme used by others in equations of state computations for gases has been used to investigate order-disorder phenomena in a face-centered cubic A_3B alloy, Cu_3Au.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DISLOCATIONS IN DEFORMED SINGLE CRYSTALS OF α-BRASS. PART II. PILE UPS, by J. D. Meakin and H. G. F. Wilsdorf. Rept. on Contract AF 49(638)162. Feb 60, 29p. 20 refs. Interim rept. IIA2027-2; AFOSR-TN-60-4.
Order from LC mi$2.70, ph$4.80 PB 147 282

An etching technique has been used to investigate the dislocation structure of deformed alpha brass single crystals. Divergences between the experimental and theoretical spacings in the isolated pile-ups and the origin of the stress maintaining the pile-ups are discussed. (See also PB 144 570)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
THIN METAL FILMS AS CORROSION INDICATORS, by Richard B. Belser and Niels Engel. Rept. for 15 Nov 58-31 Dec 59 on Finishes and Materials Preservation, Contract AF 33(616)3879. Mar 60, 74p. 12 refs. WADC Technical rept. 59-759.
Order from OTS $2.00 PB 161 757

Thin metal films were evaluated as corrosion indicators for packages. Over 500 films deposited on glass substrates were examined by exposure in sealed containers at 25°C and at known relative humidities of from 0 to 70 percent. Iron, copper, manganese, magnesium and bimetal iron-copper films were studied. Although pure metal films did not corrode to a significant degree at 70% R. H. additions of sensitizing materials such as acid fumes or inorganic salts to the films caused them to deteriorate rapidly at these conditions. Such sensitization occurred inadvertently during specimen preparation unless suitable precautions were taken. (Author)

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
THE PROPERTIES OF METALS AND ALLOYS OF PARTICULAR INTEREST IN PRECISION INSTRUMENT CONSTRUCTION; COMPILATION OF DATA FROM VARIOUS HANDBOOKS AND OTHER SOURCES, by L. M. Schetky. Rept. on Contract AF 33(616)2039. Jan 57, 42p. Rept. R-137; AD-144 130.
Order from LC mi$3.30, ph$7.80 PB 147 266

The present compendium is a selection of values felt to be the best available at this date. In several classes of alloys the properties will vary widely with heat treatment and method of fabrication. As a criterion for selection of a material destined for use in restricted space or under conditions calling for low weight, the parameter strength-to-weight ratio is often used; in the field of precision instruments this is a misleading guide, since for reasons of dimensional stability it is desirable to operate well within the stress level of the elastic limit. In this list of properties is a value for the elastic limit/density ratio and also the ratio of the modulus of elasticity to density. Tables include a list of moduli of the elements in order of their increasing magnitude, and with this the best value available for Poisson's ratio. A second list indicates the nature of the temperature coefficient of modulus for several structural alloys. (Author)

Mallory-Sharon Metals Corp., Niles, Ohio.
THE MANUFACTURE OF HEAT TREATABLE Ti6Al-4V AND Ti-2.5Al-16V TITANIUM SHEET, by Paul E. Moorhead. Bi-monthly progress rept. no. 9, 25 Nov 57-25 Jan 58, on Contract NOa(s) 56-994-c. 30 Jan 58, 29p. Rept. 4000P-70; AD-157 743.
Order from LC mi$2.70, ph$4.80 PB 147 766

The chemical analyses and mechanical properties of solution treated and of age hardened 2.5 Al-16V Ti alloy sheet are tabulated. A solution treatment temperature of 1380°F for 1/2 hr followed by water quenching gave satisfactory results. An aging temperature of 960°F (4 hr) produced higher yield and ultimate tensile strengths with lower elongations than an aging temperature of 975°F (4 hr). The effects of straining of solution treated sheet (1400°F) on the mechanical properties after aging were investigated and the results are tabulated. The hydrogen pickup of 2.5 Al-16V Ti alloy sheet during solution treatment was minimized by a ceramic coating, but the same protection was not obtained by 6 Al-4V Ti alloy sheet. The results of welding studies indicate that 2.5 Al-16V Ti alloy may yield usable mechanical properties after welding; the tension/shear ratio of age hardened sheet is nearly twice that of other Ti alloys. The mechanical properties of the 6 Al-4V Ti sheet production in the anneal condition are tabulated. Four sheets (0.040 x 48 x 96 in. nominal) of 6 Al-4V were rolled, and the rolling of sheets wider than 36 in. appears to be feasible on present mill equipment.

Massachusetts Inst. of Tech., Cambridge.
SOLID SOLUTION AND SECOND PHASE STRENGTHENING OF NICKEL ALLOYS AT HIGH AND LOW TEMPERATURES, by Regis M. N. Pelloux (Doctoral thesis) and Nicholas J. Grant. Technical rept. on Contract Nonr-1841(28). [1959] 22p. 10 refs.
Order from LC mi$2.70, ph$4.80 PB 146 032

Alloys in the systems Ni-Cr, Ni-Mo, and Ni-W, were prepared as vacuum melted alloys. Tensile tests at room temperature and stress rupture tests at 1200° and 1500°F were run for time periods to give fracture in 0.1 to 500 hours. Observations were made of solid solution and second phase strengthening or weakening, coupled with studies of ductility and the role of structure on the noted behavior patterns.

Michigan U., Ann Arbor.
THE EFFECT OF TENSILE STRESS ON DIHEDRAL ANGLES IN LEADED COPPER, by C. A. Stickels and E. E. Hucke. Rept. on Contract AF 49(638)422. 31 Mar 60, 29p. 8 refs. AFOSR-TN-60-385.
Order from LC mi$2.70, ph$4.80 PB 147 004

Experiments were conducted to determine the effect of applied stress on dihedral angles of liquid lead in copper at 900°F. It was found that dihedral angles decrease with increasing stress in the center of test specimens, but that no apparent relation exists between the amount of stress applied and the dihedral angle observed nearer the surface of the specimen. The latter phenomena is attributed to oxygen penetration which changes angles by adsorption on interfaces. It was observed that stress levels resulting in specimen fracture were accompanied by migration of lead to the specimen surface and the fracture surface. A mechanism for this movement is postulated. (Author)

[Naval Engineering Experiment Station] Annapolis, Md.
SEA WATER CORROSION TEST OF STAINLESS STEEL AND NICKEL BASE ALLOY CONDENSER TUBES, by F. Sutton. 5 Jan 59, 12p. 3 refs. Research and Development Rept. 910027B; AD-214 445.
Order from LC mi$2.40, ph$3.30 PB 147 380

Plain condenser tubes of austenitic stainless steels and nickel base alloys were tested at the Harbor Island Test Station in two model condensers of 20 tubes each. Natural sea water was pumped through the tubes at a velocity of 10 ft/sec. The condensers were operated on a 30-day "off-on" cycle during part of the test. All of the stainless steels were susceptible to pitting. Type 347 was damaged most, and Type 316 the least of the steels tested. There were no failures or serious deterioration of the nickel base alloy tubes. A Ni-CR-Fe alloy was the least affected of the nickel alloys. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
CORROSION (TEN YEAR BIBLIOGRAPHY). Dec 59, 39p. 1004 refs. OTS Selective Bibliography 401.
Order from OTS $0.10 OTS SB-401

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. The information is arranged in groupings of PB reports, AEC reports, and translations in sections as follows: corrosion resistant coatings, corrosion resistant materials, stress corrosion, corrosion tests and testing equipment, and corrosion, general, including galvanic corrosion, corrosive effects of materials, etc.

Rock Island Arsenal Labs., Ill.
AN EVALUATION OF VOLATILE CORROSION INHIBITED OILS FOR THE INTERNAL PRESERVATION OF MACHINE TOOLS IN UNCONTROLLED STORAGE, by Robert E. Johnson. 13 Nov 59, 24p. 7 refs. Rept. no. 59-2929. AD-232 438L.
Order from LC mi$2.70, ph$4.80 PB 146 838

After two years in uncontrolled storage, five volatile corrosion inhibited (VCI) oils and three grades of conventional preservative oil were evaluated to determine their comparative protective ability for the internal protection of machine tools. It was found that MIL-C-14201A Grade 1 material was most suitable for the external preservation of machine tools in uncontrolled storage.

Uppsala U. (Sweden).
THE CRYSTAL STRUCTURE OF Pd_3Si, by B. Aronsson and Anna Nylund. Technical note no. 9 on Contract AF 61(052)40. 7 Jan 60, 17p. 19 refs. AFOSR-TN-59-1269; AD-233 277.
Order from LC mi$2.40, ph$3.30 PB 146 129

The crystal structure of Pd_3Si has been established from single crystal data. The space-group is $Pnma$, and there are four formula units in the elementary cell which has the dimensions $a = 5.735$ Å, $b = 7.55$Å, and $c = 5.260$ Å. The twelve palladium atoms are situated in 8 (d) ($x = 0.1810$, $y = 0.0508$, $z = 0.3217$) and 4 (c) ($x = 0.0053$, $z = 0.9036$) positions, and the silicon atoms occupy a 4 (c) position ($x = 0.897_6$, $z = 0.469_9$). Pd_3Si, thus, crystallizes in the cementite (DO_{11}) structure. The atomic arrangement in Pd_3Si is compared with those in isomorphous phases. (Author)

Watertown Arsenal Labs., Mass.
EFFECT OF COLD REDUCTION ON THE MECHANICAL PROPERTIES OF HEAT-TREATED Ti-6Al-4V ALLOY, by Eric B. Kula and Frank R. Larson. Apr 58, 23p. 4 refs. Technical rept. WAL TR 401/296; AD-157 805.
Order from LC mi$2.70, ph$4.80 PB 147 159

The effect on mechanical properties of cold reduction after solution treating and prior to aging was studied in a heat of Ti-6Al-4V alloy. Solution temperatures of 1700 and 1850°F for one-half hour were used, followed by four-hour aging treatments at 850 and 950°F. Cold reductions up to 41 percent for the 1700°F material and 62 percent for the 1850°F material were affected by swaging. The yield and ultimate tensile strengths are increased by deformation even after aging. In most cases, deformation also improves the tensile ductility although there may be a reduction in the impact strength. After solution treating at 1850°F, swaging 62 percent, and then aging, the ultimate tensile strength was 215,000 psi, the 0.1 percent yield strength 205,000 psi; and the reduction in area 28 to 37 percent. (Author)

Watertown Arsenal Labs., Mass.
THE RECRYSTALLIZATION TEMPERATURE OF IRON AS AFFECTED BY DILUTE TRANSITIONAL ELEMENTS, by E. P. Abrahamson, II and B. S. Blakeney, Jr. Jan 60, 15p. 3 refs. WAL TR 830. 3/1; AD-231 890
Order from LC mi$2.40, ph$3.30 PB 146 827

All of the transition elements raise the recrystallization temperature of iron. In the majority of the systems, the initial effect occurs at 0.10 atomic percent or less. All changes in rates of recrystallization temperature with added elements occur within the region of solid solubility. There is a correlation between the rate of change of recrystallization temperature with atomic percent second element and the electron configuration of the second element in the ground state. (a) Atoms with like outer electron shells behave similarly. (b) For atoms having a similar number of d-shell electrons, the fewer the s-shell electrons, the greater the effect. (c) The greater the number of filled inner electron shells, for a like outer configuration, the greater the change in properties. (Author)

Watertown Arsenal Labs., Mass.
ULTRASONIC DETERMINATION OF ELASTIC CONSTANTS AT ROOM AND LOW TEMPERATURES, by Norbert H. Fahey. Apr 60, 14p. 4 refs. Technical rept. no. WAL TR 118. 1/1.
Order from OTS $0.50 PB 161 514

Using ultrasonics, certain elastic properties of materials can be determined in a nondestructive test, which means that tests can be conducted on a finished product. With a machine which operates within the range of frequencies of 1-9 megacycles, bulk, shear and elastic moduli and Poisson's ratio can be determined. Tests were conducted at temperatures ranging from room to -452°F on steel, aluminum, molybdenum, magnesium, lead, Inconel, chromium, Monel, tantalum, columbium, brass, bronze, copper, carbon, plastic, and three titanium alloys. Some of the materials did not lend themselves to the test, due either to their microstructure or to the frequency range of the equipment. For the materials investigated, as the testing temperature decreased, the elastic and shear moduli increased, and Poisson's ratio decreased. Bulk modulus remained essentially constant. The effects of specimen size and shape, machining finishes, bonding agents, etc., are also discussed. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
OXIDATION OF TUNGSTEN AND TUNGSTEN BASED ALLOYS, by E. A. Gulbransen, K. F. Andrew and others. Rept. for 1 May 58-15 Aug 59 on Metallic Materials, Contract AF 33(616)5770. Feb 60, 86p. 48 refs. WADC Technical rept. 59-575.
Order from OTS $2.25 PB 161 718

This report describes work on a fundamental study of the oxidation of tungsten and its alloys. To understand the tungsten-oxygen system thermodynamic measurements were made on the oxides WO_3, $WO_{2.9}$ and $WO_{2.72}$. The $W_3O_9(g)$ pressures over the solid oxide phases from WO_3 to WO_2 was measured and the homogeneity range of the several oxide phases determined. Kinetic studies were made on sheet and wire specimens from 500°C to 1300°C and for a broad pressure range. Crystal structure studies and photographic studies were made on the oxide scales. All the results suggest that the mechanism of oxidation is very complex. At 500°C and lower the reaction is probably diffusion controlled. Above 600°C localized edge type of reaction adds a complication. Above 1200°C the oxidation reaction is similiar to the combustion of graphite. The rate of oxidation is limited by the access of oxygen to the surface. (Author)

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
SEMI-ANNUAL REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION, by W. F. G. Swann. Rept. on Contract N6ori-144. 15 Mar 47, 78p. ATI-150 224.
Order from LC mi$4.50, ph$12.30 PB 146 952

Contents:
Cosmic ray investigations
Nuclear physics
Investigations of counters
Linear accelerator
(Report reproduces poorly)

Noyes Chemical Lab., U. of Illinois, Urbana.
ISOTOPE EFFECTS IN HIGH RESOLUTION NMR SPECTROSCOPY, by H. S. Gutowsky. Technical rept. no. 18 on Contract Nonr-1834(13). 6 May 59, 6p. 8 refs. AD-219 836.
Order from LC mi$1.80, ph$1.80 PB 146 449

Fluorine resonance in the CF_2D group of n-C_3F_7D is shifted upfield by $0.60 \pm 0.05 \times 10^{-6}$ from that in the parent compound, n-C_3F_7H, while there is a smaller upfield proton shift for the CH_2D group in OCH_2D of $0.015 \pm 0.002 \times 10^{-6}$ with respect to CH_3 in OCH_3. Proton shifts of the same magnitude have been noted in several pairs of compounds. The main purpose of this note is to suggest that the differences in vibrational amplitudes of D and H atoms are the primary cause of such isotopic shifts.

Elementary Particles

[Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.]
ON THE REPRESENTATION OF THE SOLUTIONS OF THE RESTRICTED PROBLEM OF THREE BODIES BY POWER-SERIES, by Richard Schulz-Arenstorff. 30 Mar 59, 31p. 3 refs. Rept. no. DC-TR-1-59; AD-213 701.
Order from LC mi$3.00, ph$6.30 PB 145 966

The problem considered consists of the description of the solutions of the equations of motion for a particle with mass zero under the gravitational attraction of two positive masses, which revolve in plane circles around their center of gravity. This is nearly the situation for a lunar probe flight.

Cambridge U. (Gt. Brit.)
PHYSICAL LIMITATIONS TO DISPERSION RELATIONS, by John G. Taylor. Technical scientific note no. 3 on Contract AF 61(052)233. Jan 60, 27p. 20 refs. AFOSR-TN-60-276.
Order from LC mi$2.70, ph$4.80 PB 146 443

Limitations to the validity of dispersion relations arising in the general proof of these relations is discussed by considering fourth order perturbation theory. The exchange scattering of equal mass bosons or nucleons gives a limitation to the general proof, but closer analysis shows this limitation can be removed. The direct scattering term gives no limitation when anomalous thresholds are absent, but when they are present shows that the general proof cannot be applied to this case. A direct analysis in this latter case shows that the dispersion relations are not violated for any momentum transfer, though the two-dimensional representation is. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
CONSTRUCTION OF COUPLED SCATTERING AND PRODUCTION AMPLITUDES SATISFYING ANALYTICITY AND UNITARITY, by J. D. Bjorken. Technical note no. 14 on Contract AF 49(638)388. Mar 60, 9p. 6 refs. AFOSR-TN-60-394.
Order from LC mi$1.80, ph$1.80 PB 146 875

A practical method has been found for computing coupled scattering and production processes within the framework of dispersion theory. (Author)

Johns Hopkins U., Baltimore, Md.
ANGULAR DISTRIBUTION OF K_L - MESON SECONDARIES, by E. B. Brucker and A. Pevsner, and others. Rept. on Contract AF 18(603)143. Jan 60, 10p. 1 ref. AFOSR-TN-60-94.
Order from LC mi$1.80, ph$1.80 PB 146 928

Johns Hopkins U., Baltimore, Md.
THE MASS OF THE Λ^o HYPERON, by Edward Byerly Brucker. Thesis. Rept. on Contract AF 19(603)143. Jan 60, 81p. 60 refs. AFOSR-TN-60-72.
Order from LC mi$4.80, ph$13.80 PB 146 927

The mass of the Λ^o -hyperon was determined in nuclear emulsion from the range and the relative orientation of the decay particles of twenty-five Λ^o decays. The new determination resulted in a Λ^o mass of 1115.55 ± 0.15 Mev, which corresponded to a Q-value of 37.71 ± 0.14 Mev. This new Q-value averaged with that of Barkas yielded a binding energy for ΛH^3 of $+0.12 \pm 0.26$ Mev. The density and thicknesses of the pellicles of the emulsion stack were accurately determined using, respectively, Archimedes' principle and a dial indicator.

Washington U., St. Louis, Mo.
A MEASUREMENT OF THE LONGITUDINAL POLARIZATION OF Pr^{144} BETA-PARTICLES, by Werner Alfred Wilhelm Mehlhop. Doctoral thesis. Technical rept. no. 26 on Contract AF 18(603)108. 22 Feb 60, 112p. 46 refs. AFOSR-TN-59-1323.
Order from LC mi$6.00, ph$18.30 PB 147 144

A precision determination of the longitudinal polarization of the beta particles from radioactive Pr^{144} is reported. The polarization sensitive process utilized in this experiment is Møller-scattering, i.e. the scattering of free electrons by free electrons. A major feature of the apparatus is the detection of the two final state electrons (the original one and the one knocked out of the foil) in fast coincidence; this technique, necessary to distinguish the relatively scarce Møller-events from the hugh background of nuclear scatterings, at the same time discriminates against various undesired scatterings off chamber walls etc., all these scatterings being non-coincident. The thesis contains a thorough discussion of the two nuclei under investigation (Pr^{144} and the reference nucleus Y^{90}), especially from the point of view of small theoretical corrections potentially altering the simple $\frac{v}{c}$ - dependence of the polarization.

Instruments and Installations

Army Signal Research and Development Lab., Fort Monmouth, N. J.
IRRADIATION OF SEMIRAD AT THE GENERAL ATOMIC LINEAR ACCELERATOR (LINAC), 5 MAY 1959, by Stanley Kronenberg and Harry M. Murphy, Jr. 1 Sep 59, 17p. 2 refs. USASRDL Technical rept. 2070; AD-226 991.
Order from LC mi$2.40, ph$3.30 PB 146 787

Semirad instruments were irradiated with short bursts of gamma radiation at the linear electron accelerator (LINAC), General Dynamics Corp., San Diego, Calif. The purpose of the experiment was to determine Semirad response to radiation pulses of less than 10-μsec duration. Semirad instruments were exposed to the LINAC radiation source, and signals from the Semirad were transmitted to a triggered oscilloscope and the traces photographed. The Semirad response demonstrated that the time resolution was on the order of 10 μsec or less. An interesting side effect was observed, viz., secondary-electron energies of >300v were noted. These high-energy secondary electrons are as yet unexplained. (Author)

Convair, Fort Worth, Tex.
CONVAIR REMOTE-AREA FAST-NEUTRON MONITOR, by A. H. Smith. Rept. on Contract AF [33](600)32054. 4 Aug 58, 30p. NARF 58-30T; MR-N-182; AD-201 127.
Order from LC mi$2.70, ph$4.80 PB 147 596

A multichannel system of remotely operated, fast neutron detectors for dose rate measurements to 20 rem/hr in the energy range from 0.1 to 10 Mev is described. The application of this system in health physics monitoring of neutron dose rates in reactor operation areas is discussed. A general description of the electronic system is followed by a detailed consideration of the system broken down into its functional units: a detector preamplifier, linear amplifier, pulse shaping network, digital-to-analog conversion network, differences amplifier and dose rate recorder. (Author)

Maryland U., College Park.
FINAL PROGRESS REPORT. Rept. for 24 Feb 50-31 Dec 58 on Contract NObsr-49066. [1958] 8p. AD-216 000.
Order from LC mi$1.80, ph$1.80 PB 147 369

The two general phases of work on halogen counters are reported: exploration and application. An outline of the accomplishments of the first phase is included. The second phase has been devoted to the construction of geiger counters and is summarized under the following categories: U. S. Patent Application no. 666, 831; all glass vacuum gauge; the use of chlorine 36 to study the action of chlorine gas in contact with various metal and glass surfaces; and the construction of some counters from the standpoint of obtaining a high degree of stability.

Naval Radiological Defense Lab., San Francisco, Calif.
AN ALPHA SURVEY RADIAC FOR FIELD USE, by K. Sinclair and G. Kiyoi. 14 May 59, 32p. 9 refs. Research and development technical rept. USNRDL-TR-326; AD-218 286.
Order from LC mi$3.00, ph$6.30 PB 147 376

An alpha survey radiac employing a photomultiplier tube and scintillation detector was developed. The instrument utilizes transistor circuitry and operates from 2 standard flashlight batteries. Four linear ranges are provided with full scale indication on the highest range corresponding to 10,000 $\mu g/m^2 Pu^{239}$. The instrument was designed with a separable probe and a telescoping extension for easier ground monitoring. A thorium metal source is attached to the instrument housing for checking instrument calibration in the field. The device conforms satisfactorily to the military requirements for altitude, humidity, vibration, shock, and storage. The operational battery life is in excess of 40 hours. Instrument error at low temperatures slightly exceeds the ±20% accuracy requirement; however, adequate measurements are readily made by using the thorium check source to provide a check point. Instrument response to low energy X-rays is excessive. However, tests indicate that a simple lead filter will eliminate this difficulty. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
A FLAME PHOTOMETRIC APPARATUS FOR THE DETERMINATION OF RADIOACTIVE MATERIALS, by M. Honma. 24 Apr 56, 11p. 6 refs. Research and Development technical rept. USNRDL-TR-83; AD-99 256.
Order from LC mi$2.40, ph$3.30 PB 147 015

Quantitative determinations with the flame photometer are generally carried out without regard to the combustion products. The gases and particulate matter evolved from the combustion are usually allowed to diffuse into the room. At best, if the oxidation products are thought to be harmful the flame photometer is operated in an efficient hood. However, when radioactive solutions have to be analyzed by the flame photometer they cannot be run under ordinary circumstances. Since health hazards and spatial contamination are prime considerations when running these solutions, provisions must be made so that the radioactive particles can be contained and controlled. A triple-filter apparatus has been devised to be used with the flame photometer in which the radioactive particles are filtered out before the exhaust gases are discharged. The operational techniques for the apparatus are discussed. A table showing the contamination of the various parts of the apparatus after an 80-hr run is presented. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
A LOW RANGE BETA-GAMMA SURVEY METER, by M. H. Eklund and G. A. Work. 3 Feb 58, 54p. 5 refs. Research and Development technical rept. USNRDL-TR-255; AD-205 624.
Order from LC mi$3.60, ph$9.30 PB 147 377

A low range beta-gamma survey meter employing halogen-quenched G-M tubes and transistor circuitry has been developed. The instrument measures gamma radiation from 0 - 500 mr/hr in four linear ranges and provides beta indication on all ranges. The instrument has been conservatively designed to meet military specifications. A transistor oscillator converts battery voltage to regulated high and low voltages, giving more than 400 hours of operation with two easily obtainable flashlight cells. The use of a corona regulator has been avoided. The rate-meter is an advanced zero-stable diode pump circuit requiring no pulse-width range switching. The survey meter has been packaged in a form providing easy handling with one-hand operation for some monitoring applications. The instrument is also alpha sensitive, reading an equivalent 2 mr/hr in contact with a plutonium source of 5.10^{-3} micro-curies/cm^2. (Author)

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
A SURVEY OF CURRENT RESEARCH AND DEVELOPMENTS IN THE FIELD OF DOSIMETRY (FIRST ADDENDUM) by Mary J. Oestmann and J. F. Kircher. Rept. on Contract AF 33(616)5171. 31 Mar 59, 21p. 40 refs. REIC rept. no. 6 (Addendum); AD-210 766.
Order from LC mi$2.70, ph$4.80 PB 147 104

This is the first addendum to the REIC Report No. 6 "A Survey of Current Research and Developments in the Field of Dosimetry" Very few new dosimeter concepts have been reported during the past year. Advances made during 1958 consist primarily of refinements of the previously established dosimeter systems. Investigations have involved reaction mechanisms and the determination of more accurate G-values. An appropriate choice of materials has helped to extend the useful range of some dosimeters. Standard foils and methods of measurement of these foils are being developed for neutron dosimetry. Further details on any one system may be found from the extensive bibliography provided. (Author) (See also PB 151 571)

Nuclear Engineering and Power

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE FEASIBILITY OF REDUCING THE COST OF DISPOSAL OF REACTOR WASTES BY USING FISSION PRODUCTS AS HEAT SOURCES, by Luther M. Hardin and Robert P. Beckelheimer. Nov 59, 50p. 26 refs. CWLR 2307; AD-229 969.
Order from LC mi$3.30, ph$7.80 PB 146 757

Predictions and calculations are presented for (1) the rate of growth of the nuclear-power industry, (2) the total fission-product power per unit reactor power (3) the useful fission-product heat output per unit reactor power, (4) the useful heat output from all the fission products resulting from the nuclear power industry during the period 1960 to 1980. Costs involved in the production of heat are compared with the value of the heat produced. (Author)

Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
SOME NEW TYPES OF NEUTRON-SHIELDING MATERIALS, by Anthony N. Fasano. Research conducted at Brookhaven National Labs. June 59, 7p. WADC Technical note 59-227.
Order from OTS $0.50 PB 161 308

Materials having high neutron-absorption cross sections are needed for protecting gamma and neutron detectors from thermal-neutron damage and to form collimators for beams of neutrons. Boron or lithium, as the powdery compounds B_4C and LiF, could absorb the neutrons, but as powders are impossible to apply or form into protective shields. Processes were developed using inexpensive plastic, paraffin, and linseed oil as bonds and G.E. thinner, Saurizen thinner, trichlorethylene, and turpentine as solvents to produce materials that can be molded, formed, cast, rolled, or painted as a protective shielding or coating. Methods were devised for reclaiming the expensive boron and lithium compounds. (Author)

Nuclear Reactions

Naval Research Lab., Washington, D. C.
A STUDY OF PHOTONS IN SODIUM IODIDE SCINTILLATION CRYSTALS, by Charlotte M. Davisson and L. A. Beach. Final rept. 31 Dec 59, 75p. 23 refs. NRL rept. 5408.
Order from LC mi$4.50, ph$12.30 PB 146 030

Using Monte Carlo methods coded for computation by the Narec digital computer, a study has been made of the interactions within NaI(Tl) crystals of photons incident along the center axis of cylindrical crystals. Incident energies studied were 0.3, 0.5, 0.7, 1.0, 1.2, and 1.5 Mev, and crystal sizes ranged from 1 in. diameter by 1 in. long to 5 in. diameter by 8 in. long. Pair production was included only as an absorption,

and the results were not modified by any response function of counting and recording instruments. The results are presented in a way that shows the variation with incident energy, with crystal diameter, and with crystal length of the following: (a) histogram distributions of the energy given to the crystal by the photons, (b) photoefficiencies, (c) photofractions, (d) number of collisions within the crystals, and (e) the geometrical distribution of the emerging, scattered photons. Constants for an empirical equation for photofractions as a function of incident energy dimensions were obtained from the results and can be used to estimate photofractions for any incident energy and crystal size in the ranges studied. (Author)

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
STUDY OF SOME REACTIONS OF 15 MEV DEUTERONS WITH THE LITHIUM ISOTOPES, by Ernst Wolfgang Hamburger. Doctoral thesis. Technical rept. no. 12 on Precision Scattering of Nuclear Particles, Contract N7onr-32505. Apr 59, 132p. 47 refs.
Order from LC mi$6.90, ph$21.30 PB 146 035

Metallic targets of enriched Li^6 and Li^7 were bombarded with 15 Mev deuterons. The results of the (d, p),(d,t) and (d,He^3) reactions were compared with stripping theory and with the predictions of the shell model. The agreement is, in general, satisfactory.

Radioactivity

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PORTABLE REMOTELY OPERATED DEVICE FOR PRODUCING A GAMMA RADIATION FIELD, by Ralph E. Rexroad and Murray A. Schmoke. Dec 59, 21p. 2 refs. CWL Special Pub. 3-8; AD-231 042.
Order from LC mi$2.70, ph$4.80 PB 146 857

A portable field device is described for lifting a high-intensity gamma radiation source from its shield without exposing the personnel involved to harmful radiation. The device raises the radioactive source from its steel-jacketed lead shield by air pressure. High-level radiation fields can be produced with this system with very little exposure of test personnel to radiation.

Institute of Engineering Research, U. of California, Berkeley.
ON THE SMALL-SCALE NON-HOMOGENEITY OF FALLOUT DEPOSITION, by G. M. Corcos. Rept. on Contract CD-SR-58-40. 30 Oct 58, 54p. 11 refs. Series no. 2, issue no. 2; OCDM-UCAL-2-2-58.
Order from LC mi$3.60, ph$9.40 PB 147 391

The main contributions of the present report are to provide a guide to the testing of fallout deposition and to adduce evidence that inhomogeneous depositions should be expected, mostly through the larger particles.

Naval Radiological Defense Lab., San Francisco, Calif.
ANALYSIS OF RADIOLOGICAL DECONTAMINATION DATA OBTAINED FROM FIELD TESTS, by C. F. Miller. 3 Apr 59, 86p. 7 refs. Research and development technical rept. USNRDL-TR-321; AD-219 720.
Order from LC mi$4.80, ph$13.80 PB 147 379

Reclamation data from Operation Plumbbob are used to illustrate a method of treating and analyzing such data obtained in field-test experiments. The method utilizes available radiation-scattering computations to estimate the contribution of radiation sources outside reclaimed areas to the radiation field inside the areas. These contributions are then subtracted to determine a more accurate value of the true effectiveness of the reclamation procedure of procedures. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
GAMMA DECAY OF FISSION PRODUCTS FROM THE SLOW-NEUTRON FISSION OF U^{235}, by Carl F. Miller. 11 July 57, 106p. Research and Development technical rept. USNRDL-TR-187; AD-147 420.
Order from LC mi$5.70, ph$16.80 PB 147 393

Photon energy radiation rates and photon emission rates from the fission products produced by slow-neutron bombardment of U^{235} are computed, using nuclear decay scheme data and the results of new computations for the gross activity in terms of disintegration rate. The computed rates were used to determine, as a function of time after fission, the mean photon energy per disintegration, and the number of beta rays per photon. Curves showing photon energy radiation rates, photon emission rates, and beta rates for a time range of about 46 minutes to about 300 years after fission are presented. A comparison is made of activity and the computed photon energy radiation rates for 1 hr to 3 years after fission. The computed decay curves for 10^4 fissions from slow-neutron fission of U^{235} using the USNRDL 4-pi Ionization Chamber is presented. (Author)

Naval Radiological Defense Lab., San Francisco, California.
PHYSICAL, CHEMICAL, AND RADIOLOGICAL PROPERTIES OF SLURRY PARTICULATE FALLOUT COLLECTED DURING OPERATION REDWING, by N. H. Farlow and W. R. Schell. 5 May 57, 17p. 7 refs. Research and Development Technical rept. USNRDL-TR-170; AD-145 733.
Order from LC mi$2.40, ph$3.30 PB 147 381

The properties of individual fallout particles produced by nuclear detonations at zero height over shallow sea water are analytically described for the first time. The particles produced during Operation REDWING were slurry masses composed of water, dissolved and crystalline sea salts, and seawater-insoluble solids from the weapon, barge, and ocean floor. Special techniques were used to measure the chloride, water, and insoluble-solids content of individual slurry particles. Autoradiography showed that the activity is primarily associated with the solids. A table of

experimental data presents particle size versus time of arrival after detonation as well as measurements of particle density and relative specific activity. Estimates of mass and relative activity of fallout per unit area for certain locations about the shot point are shown. (Author)

Naval Research Lab., Washington, D. C.
A STANDARD SOURCE OF RADIATION FOR RADIAC DETECTORS. PART II. EXTENSION OF THE RANGE OF EXPOSURE-DOSE RATES AND THE NEW Cs-137 SOURCE, by A. E. Nash and W. E. Kunz. 22 Apr 60, 14p. 8 refs. NRL rept. 5462.
Order from LC mi$2.40, ph$3.30 PB 145 058

Four facilities of similar design to produce standard gamma-ray fields have been constructed and calibrated for use with cobalt-60 and cesium-137 sources. These facilities provide four intensity ranges, two of which, the low and the medium ranges (the medium range was formerly called the high range), have previously been described and calibrated. The low range covers the region between background and 0.5 r/hr using interchangeable sources of Co-60, Cs-137, and Ra. The medium range, using Co-60, extends the field to 50 r/hr. The two new higher ranges extend the exposure-dose rate for the Co-60 source (150 curies) in one case and introduce a new source of Cs-137 (100 curies) in the other. The range of calibrated gamma-ray intensity now includes the region from background to over 2000 r/hr for Co-60 and to 800 r/hr for Cs-137. In addition to the calibration of the two new facilities, the older medium range has been recalibrated using a carbon ionization chamber, for which a calibration procedure has been adapted from a standard procedure. The two new sources are being used in conjunction with the new 300-kev x-ray facility to provide energy calibration points for energy-dependence measurements. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB. Ohio.
MAGNETIC SHOES FOR HUMAN ORIENTATION IN SPACE, by J. F. Nicholson and D. W. Naas. Rept. on Solid State Research and Properties of Matter. Feb 60, 12p. 6 refs. WADC TN-59-352.
Order from OTS $0.50 PB 161 727

This report describes both permanent and electromagnetic shoes for human orientation in a weightless environment. The electromagnetic shoes operate on a low voltage power source which may be adjusted to the individual requirements of the wearer. A microswitch which interrupts the magnetic circuit each time the heel is raised reduces walking fatigue and increases the operational life of the batteries. An inertia switch is included in the magnetic circuit as a safety device. When the switch senses any sudden acceleration or deceleration, it shunts the potentiometer and allows additional current to flow to the electromagnet thereby increasing the holding force. (Author)

Maritime Administration, Washington, D. C.
OFFICER AND CREW STANDARD FURNITURE. Drawings prepared by Raymond Loewy Associates on Contract MA-1755. June 60, 49p.
Order from OTS $1.50 PB 161 768

Quartermaster Research and Engineering Center, Natick, Mass.
PONCHO, LIGHTWEIGHT, OD, W/HOOD (PROTECTIVE), FINAL DEVELOPMENT AND ENGINEERING TEST OF, by S. J. Shurtleff. July 58, 26p. 10 refs. Technical rept. CP-8.
Order from LC mi$2.70, ph$4.80 PB 138 275

Military characteristics for protective clothing and equipment require that the items be non-flammable, protective against thermal and CBR agents, and that present standard items of field clothing be considered in meeting these objectives. The protective poncho described represents progress made by the Quartermaster Corps to meet these combined requirements. The protective poncho is made in the same design as the standard vinyl-coated poncho, but is fabricated of a neoprene-coated Fortisan fabric.

Tropical Deterioration Administrative Committee, Office of Scientific Research and Development.
TROPICAL DETERIORATION OF EQUIPMENT AND MATERIALS. Summary technical rept. vol. 1, Contract OEMsr-1131. 1946, 100p. 89 refs.
Order from LC mi$5.40, ph$15.30 PB 139 781

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Organisms associated with tropical deterioration
Prevention of deterioration of optical instruments
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Tropical deterioration of photographic equipment and supplies
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PHYSICS

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TRANSISTOR PHYSICS AND ELECTRONICS, LECTURES GIVEN SEPT. 1952-JUNE 1953, by W. H. Duerig, J. F. Jenkins, Jr. and others. Rept. on Contract NOrd-7386. Oct 53, 431p. 69 refs. TG-220.
Order from LC mi$11.10, ph$66.60 PB 147 283

This set of lecture notes was prepared to introduce electronics engineers to the subject of transistors and their application techniques.

California U., Berkeley.
THE THRESHOLD CRITERIA FOR ELECTRICAL BREAKDOWN AND SPARK BREAKDOWN IN GASES, by Leonard B. Loeb. Rept. on Contract Nonr-222(44). [1958] 23p. 48 refs.
Order from LC mi$2.70, ph$4.80 PB 137 959

Columbia U., New York.
POINCARÉ AND THE SHORTCOMINGS OF THE HAMILTON-JACOBI METHOD FOR CLASSICAL OR QUANTIZED MECHANICS, by L. Brillouin. Quarterly rept. no. 5 on Contract Nonr-266(56). 31 July 59, 23p. 7 refs. AD-219 928.
Order from LC mi$2.70, ph$4.80 PB 147 069

Institute of Mathematical Sciences, New York U., N. Y.
DIFFRACTION BY AN ELLIPTIC CONE, by Lester Kraus and Leo M. Levine. Rept. on Contract AF 19(604)5238. Mar 60, 32p. 11 refs. Research rept. no. EM-156; AFCRC-TN-60-195.
Order from LC mi$3.00, ph$6.30 PB 147 527

The boundary value problems corresponding to a spherical wave incident on an acoustically soft or hard elliptic cone, or plane angular sector, are solved. The method of separation of variables in a sphero-conal coordinate system is used. The special functions which arise are simply periodic and nonperiodic solutions of the Lame differential equation. (Author)

Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON EFFECTS OF NUCLEAR RADIATION ON MAGNETIC AND DIELECTRIC MATERIALS: INSTRUMENTATION, by S. I. Taimuty, C. A. Rosen and others. Scientific rept. no. 3 on Contract AF 19(604)4141. 10 Nov 59, 23p. 8 refs. AFCRC-TN-59-990; AD-232 109.
Order from LC mi$2.40, ph$7.80 PB 145 970

As the first part of a project to study the effect of nuclear radiation on magnetic and dielectric materials, three instruments have been developed to measure radiation-induced changes in the properties of magnetic and ferroelectric materials. One is a magnetic hysteresigraph for recording hysteresis loops in toroidal magnetic samples at frequencies of 400 cps to 100 kcps. The second is an apparatus employing a bridge technique for small-signal magnetic permeability measurements at frequencies of 15-640 kcps. The third is a ferroelectric hysteresigraph for recording hysteresis loops in ferroelectric materials at frequencies of 60-10,000 cps. (Author) (See also PB 161 115)

Acoustics

General Applied Science Labs., Inc., Westbury, N. Y.
THE NOISE FIELD OF A SUBSONIC JET, by Gino Moretti and Simon Slutsky. Rept. on Contract AF 49(638)194. Nov 59 169p. 8 refs. GASL Technical rept. no. 150; AFOSR-TN-59-1310.
Order from LC mi$7.80, ph$25.80 PB 147 321

The acoustic far field of a singularity is investigated under several different conditions of the medium. The simple cases of a source in an infinite wind, as observed at a fixed or a moving point, are analyzed to permit comparison with physical systems of practical interest, e.g., jet engine fly-by noise analysis. Widespread misunderstanding of the Lighthill Mach number dependence has been noted and clarified by means of the above analysis. The far field of a singularity imbedded in a jet has been determined as a function of jet velocity and temperature distribution with special emphasis on the case of uniform distribution in the jet. Comparison of experimental results is made and fair agreement noted. Factors involved in failure to obtain complete agreement are discussed. (Author)

[Max-Planck Institut für Strömungsforschung (Germany)].
EXPERIMENTS RELATING TO THE INTERACTION OF SOUND AND TURBULENCE, by Dieter W. Schmidt. Rept. for 1 Dec 58-30 Nov 59 on Contract AF 61(514)1143. [1960] 20p. 6 refs. AFOSR-TN-60-347.
Order from LC mi$2.40, ph$3.30 PB 147 110

The paper gives some new experimental results about the scattering of sound by a turbulent flow. The dependence of the scattering on the frequency of sound and on the direction of the scattering vortices was investigated. In both cases good agreement was obtained between the measurements and theoretical predictions. Additionally, some equipment is described which facilitates the use of hot-wires for the measuring of turbulence. Especially, design characteristics of an apparatus are given, by which hot-wire probes can be rewired precisely and quickly. (Author)

Naval Ordnance Test Station, China Lake, Calif.
THE DISPLACEMENT TRANSDUCER: A DEVICE FOR MEASURING LINEAR DISPLACEMENT, by D. E. Melton. 7 Nov 58, 25p. 2 refs. NOTS TP-2139; NAVORD rept. 6433; AD-214 236.
Order from LC mi$2.70, ph$4.80 PB 146 978

A linear-displacement measuring device was designed and tested. The device, known as the Displacement Transducer, has been used to determine the inward diametrical deflection of the walls in cylindrical pressure vessels when such vessels are subjected to external hydrostatic pressure. (Author)

Navy Electronics Lab., San Diego, Calif.
INTERLEAVED-PLATE ELECTRODYNAMIC TRANSDUCER. PART 1. STATIC THRUST ANALYSIS, by Burwell Goode. 11 Dec 58, 11p. 1 ref. Research and Development rept. 883; AD-214 347.
Order from LC mi$2.40, ph$3.30 PB 146 977

An electrodynamic transducer has been designed to serve as a broadband low-frequency underwater sound source, putting a reasonable amount of power into the water for the range 20 to 2000 cps. It is a camera-size, twin-piston transducer, with parallel plates of copper or aluminum windings, separated by silicon iron strips, serving as driving components. A thrust formula was derived and compared with the experimental values of a pilot model. The vibrator can deliver 200 pounds of rms thrust for pulse operation. (Author)

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
THE EVALUATION OF SURFACE REVERBERATION IN SONAR, by J. Warren Horton. 4 Mar 59, 19p. 22 refs. USL Research rept. no. 422; AD-217 108.
Order from LC mi$2.40, ph$3.30 PB 147 378

A significant factor affecting the magnitude of the acoustic energy returned to a source point in the ocean as a result of back-scattering from the ocean surface is the coefficient by which to multiply the incident intensity at a scattering point to obtain the surface area derivative of the intensity of the scattered energy, as measured at unit distance from this point. This scattering coefficient is a function of the angle between the path by which energy reaches and leaves the scattering surface and this surface. To compute the apparent plane wave intensity of the energy returned to the source point, at any instant, it is necessary to evaluate the derivative of the free-field intensity of this energy with respect to area of scattering surface. This derivative is a function of (1) the scattering coefficient, (2) the propagation factor applying to the path between source point and scattering point, (3) the relative transmitting and receiving responses of the transducer applying to this path, and (4) the index intensity of the transmitted energy pulse. The value of the integrand appearing in the expression for the intensity of the received energy may be measured, as a function of time, by observing the rate of change of this energy with change in pulse length. Since all factors in this integrand except the scattering coefficient may be evaluated, this coefficient may be determined. This method is theoretically ideal and operationally practical. (Author)

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
MUTUAL RADIATION IMPEDANCE BETWEEN PISTONS ON SPHERES AND CYLINDERS, by Carles H. Sherman. 24 Nov 58, 32p. 24 refs. USL Research rept. no. 405; AD-207 686.
Order from LC mi$3.00, ph$6.30 PB 147 382

Determination of the mutual radiation impedance coefficient is shown to be the essential part of the acoustic radiation problem for an array of interaction pistons. Expressions for this coefficient are derived in the cases of circular and rectangular pistons on a rigid sphere and rectangular pistons on an infinite, rigid cylinder. Numerical data showing the real and imaginary parts of this coefficient as a function of the separation between circular pistons on a sphere are presented for several values of ka. (Author)

Electricity and Magnetism

Indiana Steel Products Co., Valparaiso.
THE REMANENCE OF ALNICO V AND VI MAGNETS BETWEEN ROOM TEMPERATURE AND 550°C, by Rudolf K. Tenzer. Rept. for Nov 55-Aug 59 on Magnetic Materials, Contract AF 33(616)3385. Jan 60, 21p. 2 refs. WADC Technical rept. 59-438.
Order from OTS $0.75 PB 161 708

Because Alnico V and VI magnets have been found suited for use at temperatures up to 550°C, the behavior of remanence in such magnets was studied closely at elevated temperatures. Temperature effects on the remanence of a magnet are clearly classified and defined: (a) reversible (b) irreversible and (c) effects due to changes in the material. These effects were determined on Alnico V and VI magnets at temperatures up to 570°C for periods as long as 1000 hours. Material effects of a few percent can be minimized for magnet applications between 350°C and 550°C by heat treating at the highest operating temperature for at least 24 hours. Irreversible effects can be eliminated by cycling the magnets between room temperature and the highest operating temperature. After stabilization, remanence varies less than ±1% at elevated temperatures during exposures up to 1000 hours. Reversible effects vary according to the type of material and the temperature range in which a magnet is stabilized. (Author)

National Bureau of Standards, Boulder, Colo.
DYNAMIC MEASUREMENTS OF THE MAGNETO-ELASTIC PROPERTIES OF FERRITES, by Virgil E. Bottom. [1957] 54p. 12 refs. Technical note no. 49.
Order from OTS $1.00 PB 151 408

The relations between the mechanical and magnetic properties of a ferrite are derived for the small signal or reversible condition using thermodynamic principles. The equation of motion of a ferrite ring driven in its fundamental mode is set up and solved leading to the equivalent electrical circuit of the magnetostriction resonator. From mechanical measurements of the density and dimensions of the ring and electrical and frequency measurements of the resonator, the elastic modulus, permeability, magnetostriction coefficients and loss factors in the ferrite can be determined. Apparatus is proposed for performing the above measurements. (Author)

Electronics

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PROCEEDINGS OF THE ANNUAL SYMPOSIUM ON FREQUENCY CONTROL NO. 13, 12-14 MAY 1959, ASBURY PARK, N. J. 21 Aug 59, 739p. 107 refs.
Order from LC mi$11.10, ph$111.90 PB 146 982

See also PB 142 945

Canterbury U. (New Zealand).
SOUTHERN HEMISPHERE METEOR RADIANTS AND RATES. PART (a) METEOR RATES WITH CONSTANT PARAMETERS, by C. Ellyett, C. S. L. Keay and others. Scientific rept. no. 1 on Contract AF 64(500)6. 27 Oct 59, 20p. 5 refs. AFCRC-TN-59-964; AD-232 112.
Order from LC mi$2.40, ph$3.30 PB 146 131

An experiment is conducted to obtain continuous observation of all-sky radar-meteor rates over a year. This study involved a critical appraisal of all the experimental factors which can introduce spurious rate variations. Apparatus is described. Both artificial and galactic noise cause errors. A special design of receiver, using two IF channels, largely overcomes the artificial noise. The galactic noise can be overcome by a self-compensating video stage. A riometer was built to study radio noise of auroral origin, and to provide complementary data to the meteor receiver in assessing the effect of noise variation on meteor rate counts. (Author)

Case Inst. of Tech., Cleveland, Ohio.
STUDY OF CONTROL OF APERTURE FIELDS. Scientific rept. no. 10 for 1 June-30 Nov 59 on Contract AF 19(604)3887. [1959] 55p. 19 refs. AFCRC-TN-60-155.
Order from LC mi$3.60, ph$9.30 PB 146 918

Anisotropic properties of artificial dielectrics: shunt susceptance of planar array of circular discs, evaluation of interaction fields, and variational formulation for shunt susceptance; Diffraction of a plane wave by a reflector; Solid angle reflector synthesis; and measurement of surface currents. (See also PB 139 897)

Electronics Research Lab., Stanford U., Calif.
THE MECHANISM OF RADIO REFLECTIONS FROM METEORIC IONIZATION, by Von R. Eshleman. Technical rept. no. 49 on Contract N6onr-251, T.O. 7. 15 July 52, 137p. 46 refs. ATI-163 933.
Order from LC mi$6.90, ph$21.30 PB 146 479

The development of a theory of radio reflections from cylinders of ionization is undertaken in order to explain the characteristics of radio echoes from meteor trails. It is found that the field strength of a radio wave reflected from an ionization column is dependent upon the polarization of the incident wave with respect to the cylinder axis, the size of the column, the total number of electrons per unit of length along the column, and the radial variation of electron volume density. Two theoretical approaches to the problem are investigated. One approach is obtained by solving the electromagnetic wave equation for dielectric columns with cylindrical symmetry, while the other method consists of summing the fields scattered by the individual electrons in the column.

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
THE CONDUCTANCE OF A SLOT IN AN ARRAY ANTENNA, by S. J. Rabinowitz. Rept. on Contract AF 19(122)458. 31 Dec 58, 23p. 16 refs. Technical rept. no. 192; AD-209 908.
Order from LC mi$2.70, ph$4.80 PB 146 210

The driving point impedance of an element in an array antenna is different from its value when it is isolated in free space. This difference is due to the mutual coupling between elements of the array. The conductance of a slot element in a planar array or in a linear array is found. The calculations are based on well-known antenna gain and pattern relations. Complete agreement between these values and those found by different methods results. (Author)

Naval Research Lab., Washington, D. C.
COMPARISON OF MICROWAVE AND LANGMUIR PROBE TECHNIQUES FOR THE INVESTIGATION OF ELECTRICAL DISCHARGES, by R. C. Jones, C. M. Howe, and J. L. Ahearn. Interim rept. 21 Apr 60, 20p. 11 refs. NRL rept. 5468.
Order from LC mi$2.40, ph$3.30 PB 145 350

Properties of rocket motor exhausts have been studied at NRL by propagating focused microwave energy through them. In this study, the exhaust was replaced by an electrodeless discharge. The attenuation was measured and then compared with that predicted on the basis of a given electron density and collision frequency. These parameters were arrived at by probe measurements. Agreement between the two methods fell within the range of accuracy of measurement. (Author)

Oxford U. (Gt. Brit.)
HARMONICS FROM A MICROWAVE GAS DISCHARGE, by N. R. Bierrum and D. Walsh. Technical note no. 5 on Contract AF 61(514)1183. [1959] 11p. 5 refs. AFOSR-TN-60-280.
Order from LC mi$2.40, ph$3.30 PB 146 441

Harmonic power from a 10 cm. wavelength glow discharge in neon has been detected down to 6 mm wavelength (18th harmonic). The fundamental power is fed from the waveguide to a coaxial line terminated by the discharge tube. A second smaller waveguide is coupled to the coaxial line to extract the harmonic power. With careful matching at each wavelength, the conversion loss appears to fall off by only 3-4 db per harmonic after an initial drop of 35 db to the third harmonic (lowest harmonic measured). A typical conversion loss from 10 cm. to 8 mm (12th harmonic) is 63 db, e. g. 20 kW input, 10 mW output. In general the output power increases with input power until arcing in the mount spoils the measurement. A pressure range of 5-39 mm. Hg. has been used. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
ANTENNA HEIGHTS AND INTERFERENCE REDUCTION, by Benjamin Lindeman. Apr 60, 28p. 4 refs. RADC-TN-60-45.
Order from LC mi$2.70, ph$4.80 PB 146 922

The use of receiving antenna height adjustment to minimize interference effects is explored in detail. A working set of formulas and nomograms is provided to assist design and installation personnel in establishing antenna heights, in order to increase compatibility of equipments that are in close proximity. (Author)

Syracuse U. Research Inst., N. Y.
A STUDY OF POSTS IN CIRCULAR WAVEGUIDE, by Alfred T. Villeneuve. Final rept. for 1 Feb 56-30 May 57 on Contract AF 30(602)1507. 20 June 57, 77p. 14 refs. SURI rept. no. EE400-575F; RADC-TR-57 145; AD-131 241.
Order from LC mi$4.50, ph$12.30 PB 146 127

This report describes a study for the determination of the equivalent circuit parameters of a thin conducting post spanning the cross section of circular waveguide and the application of such posts to the polarization twist duplexer. A variational approach is applied to the equivalent circuit problem and the general problem of the equivalent circuit of obstacles in guides is discussed. No numerical results have been obtained for the equivalent circuit parameters. The problem of application of posts to the polarization twist duplexer was investigated through the use of matrix methods, but no conclusions could be drawn from such a formulation without extensive cut and try calculations.

Willow Run Labs., U. of Michigan, Ann Arbor.
FOUNDATIONS OF CIRCUIT ANALYSIS, by William M. Brown. Rept. on Proj. Michigan, Contract DA 36-039-sc-78801. Sep 59, 21p. 6 refs. 2900-92-R; AD-226 336.
Order from LC mi$2.70, ph$4.80 PB 146 828

A unified picture is given of operational circuit analysis through a study of its foundations. Several specific considerations are discussed as extensions of the basic theory. A feature of the development that the memorandum provides is that the existence and uniqueness of a transfer function and some of its properties are established without reference to differential equations or other detailed aspects of circuits. The role of exponentials is first studied in detail, and it is proved that exponentials and only exponentials are eigen functions for all linear, time-invariant circuits. The following three circuit properties are then considered: (1) the output at any one complex frequency depends only upon the component of the input at that frequency; (2) the circuit is linear; or (3) the circuit is time-invariant. It is shown that any two of these properties imply the other one, but that no one implies any other. A general transform which includes sinusoidal analysis, Fourier, Laplace and Stieltjes transforms as special cases is defined and discussed briefly. The topics of nonreal circuits and realizable circuits are discussed briefly. (Author)

Molecular Physics and Spectroscopy

Hebrew U. (Israel).
PARAMAGNETIC AND OPTICAL SPECTRA OF YITTERBIUM IN THE CUBIC FIELD OF CALCIUM FLUORIDE, by W. Low. Technical note no. 11 on Contract AF 61(052)59. Jan 60, 8p. 7 refs. AFOSR-TN-60-308.
Order from LC mi$1.80, ph$1.80 PB 147 109

The paramagnetic resonance spectrum of Yb^{3+} in CaF_2 was observed at 20°K and 3 cms wavelength. The spectrum is described by a cubic spin Hamiltonian $\mathcal{H} = g\beta H.S. + A S.I$ with $g = 3.426 \pm 0.001$, $S = 1/2$, $A^{171} = 886.5 \pm 1.5 \times 10^{-4}$ cm^{-1}, $A^{173} = 243.2 \pm 0.4 \times 10^{-4}$ cm^{-1}, $I^{171} = 1/2$, $I^{173} = 5/2$. The ratio of magnetic moments is $\frac{\mu^{173}}{171} = 1.374_9 \pm 0.005$. The optical spectrum shows lines of 9774, 9770, 9763 A° and more diffuse and unresolved bands at 9080 and 12730 A°. The paramagnetic spectrum is explained as arising from the Γ_7 doublet. The other levels are removed by at least a few cm^{-1} leading to an isotropic g value of 3Λ or $\frac{24}{7}$ for the lowest Γ_7 level. (Author)

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE SPECTRUM OF MANGANESE IN CORUNDUM, by W. Low and J. T. Suss. Technical note no. 12 on Contract AF 61(052)59. Feb 60, 7p. 12 refs. AFOSR-TN-60-423.
Order from LC mi$1.80, ph$1.80 PB 147 108

The paramagnetic resonance spectrum of Mn^{2+} in Al_2O_3 was measured at 3 cms. The spectrum can be expressed in a spin Hamiltonian with trigonal symmetry with the following parameters: $g_{\parallel} = 2.0017 \pm 0.001$, $g_{\perp} = 2.000 \pm 0.002$, $D = +194.2 \pm 1$, $a\text{-}F = +21.9 \pm 0.6$, $A = -79.6 \pm 0.5$, $B = -78.8 \pm 0.8$ in units of 10^{-4} cm^{-1}. (Author)

King's Coll., U. of London (Gt. Brit.)
MOLECULAR SPECTROSCOPY REPORT, 1958-1959, by W. C. Price, G. R. Wilkinson and others. Final technical rept. no. 1, 1 Nov 58-31 Oct 59 on Contract DA 91-591-EUC-969. Oct 59, 155p. 27 refs.
Order from LC mi$7.50, ph$24.30 PB 146 831

Subject of Research: (1) The infrared spectra of some ionic and molecular crystals using high resolution over wide wavelength ranges and at temperatures down to that of liquid helium. (II) The absorption spectra of different materials (in solid, liquid or gas phase) in the infrared and in the vacuum ultraviolet.

Istituto di Fisica Superiore, Universita di Pavia (Italy).
A MICROWAVE SPECTROGRAPH FOR PARAMAGNETIC RESONANCE. SOME PRELIMINARY RESULTS OBTAINED ON TWO NEW FREE RADICALS, by A. Giarda, G. Lanzi and others. Final technical rept. for Sep 58-Aug 59 on Contract DA 91-508-EUC-396. Nov 59, 22p. AD-232 704.
Order from LC mi$2.70, ph$4.80 PB 146 834

A description is given of a microwave reflection spectrograph which operates at a fixed frequency of about 9300 mc, corresponding to a wavelength of about 3 cm in vacuum. The waveguide circuit includes a resonant cavity wavemeter for frequency measurements. The branch which contains the klystron generator is equipped with a ferrite insulator to prevent reflections toward the klystron; another branch contains the attenuators and matching devices. The electromagnetic field in the microwave region is generated by a 723 A/B reflex klystron at a frequency

ot 9370 mc with an output power of 20 megawatts. The resonant cavity is mechanically tuned with a screw which acts on the upper side of the klystron. The electromagnetic field is fed into the waveguide through a small coaxial cable. The detector is a 1 N 236 silicon diode rectifier which is capable of detecting the signal (9300 mc AC voltage modulated by 70c AC voltage). Measurements were made of the line widths and spectroscopic splitting factors of the quinazoline bisulfate and phenothiazine perchlorate free radicals.

Massachusetts Inst. of Tech., Cambridge.
SOLID STATE AND MOLECULAR THEORY GROUP. Quarterly progress rept. no. 32 on Contract Nonr-1841(34). 15 Apr 59, 102p. 46 refs.
Order from LC mi$5.70, ph$16.80 PB 146 031

Contents:
Zeeman splittings of paramagnetic atoms in crystalline fields
Crystalline field calculation
The linear chain
Interaction of a hole with mobile lattice ions in KCl
Energy bands and approximate potentials
Iron series Hartree-Fock calculations
One-electron energies in the iron group
Atomic scattering functions for the iron series
Solid-state and molecular theory group programming notes
Programming techniques
Properties and interactions of the helium atom
Programs for evaluation of molecular integrals
Multi-center integral programs for I. B. M. 704 computer
Electronic wave functions for polyatomic molecules
(See also PB 144 229)

Spectroscopy Lab., Mass. Inst. of Tech., Cambridge.
INVESTIGATION OF FAR INFRARED SPECTRA, by Richard C. Lord. Rept. for Mar 58-Aug 59 on Experimental Techniques for Materials Research, Contract AF 33(616)5578. Feb 60, 34p. 38 refs. WADC Technical rept. 59-498.
Order from OTS $1.00 PB 161 738

Applications of a small grating spectrometer to problems of molecular structure by means of infrared absorption spectra in the region 50 - 300 cm^{-1} are reviewed. Infrared spectra in the range 50 - 300 cm^{-1} are reported and discussed briefly for methyl amine, hydrazine and trimethylene oxide, and in the range 50 - 600 cm^{-1} for cyclopentane, cyclohexane, cycloheptane, cyclooctane, oxycyclopentane (tetrahydrofuran) and 1, 4-dioxycyclohexane (dioxane). Isolated low frequencies are given for thiacyclobutane, disilylacetylene and dimethyl acetylene. New values for the thermodynamic functions of hydrazine are given, and values from the literature are included for diborane and cyclobutane. (Author)

Washington U., Seattle.
A MASS SPECTROMETRIC STUDY OF NEGATIVE ION FORMING REACTIONS IN OXYGEN, by P. L. Randolph and R. Geballe. Technical rept. no. 6 on Contract DA 04-200-ORD-664. 1 Aug 58, 99p. 63 refs. OOR rept. 442.8-P.
Order from LC mi$5.40, ph$15.30 PB 137 902

Willow Run Labs., U. of Michigan, Ann Arbor.
RAPID-SCAN SPECTROSCOPY WITH A FABRY-PEROT INTERFEROMETER, by R. W. Terhune and C. W. Peters. Rept. on Proj. Michigan, Contract DA 36-039-sc-78801. May 60, 15p. 6 refs. 2900-157-R.
Order from LC mi$2.40, ph$3.30 PB 147 364

The construction and operation of a variable-spacing Fabry-Perot interferometer that could be used at scanning rates up to 500 scans per second is described. Multilayer interference coatings were used for reflecting surfaces in the near infrared. The high spectral luminosity of the interferometer made its use favorable in low orders for rapid-scan spectroscopy, and in high orders in combination with a grating spectrometer for greater spectral resolution. (Author)

Optics

Avco Corp., Wilmington, Mass.
MIE SCATTERING IN THE FORWARD AREA, by R. Penndorf. Scientific rept. no. 2 on Research on Aerosol Scattering in the Infrared, Contract AF 19(604)5743. Feb 60, 91p. 18 refs. Technical rept. RAD-TR-60-10; AFCRC-TN-60-285.
Order from LC mi$5.40, ph$15.30 PB 146 907

The scattering of light is investigated from a theoretical point of view. After explaining the basic Mie formulas, several useful scattering functions are defined. The scattering pattern for the forward, sideward, and backward area is briefly described, followed by a very detailed investigation for the forward direction, which is based on all available data computed according to the Mie formulas. A wide range of refractive indices n from $n = 1.05$ to $n = 2.0$ have been selected, and all values of i_θ and p_M are extensively listed in the appendix. The behavior of these scattering coefficients is investigated and described in detail. This is followed by a careful investigation of practical limits for the Mie region, which can be defined only arbitrarily. Methods are developed for computing the scattering functions by simple means. Applications of these theoretical data are given to compute the angular Mie cross section and the volume-scattering coefficient by a graphical method. These scattering values can be derived also for given size distributions of the aerosol.

Syracuse U. [Research Inst.] N. Y.
THIN FILMS WHICH PRODUCE PHOTOELECTRIC AND PHOTORESISTIVE EFFECTS, SECTION I AND II (OF FOUR SECTIONS) by Werner Beyen, Donald Bode and others. Final engineering rept. on Contract W33-038-ac-15160. 1 Apr 55, 37p. 8 refs. Physics rept. 101-35; AD-60 906.
Order from LC mi$3.00, ph$6.30 PB 146 950

Section I contains a description of apparatus and techniques for the measurement of infrared photoconducting devices, Section II contains a summary of the electrical and optical properties of PbTe films.

Willow Run Labs., U. of Michigan, Ann Arbor.
THE EFFECT OF FILM-THICKNESS VARIATIONS ON COHERENT LIGHT, by Arthur L. Ingalls. Rept. on Project Michigan, Contracts DA 36-039-sc-78801, AF 33(600)38019, and AF 30(635)2905. Oct 59, 15p. 3 refs. 2900-88-R.
Order from LC mi$2.40, ph$3.30 PB 146 829

This report describes the experiments which measured perturbations in monochromatic coherent light caused by variations in film thickness, and discusses the results. The introduction of commercial photographic film into the aperture of an optical system disturbs the coherence of the transmitted light, because of the variations in thickness and refractive index present in the film. Such variations in film may be made visible, as contour lines, by light interference pattern were measured, and calculations of light-path variations made. A qualitative analysis showed that film-base thickness-variation was primarily responsible for deterioration of coherence. Formulas are given which show the effect of film variations on coherent light for both use and measurements; and figures are included which show the distribution of film quality.

Solid State Physics

Army Engineer Research and Development Labs., Fort Belvoir, Va.
OPTICAL AND ELECTRON MICROSCOPY OF SODIUM AND POTASSIUM AZIDES, by Johann Joebstl and Hyman Rosenwasser. 27 Apr 59, 108p. 10 refs. Technical rept. 1577-TR; AD-219 245.
Order from LC mi$5.70, ph$16.80 PB 147 462

Crystal habits of sodium and potassium azides have been studied by optical and electron microscopy. The growth features are illustrated with photomicrographs. Observations have also been made on the effects of aging, etching, and heating of these azides. (Author)

Conservatoire des Arts et Métiers, Paris (France).
DYNAMICAL THEORY OF THE REFLECTION OF X-RAYS ON CURVED CRYSTALS, by D. Taupin. Technical (Final) rept. on Contract AF 61(052)51. Jan 60, 34p. 10 refs. AFOSR-TR-60-30.
Order from LC mi$3.00, ph$6.30 PB 146 434

A dynamical theory is applied to perturbated crystals. It allows for a perturbation being regular and continuous, and depending on one geometrical coordinate; this coordinate is perpendicular to the reflecting plan planes and to the crystal surfaces.

Cornell U., Ithaca, N. Y.
INVESTIGATION OF ATOMIC PHENOMENA OCCURRING ON AND NEAR THE SURFACES OF SOLID, by Richard C. Bradley. Final rept. on Contract AF 18(600)674, Task II. 29 Feb 60, 11p. 26 refs. AFOSR-TR-60-45.
Order from LC mi$2.40, ph$3.30 PB 146 433

Field emission microscopy has been used for studying the surface of an alloy, and the kinetics of metals adsorbed on metal substrates. Mass spectrometry has been used to study the nature and properties of secondary ions, surface and bulk compositions, and surface and bulk kinetics.

Eagle-Picher Research Labs., Miami, Okla.
RESEARCH ON GROWING OF CADMIUM SULFIDE CRYSTALS FOR DOSIMETER PURPOSES, by J E. Powderly and K. E. Bean. Quarterly rept. no. 3, 17 Oct 57-17 Jan 58, on Contract DA 36-039-sc-73270. [1958] 64p. 4 refs.
Order from LC mi$3.90, ph$10.80 PB 137 660

Runs can now be consistently reproduced to provide single crystals of large size and of good crystalline structure. Single crystallites weighing in the order of 50 grams are regularly produced. Location of these impurities in the crystals are consistent with the vapor pressure of their sulfides. (See also PB 137 662)

General Electric Research Lab., Schenectady, N. Y.
EFFECT OF Li-B ION PAIRING ON Li^+ ION DRIFT IN Si, by E. M. Pell. Scientific rept. no. 4 on Contract AF 19(604)5551. 28 Apr 60, 18p. 7 refs. AFCRC-TN-60-386.
Order from LC mi$2.40, ph$3.30 PB 147 359

When Li^+ and B^- ions are present simultaneously in Si, relatively immobile Li-B ion pairs are formed. Only those Li^+ ions which have not become paired with B^- are free to diffuse through the Si, and measurement of the effective diffusion rate of the Li^+ can thus be used to determine the fraction of Li^+ paired. Such measurements have been made in the range 0°C to 100°C using the method of ion drift in a pn junction. The results agree well with the Reiss model for ion pairing, yielding a distance of closest approach between Li^+ and B^- of 2.5 to 2.7°A. This value is larger than given by the sum of Li^+ and B^- radii; it is roughly equal to the distance from a lattice atom site to the next-nearest interstitial site (2.72 Å). The kinetics of the ion pairing reaction have been investigated by the same technique. The resulting value for the capture radius of the B^- ion agrees satisfactorily with theory. (Author)

Illinois U., Urbana.
ELECTRON MOBILITY AND SCATTERING PROCESS IN AgBr AT LOW TEMPERATURES, by Dwight C. Burnham, Frederick C. Brown, and Robert S. Knox. Technical note no. 3 on Contract AF 49(638)579. Mar 60, 48p. 41 refs. AFOSR-TN-60-419.
Order from LC mi$3.30, ph$7.80 PB 146 930

The Hall effect for electrons released by light in high-purity crystals of AgBr has been studied experimentally in the temperature range 4° to 120°K. The observed mobilities exceed 20,000 cm^2/volt-sec at very low temperatures. The general features of the dependence of low-field Hall mobility on temperature can be understood by comparison with standard theory. A nearly exponential dependence of mobility on 1/T is observed from 40° to 120°K, as predicted for scattering by optical vibrations of the lattice. The slope of the log μ versus 1/T data agrees quite well with the Debye Θ for the longitudinal optical mode as deduced from Reststrahl data. Below 40°K the observed mobilities can be explained in terms of a combination of the effects of optical, acoustical and charged impurity scattering. The last process appears to dominate below 15°K. High-field effects are observed which can be explained by classical transport theory assuming a conduction band of standard form as well as isotropic scattering. (Author)

Illinois U., Urbana.
THE INTERACTION OF DISLOCATIONS WITH AN APPLIED STRESS IN ANISOTROPIC CRYSTALS, by G. de Wit and J. S. Koehler. Technical rept. no. 6 on Contract Nonr-1836(26). June 59, 125p. 14 refs. AD-218 496.
Order from LC mi$6.30, ph$19.80 PB 147 460

The differential equation of equilibrium is derived for a dislocation pinned at 2 points in the same glide plane in an elastically anisotropic crystal with an applied stress. It is assumed that the dependence of the dislocation energy on the geometry of the dislocation line is accounted for by using an energy per unit length, E, which for fixed Burgers vector is a function only of θ the angle between the Burgers vector and the dislocation segment. A parametric solution of the differential equation is found in terms of E and its derivatives. When the orientation dependence of E is approximated by that of the elastic energy per unit length of a long straight dislocation, numerical work done for some real face centered cubic and body centered cubic crystals indicates that the first few terms in a Fourier expansion give a good fit to E. Using this expansion, the solution of the differential equation is plotted so that only one curve is needed to obtain the equilibrium shape of the dislocation for all values of the stress. Appreciable deviation from a circle is found. The above information about dislocation shape versus applied stress, together with some simple assumptions concerning dislocation density enables one to calculate the average strain produced in a crystal under applied stress when dislocations are present as compared to a crystal with no dislocations. (Author)

Liége U. (Belgium).
NUCLEAR QUADRUPOLE RESONANCE IN IRRADIATED ORGANIC CRYSTALS AND IN A SEMICONDUCTOR ELECTRON SPIN RESONANCE IN CARBONACEOUS ROCKS, by Jules Duchesne. Technical scientific note no. 1 on Contract AF 61(052)167. 31 Jan 60, 44p. 15 refs. AFOSR-TN-59-1214.
Order from LC mi$3.30, ph$7.80 PB 147 112

The intensity of quadrupole lines is used as a method for the study of the damage induced by high energy radiation in solid matter. Thermally treated irradiated compounds, which are thereafter re-irradiated, are especially considerd. In this connexion, the origin of radioprotection phenomena, and the behavior of the interactions between centers perturbed by irradiation, are studied further. Not only gamma-rays are used, but also X-rays and neutrons. The new method is successfully applied to a semiconductor. Parallel use of quadrupole spectroscopy and electron spin resonance is found highly valuable. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
EFFECTS OF APPLIED ELECTRIC FIELDS ON PARAMAGNETIC RESONANCE IN CHROME ALUMS, by M. E. Browne. Rept. on Physical Electronics. Apr 60, 21p. 13 refs. LMSD-288212.
Order from LC mi$2.70, ph$4.80 PB 147 366

The paramagnetic resonance spectra of single crystals of potassium chrome alum and ammonium chrome alum have been investigated in the presence of applied electric fields at 9.3 kmc in the temperature range 4-300°K. The measurements were made in an effort to detect the possible existence of a term of the form $\xi \mu_0 \vec{\sigma} \cdot \vec{E}$ in the interaction Hamiltonian for an electron in an electromagnetic field. Such a term corresponds to the existence of an electron electric dipole moment and would result in a lifting of Kramers' degeneracy for a magnetic ion in a crystalline field. No such term was observed, and the upper limit on ξ obtained was $\xi < 0.007$. A dependence of the dielectric loss on electric field was observed in both alums at microwave frequencies, (Author)

North Carolina U., Chapel Hill.
ELECTRIC AND MAGNETIC PROPERTIES OF VERY THIN FILMS WITH SPECIAL EMPHASIS ON SUPERCONDUCTIVITY, by Rolfe E. Glover, III. Annual summary rept. for 1 June 58-31 May 59 on Contract Nonr-855(08). [1959] 16p. 3 refs.
Order from LC mi$2.40, ph$3.30 PB 146 846

Attempts were made to measure the dependence on temperature of the critical current in thin superconducting films. Sharp peaks in the current density are found at the 2 edges of the film. A new cryostat was completed to maintain constant temperature in the range from 1° to 20°K.

Raytheon Co., Waltham, Mass.
SINGLE CRYSTAL GROWTH OF THE GARNET TYPE OXIDES. PART I. PHASE RELATIONS IN THE SYSTEM Fe_2O_3-Fe_3O_4-$YFeO_3$ IN AIR, by H. J. Van Hook. Scientific rept. no. 1 on Contract AF 19(604)5511. 29 Jan 60, 39p. 14 refs. AFCRC-TN-60-162.
Order from LC mi$3.00, ph$6.30 PB 147 056

Measurements have been made of temperature and ternary composition for coexisting liquid and crystalline phases on the air isobar in the system Fe_2O_3-Fe_3O_4-$YFeO_3$ with particular regard to the stability range and compositional limits of yttrium-iron garnet.

Phase equilibrium relationships were determined by conventional quenching techniques combined with measurements of loss in weight at the reaction temperature to locate true ternary compositions. The intersection of the air isobar with the ternary univarient boundary curve for coexisting magnetite, garnet and liquid phases results in an eutectic-type situation at the composition $Y_{0.27}Fe_{1.73}O_{2.87}$ and 1469° ± 2°C. A similar intersection of the isobar with the boundary curve for coexisting garnet, orthoferrite, and liquid phases gives rise to a peritectic-type reaction at 1555° ± 3°C and $Y_{0.44}Fe_{1.56}O_{2.89}$. The yttrium-iron garnet crystallizing from liquids within these temperature and composition limits contains up to 0.5 mole percent iron oxide in excess of the stoichiometric formula in terms of the starting composition 37.5 mole percent Y_2O_3, 62.5 mole percent Fe_2O_3. Loss of oxygen in the garnet phase is appreciable in this temperature range; approximately 3 mole percent FeO is present at 1470°C. Solubility of excess of iron oxide and partial reduction in air are invarient conditions during the growth process and the composition of the garnet formed can only be changed by a change in oxygen pressure.

Watertown Arsenal Labs., Mass.
DEBYE TEMPERATURE OF CARBONYL IRON, by Charles P. Gazzara. May 60, 24p. 26 refs. Technical rept. WAL TR-805.2/1.
Order from LC mi$2.70, ph$4.80 PB 146 161

The Debye characteristic temperature, Θ, of carbonyl iron has been determined as being between 433°K and 445°K at an ambient temperature of 310°K from an X-ray diffraction study utilizing both monochromatized and filtered radiation by both a stationary and scanning slit method. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
POLARIZATION, MICROWAVE DISPERSION, AND LOSS IN HIGH-PERMITTIVITY FERROELECTRICS, by Howard Diamond. Rept. on Proj. Michigan, Contract DA 36-039-sc-78801. Jan 60, 103p. 33 refs. 2900-121-T; AD-231 701.
Order from LC mi$5.70, ph$16.80 PB 147 304

An analysis was conducted of experimental data, polarization, dispersion, and loss processes in high-permittivity ferroelectrics. The study proceeds from the observation that, according to published data, polycrystalline $BaTiO_3$ and similar compositions show strong relaxation in permittivity at microwave frequencies. This phenomenon is shown to be generally related to polarization and loss properties of the dielectric. Processes of particular interest in accounting for the microwave relaxation are: (a) domain effects, (b) possible dipolar or molecular polarization, and (c) mechanical effects produced by piezoelectric and electrostrictive coupling. The conclusions that may be drawn from this work are as follows: (1) the field sensitivity of the incremental permittivity of polycrystalline ferroelectrics is not a domain effect, but results from an induced ferroelectric state in nonferroelectric grains; (2) nonlinear permittivity under electric fields must necessarily be accomplished by substantial thermal sensitivity; (3) orientation of the domains does not contribute to microwave dispersion; (4) molecular or dipolar relaxation does not occur at microwave frequencies for $BaTiO_3$ single crystals; therefore this is not a mechanism for dispersion in the ceramic, and (5) dielectric loss as well as piezoelectric and electrostrictive activity would result in microwave dispersion in high-permittivity ferroelectrics. (Author)

Theoretical Physics

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
OBSERVATIONS OF A RELATIVISTIC SPACE TRAVELER, by J. Richard Haskins. 1 June 59, 9p. 7 refs. ARGMA TR 1C31R; AD-219 064.
Order from LC mi$1.80, ph$1.80 PB 147 579

The question of asymmetrical aging in space travel is discussed regarding the possibility of distant clocks apparently running backward as observed by an accelerated space traveler. Results show that this apparent backward running of clocks is consistent with apparent reabsorption of photons emitted earlier by a distant star. (Author)

Cambridge U. (Gt. Brit.)
THE ANAYLTIC PROPERTIES OF PERTURBATION THEORY, by J. C. Polkinghorne and G. R. Screaton. Technical (scientific) note no. 4 on Contract AF 61(052)233. Jan 60, 17p. 12 refs. AFOSR-TN-60-277.
Order from LC mi$2.40, ph$3.30 PB 146 442

A general method is given for locating the complex singularities of the contributions from Feynman diagrams regarded as functions of the external scalar products. The method is illustrated by application to the third-order vertex function. (Author)

Carnegie Inst. of Tech., Pittsburgh, Pa.
THE SHIELDING OF A FIXED CHARGE IN A HIGH DENSITY ELECTRON GAS, by J. S. Langer and S. H. Vosko. Technical rept. no. 8 on Contract Nonr-760(13). [1959] 31p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 146 047

The shielding of a small fixed charge in a high-density electron gas is calculated by means of a technique similar to that used by Gell-Mann and Brueckner for calculating the correlation energy. A closed expression for the density of displaced electrons is derived and evaluated numerically for several densities of the electron gas. An asymptotic form is also given. (Author)

Chicago U., Ill.
QUASI-FINITENESS OF THE INTERACTION HAMILTONIAN OF CERTAIN QUANTUM FIELDS, by I. E. Segal. Technical note no. 1 on Contract AF 49(638)666. Apr 60, 14p. 9 refs. AFOSR-TN-60-445.
Order from LC mi$2.40, ph$3.30 PB 147 119

Forschungsinstitut für Physik der Strahlantriebe, e. v., Stuttgart (West Germany).
STOCHASTIC THEORY OF TRANSPORT PHENOMENA IN A REACTING PLASMA AT EXTREME TEMPERATURES, by H. J. Kaeppeler. Final rept. on Contract AF 61(514)1244. Mar 58, 109p. 28 refs. WADC TR-58-353; AD-155 704.
Order from LC mi$5.70, ph$16.80 PB 147 685

One of the essential tasks of theoretical plasma research is the development of an appropriate kinetic theory of nonequilibrium plasma behavior. The research reported on in this paper deals with attempts to establish such a theory. It is believed that many details of mathematical probability theory, especially the probability theory due to A. N. Kolmogoroff, are particularly well suited to describe the behavior of a system of particles, here a multi-component reacting plasma. An extension of Grad's method, including the presence of electric and magnetic fields, to the case of a non-isothermal multi-component reacting plasma is shown.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
QUANTUM STATISTICAL PAIR DISTRIBUTION FUNCTION. GENERAL THEORY AND ITS APPLICATION TO THE ELECTRON GAS, by Shigeji Fujita. Doctoral thesis. Rept. on Contract AF 18(600)1315. Mar 60, 91p. 13 refs. Technical note BN-204; AFOSR-TN-60-435.
Order from LC mi$5.40, ph$15.30 PB 146 929

A general theory for calculating the pair distribution function for a quantum statistical system is developed and applied to the electron gas. A cluster integral expansion for the pair distribution function of both quantum and classical systems is derived. The simple chain approximation to the modified interaction is responsible for the transfer of a plasmon in the case of low temperature electron gas. The pair distribution function up to the first order in the modified interaction is calculated. A new expression which relates the internal energy with the pair distribution function is derived, assuming a system of many particles interacting through pair forces. This is used to calculate the ground-state energy of an electron gas. The result is in agreement with the work of Gell-Mann Bruckner.

Institute of Theoretical Physics, Stanford U., Calif.
MOTION OF A GYROSCOPE ACCORDING TO EINSTEIN'S THEORY OF GRAVITATION, by L. I. Schiff. Technical note no. 17 on Contract AF 49(638)388. Apr 60, 28p. 50 refs. AFOSR-TN-60-449.
Order from LC mi$2.70, ph$4.80 PB 147 355

It is pointed out that only the precession of the perihelion of the orbit of the planet Mercury provides an experimental verification of general relativity theory that goes beyond special relativity and the equivalence principle. In order to provide the theoretical basis for a new experimental test of the theory, the properties of a spinning test particle, or torque-free gyroscope, are calculated in detail.

Institute of Theoretical Physics, Stanford U., Calif.
PHOTOEFFECT FROM THE L SHELL, by R.H. Pratt. Technical note no. 15 on Contract AF 49(638)388. Apr 60, 37p. 20 refs. AFOSR-TN-60-417.
Order from LC mi$3.00, ph$6.30 PB 147 356

The differential cross section for photoeffect from an atomic shell is shown to be almost independent of principal quantum number, apart from normalization, for energies well above threshold. The high-energy limits of the total cross sections for the three L subshells are calculated exactly with methods previously applied to the K shell, and extrapolations are made to cover the entire high-energy region. A procedure is indicated to account for the effects of electron screening. It is found that the contribution from the P shells is not negligible in heavy elements. Agreement with experiment is good. (Author)

Johns Hopkins U. School of Engineering, Baltimore, Md.
STEADY, FINITE MOTIONS OF A CONDUCTING LIQUID, by Robert R. Long. Technical rept. no. 8 on Contract Nonr-248(31). June 59, 15p. 8 refs. AD-219 397.
Order from LC mi$2.40, ph$3.30 PB 146 428

In certain cases of steady motion of a conducting fluid in a magnetic field the primitive equations may be integrated once, yielding a second order, partial differential equation in the stream function. This equation is highly non-linear in general but for certain choices of basic flow and magnetic fields it is tractable. Several arbitrary functions of integration have to be evaluated to make the analysis useful. This may be done in a region that remains undisturbed. A short discussion is given to suggest a procedure for deciding in a special case whether this undisturbed region is upstream or downstream. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
A DISCUSSION OF TWO INCOMPRESSIBLE MAGNETOHYDRODYNAMIC FLOWS, by Keith P. Kerney. Part 3 of rept. on Research on the Comprehensive Theory of Plasma States and Phenomena, Contract AF 33(616)5693. Oct 59, 59p. 7 refs. Technical rept. 399; WADD Technical rept. 59-486, Part 3.
Order from LC mi$3.60, ph$9.30 PB 147 780-3

This report is a presentation of approximate solutions to two problems involving the flow of an incompressible viscous fluid having low electrical conductivity through a transverse magnetic field. The first problem is that of simple pipe flow. It is shown that the effects of the Hall current and ion slip can be incorporated into the continuum solution, to a first order, and that the effects of induced properties are of the order of magnetic Reynolds number. The second problem involves the Falkner-Skan flow; it is shown that the external magnetic field must be of the order of the square root of the velocity divided by the length for similar solutions to exist. Further analysis shows that, unless the conductivity vanishes outside the boundary layer, the class of magnetic fields required for similar solutions leads to singularities in the external field. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
THE EQUATION OF STATE OF AN IONIZED GAS, by George K. Bienkowski. Master's thesis. Part 2 of rept. on Research on the Comprehensive Theory of Plasma States and Phenomena, Contract AF 33(616)5693. Sep 59, 68p. 10 refs. Technical rept. 398; WADD Technical rept. 59-486, Part 2.
Order from LC mi$3.90, ph$10.80 PB 147 780-2

Electrically conducting gases, because of the long-range coulombic forces acting between the particles, are not amenable to the usual treatment of dilute-gas kinetic theory. Calculation of the equilibrium equation of state through the molecular approach must include the forces between particles if it is to correspond to physical reality. In the methods of kinetic theory this implies that potential energy and thus spatial distribution of particles is not negligible. Since it can be shown that the exact equation of state can be computed with the additional knowledge of the distributions of particle-pairs, equilibrium pair distribution functions were investigated. The existing Debye-Huckel approximation as applied to an ionized gas was found to have some limitations as well as theoretical difficulties. The equations which can determine the distribution functions are hopelessly non-linear except for asymptotic regions and therefore approximate solutions are derived for the non-linear range and quantum effects in the ion-electron interactions are included. The resulting distributions are used to calculate the equation of state. Higher order effects resulting from the volume of the particles and attractive forces between the charged and neutral particles are evaluated and found to be at least of an order of magnitude smaller than the coulombic effects in the region under consideration.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
A MICROSCOPIC ANALYSIS OF MAGNETO-GAS-DYNAMICS, by Eugene E. Covert. Report presented at the Third Biennial Gas Dynamics Symposium, August 24-26, 1959, Northwestern U., Evanston, Ill. [1959] 48p. 45 refs. Technical rept. 395.
Order from LC mi$3.30, ph$7.80 PB 147 267

The kinetic theory approach to magneto-gas-dynamics is discussed. The several methods of considering interactions, in which the long range forces are of importance, are compared critically. In particular, the effects of the magnetic field on the particle interactions and their trajectories are shown to introduce anisotropies in magneto-gas-dynamics. The effects of these anisotropies are briefly discussed. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
A REVIEW OF THE LITERATURE OF PLASMA PHYSICS, by Eugene F. Covert and Keith Kerney. Part 1 of rept. on Research on the Comprehensive Theory of Plasma States and Phenomena, Contract AF 33(616)5693. July 59, Second printing. 177p. 677 refs. Technical rept. 373; WADD Technical rept. 59-486, Part 1; AD-227 556.
Order from LC mi$8.10, ph$27.30 PB 147 780-1

The level of development of plasma physics is discussed. It is found that the present theories account for the experimental effects if: (1) the plasma is sufficiently dense that the time between collisions is small compared to the time an atom stays in the excited state but is sufficiently rare that the volume of the particles making up the plasma is very much smaller than the volume of plasma; (2) the potential energy between particles is the sum of the particles potential energy; and (3) the excitations are sufficiently weak, or the duration of the event is sufficiently short, that linearized theories are applicable. The complexity of the basic equations allows the inference to be drawn that it is possible for interesting phenomena to exist which are not yet discovered, and that the known but unexplained phenomena are contained within these equations. (Author)

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
HARDNESS OF THE AXIALLY-SYMMETRIC MAGNETIC PISTON, by Allen B. Schaffer. 8 Jan 60, 30p. 4 refs. STL/TR-60-0000-09011.
Order from LC mi$2.70, ph$4.80 PB 146 925

A magnetic field travelling down a transmission line is to be used as a magnetic piston to push plasma. This report considers the effect of plasma leakage through the magnetic piston. By means of an order-of-magnitude treatment of the momentum equation, an expression which gages the leakage is derived. This expression can be useful in estimating the leakage and in comparing various designs for hardness to leakage. The leakage is found to vary inversely as the magnetic Reynolds No. (Author)

Physical Research Lab. Space Tech. Labs., Inc., Los Angeles, Calif.
A STUDY OF PLASMA STABILITY IN MICROWAVE CAVITIES BY A FREQUENCY-SHIFT ANALOG, by Robert A. Swanson. Rept. on Thermonuclear Propulsion Research, Contract AF 04(647)309. [1959] 15p. 3 refs. TR-59-0000-00812.
Order from LC mi$2.40, ph$3.30 PB 146 839

An equation is derived which relates the pressure change at a perturbed microwave cavity boundary to the change in resonant frequency of the cavity. The equation is used to obtain information on the stability of a plasma confined by microwave fields. (Author)

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
TRANSVERSE PINCH OSCILLATIONS, by Burton D. Fried. Rept. on Contract AF 04(647)309. 24 Mar 60, 10p. 1 ref. STL/TN-60-0000-09059.
Order from LC mi$1.80, ph$1.80 PB 146 873

It is shown that the oscillations or "bouncing" of a transverse pinch like those observed by Wuerker, et al. are predicted by a simple model in which no trapped magnetic field is assumed.

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
STX--A PROPOSED THERMONUCLEAR DEVICE, by Richard W. Hales. Rept. on Contract AF 04(647)309. 15 Apr 60, 16p. 11 refs. STL/TR-60-0000-09085.
Order from LC mi$2.40, ph$3.30 PB 147 007

A thermonuclear device, STX, is discussed in this design study which would combine the features of the linear and transverse pinches. The name derives from the use of two magnetic fields for containment which are crossed in space and time--that is, orthogonal in space (B_θ and B_z) and in time quadrature. (Author)

University of Southern California. Engineering Center, Los Angeles.
SIMULATION CONSIDERATION FOR THE EXPERIMENTAL INVESTIGATION OF ELECTROMAGNETIC PROPAGATION THROUGH THE PLASMA SHEATH, by Raymond L. Chuan. Technical note on Contract AF 19(604)5722. 29 Feb 60, 23p. 10 refs. USCEC rept. 71-201; AFCRC-TN-60-172.
Order from LC mi$2.70, ph$4.80 PB 146 871

The study of electromagnetic propagation through the plasma sheath surrounding a hypersonic vehicle under controlled laboratory conditions is considered within the capabilities of existing laboratory facilities at the University of Southern California Engineering Center. The severe limitations of the theoretical treatment of the interaction problem because of inadequate understanding of the gasdynamics involved are pointed out; which necessitate experimental studies, provided simulation is adequate and similarity conditions can be met. Scaling parameters are established, and are shown to be generally compatible with laboratory conditions. The advantages of using a wind tunnel for such studies are pointed out; and a current program at USC is described, which provides simulation of actual flight conditions encountered at 300,000 to 450,000 feet altitude. (Author)

Weizmann Inst. of Science (Israel).
ON A MODIFIED BETHE-GOLDSTONE EQUATION, by Amnon Katz. Technical note no. 1 on Contract AF 61(052)337. 1 Feb 60, 39p. 16 refs. AFOSR-TN-60-307.
Order from LC mi$3.00, ph$6.30 PB 146 421

A many fermion system with BCS interaction is treated by a modified BG equation which takes into account a self consistent spreading of the Fermi surface. Our method employs a modified wave function which is an eigenstate of one modified hamiltonian and from which energies are determined by another. Pairs with total momentum o are treated as elementary entities. All modifications are achieved by a "projection operator" which a priori takes care of the interference between pairs due to their statistics. The only case solved is the one where all interacting pairs go into the Cooper state of the modified hamiltonian. The results are identical with those of BCS. (Author)

Aeronautical Research Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
AN EXPERIMENTAL STUDY OF THE INTERACTION OF STRONG SOUND FIELDS WITH FREE CONVECTION BOUNDARY LAYERS, by Arthur L. Sprott, Jack P. Holman, and Frederick L. Durand. Nov 59, 32p. 11 refs. WADC Technical rept. 59-717.
Order from OTS $1.00 PB 161 724

It is demonstrated experimentally that strong progressive sound fields may interact with a free convection boundary layer on a horizontal cylinder in such a manner as to produce increases in heat transfer rates of the order of 100 percent. Shadowgraph flow visualization studies indicate that the mechanism of the interaction is such that a separated flow region on the upper side of the cylinder is produced. No effect on the boundary layer or heat transfer is observed until the sound intensity is raised above a certain critical value. For the experiments described in the paper, the critical sound pressure level ranged from 134 to 138 decibels. In a qualitative analysis of the experimental results it is postulated that the increase in heat transfer is the result of an interaction of the phenomenon of acoustical streaming with the free convection boundary layer. It is also believed that the mechanism of thermoacoustic transduction may be applicable. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
SOLAR FURNACE SUPPORT STUDIES. 1958, 206p. 2 refs. AFMDC-TR-58-7; AD-135 014.
Order from LC mi$9.30, ph$31.80 PB 147 143

Contents:
Preliminary measurements of the solar radiation at Cloudcroft, New Mexico
Notes on the potential performance of the Cloudcroft solar furnace
Suggested methods of aligning the planes of the solar furnace heliostat mirrors into parallelism
Basic optical considerations in the choice of a design for a solar furnace
The loss of energy by absorption and reflection in the heliostat and parabolic condenser of a solar furnace
Calculation of the concentration of a solar radiation through the focal spot of a parabolic mirror
Calculation of the concentration of energy at points outside the focal spot of a parabolic condenser
Rigid-body torsional oscillations of axially supported heliostat mirror
Transient temperature distribution in a thermally irradiated body with variable heat-transfer coefficient
A solar furnace using a horizontal heliostat array

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
COMPRESSIBLE FLOW TABLES k = 1.40 STAGNATION TEMPERATURE CHANGE WITHOUT FRICTION, by C. Hoebich. Rept. on One-Dimensional Compressible Flow Tables for a Perfect Gas in Mach Number Increments of 0.001 (k = 1.40). June 59, 90p. ARGMA TN 1H 1N-5; AD-220 506.
Order from LC mi$4.80, ph$13.80 PB 147 151

Functions are tabulated of Mach numbers for compressible perfect gas. The ratio of specific heats k is 1.40. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate time-consuming interpolation. (Author)

Georgia Inst. of Tech., Engineering Experiment Station, Atlanta.
CONVECTIVE FLOW DUE TO ACOUSTIC VIBRATIONS IN HORIZONTAL RESONANT TUBES, by Thomas W. Jackson and Harold L. Johnson. Final rept on Contract AF 49(638)459. Mar 60, 40p. 10 refs. AFOSR-TR-60-52.
Order from LC mi$3.00, ph$6.30 PB 146 432

This study consisted of an experimental investigation of the convective flow due to acoustic vibrations in a horizontal resonant tube. The flow was made visible by illuminating smoke particles in the air by means of a 200 watt-second flash filament source and recording the motion photographically.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
ELECTRODE BOUNDARY LAYERS IN DIRECT CURRENT PLASMA ACCELERATORS, by Jack L. Kerrebrock. Technical note no. 1 on Contract AF 49(638)758. Jan 60, 52p. 7 refs. AFOSR-TN-60-287.
Order from LC mi$3.60, ph$9.30 PB 146 773

One of the problems which must be faced in the development of direct-current plasma accelerators is that of boundary layer growth on the electrode surfaces. These surfaces must be maintained at a somewhat lower temperature than is desirable in the bulk of the gas flow. The associated reduction in electrical conductivity near the electrode surface, together with the continuous current through the boundary layer, may result in greatly augmented Joule heating near the surface, and increased heat transfer. This phenomenon is treated within the framework of boundary layer theory. It is found that similar solutions for the thermal and viscous boundary layers exist for a certain class of accelerated flows in which the velocity varies as a power of the streamwise coordinate. The solutions show that the heat transfer rate at Mach numbers near unity may be as much as ten times that which would be expected for a normal boundary layer. At higher Mach numbers, the similarity is not precisely valid; however, the analysis indicates qualitatively that a stagnation enthalpy overshoot may occur in the high temperature portion of the boundary layer as a result of the electromagnetic acceleration. (Author)

Columbia U., New York.
THE MEASUREMENT OF THE THERMAL CONDUCTIVITY OF GASES AT HIGH TEMPERATURE, by Charles F. Bonilla, Barry L. Tarmy, and C. S. Lee. Progress rept. on Contract Nonr-266(11). 20 Jan 54, 33p. 13 refs. CU-1-54-Nonr-266(11)-Ch.E; AD-35 482.
Order from LC mi$3.00, ph$6.30 PB 147 156

A method for the measurement of the thermal conductivity of gases is derived which is independent of radiation. The method employs a hot-wire cell with its wire heated by a sinusoidal ac superimposed upon a dc. The operating conditions under which the radiation introduced no appreciable error are indicated as well as the inherent limitations of the method. Optimum cell design and operating conditions are suggested. Results indicated that it is possible to obtain the thermal conductivity of gases at high temperature from electrical responses which are sufficiently sensitive to thermal conductivity but are insensitive to wire-to-wall radiation. The phase lag of the third harmonic of voltage produced across the wire with respect to some standard appeared to be a sensitive indicator of thermal diffusivity for gases at high temperatures. It appears to be possible to use the amplitude of the third harmonic to measure the thermal diffusivity of liquids.

Institute of Research, Lehigh U. [Bethlehem, Pa.]
AN INTERFEROMETRIC STUDY OF SHOCK TUBE BOUNDARY LAYERS, by John R. Asbridge. Doctoral thesis. Technical rept. no. 14, 1955-1959 on Contract N7onr-39302. 10 Apr 59, 105p. 28 refs.
Order from LC mi$5.70, ph$16.80 PB 145 944

Boundary layers in the hot gas flow behind the shock wave on the walls of a rectangular shock tube have been studied for eleven flow conditions by observing their density structure with a Mach-Zehnder interferometer. The boundary layers are observed to be thin and slowly growing at first, possessing the structure and growth rate predicted by Mirels for laminar layers. This laminar structure extends for only a limited distance behind the shock. Then the boundary layer profile gradually becomes similar to that which has been observed for steady turbulent layers, although a systematic difference is detected for most flow conditions. The structure of the boundary layer during the transition from laminar to turbulent flow is observed to be consistent with the turbulent spot mechanism of transition, but no direct evidence for turbulent spots has been found. Free stream density variations coincident with the boundary layer growth are observed and presented.

Laboratoire Méditerranéen de Recherches Thermodynamiques (France).
THE SPUTTERING OF MOLECULES OF A THIN LAYER BY A LOW DENSITY SUPERSONIC FLOW IN FREE MOLECULAR REGIME, by F. Marcel Devienne and Georges M. Forestier. Technical note on Contract AF 61(052)124. Dec 59, 30p. 6 refs. AFOSR-TN-60-317.
Order from LC mi$2.70, ph$4.80 PB 147 111

The study of the stability of cadmium and antimony thin layers has been effected in a rarefied gas supersonic wind tunnel either in an air or an argon flow. Radioactive isotopes have been used in this study. It has shown that at a same temperature, the cadmium and antimony thin layers are less stable in a gas flow at great speed, than in vacuum. (Author)

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
A RELAXATION TIME TECHNIQUE FOR MEASUREMENT OF THERMAL DIFFUSIVITY, by George Sonnenschein and Robert A. Winn. Rept for Sep 58-May 59 on Materials Analysis and Evaluation Techniques. Feb 60, 29p. 7 refs. WADC Technical rept. 59-273.
Order from OTS $0.75 PB 161 752

A method has been developed for measuring the thermal diffusivity of solids under conditions of one-dimensional transient heat flow in a semi-infinite plate of finite thickness, adiabatically insulated at one face and subject to a constant thermal flux at the other. The method involves measurement of the time elapsed from start of exposure and of the temperature rise at a point along the direction of heat flow. The feasibility of the technique has been demonstrated on aluminum, Armco iron, copper, yttrium, and on a plastic laminate, covering the diffusivity range from 7 x 10-4 to 1.0 cm^2/ sec. and temperatures between 25 and 950°C. (Author)

Naval Research Lab., Washington, D. C.
THE SUITABILITY OF PLATINUM, MOLYBDENUM, TANTALUM, AND TUNGSTEN AS HIGH-TEMPERATURE LENGTH STANDARDS, by J. L. White. 17 June 58, 19p. 41 refs. NRL Rept. 5159.
Order from LC mi$2.40, ph$3.30 PB 132 840

In view of the increasing need for high-temperature length standards to be used in the design and calibration of apparatus for high temperatures, the thermal expansion data available in the literature for platinum, molybdenum, tantalum, and tungsten have been critically evaluated.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
SOME APPROXIMATIONS TO THE SOLUTION TO THE BINARY BOUNDARY-LAYER PROBLEM, by Eugene E. Covert. Rept. on Contract AF 49(638)245. Sep 59, 30p. 10 refs. Technical rept. 390; AFOSR-TN-59-1091.
Order from LC mi$2.70, ph$4.80 PB 147 781

Some approximate relations between shear, mass transfer and heat transfer are developed for the case of arbitrary external velocity, blowing distribution, and wall temperature. The approximations are compared with known solutions and are in satisfactory agreement with them. (Author)

Physical Research Lab., Space Tech. Lab., Inc., Los Angeles, Calif.
THE SUPERFAST PINCH EXPERIMENT, by Vernal Josephson. Rept. on Contract AF 04(647)309. 2 Nov 59, 29p. TR-59-0000-09880.
Order from LC mi$2.70, ph$4.80 PB 146 819

An assembly designed to accelerate deuterons to ~ 10kev by means of a radially converging magnetic piston has been constructed and tested. The emphasis in this report is on design features and operational problems encountered.

Republic Aviation Corp., Farmingdale, N. Y.
STATISTICAL THERMODYNAMICS APPLIED TO CHEMICAL KINETICS OF COMBUSTION, by Edwin F. Fricke. Rept. on Proj. MX-773. 1 Oct 47, declassified 30 Dec 55, 515p. Rept. no. EDR-22-407; ATI-22 410.
Order from LC mi$11.10, ph$78.90 PB 147 392

A general summary of the fields of thermodynamics is presented. The thermodynamic functions for all of the important combustion gases have been tabulated at 100° intervals from 300° to 5000° Kelvin. Several fuel gases have been investigated. The theoretical combustion equation for n-pentane has been developed for all types of air-fuel ratios. A complete survey of the methods of calculating the thermodynamic functions has been included. Atomic and molecular energy levels have been discussed in detail. All types of homogeneous gas reactions have been worked out. (Portions of this report will not reproduce well)

[Space Sciences Lab.], General Electric Co., Philadelphia, Pa.
PLASMA JET TEMPERATURE STUDY, by Willard J. Pearce. Rept. for June 58-June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5848. Feb 60, 111p. 42 refs. WADC Technical rept. 59-346.
Order from OTS $2.50 PB 161 735

Spectral methods for measuring plasma temperatures in the range 5,000 to 15,000°K have been compared on theoretical and experimental grounds. For plasma jets, the best method is to determine the temperature from the intensities of atomic lines or of ionic lines, from the relation I=KgA Exp(-E/kT). Tables of values of the required constants have been compiled and examples of various modifications of the method have been given. Technique and constants have been given which permit determination of radial distributions of temperature with the least difficulty. (Author)

Wave Propagation

Electrical Engineering Research Lab., U. of Texas [Austin].
PROPAGATION STUDIES BETWEEN 18.0 AND 25.5 KMCS, by C. W. Tolbert, A. W. Straiton, and C. O. Britt. Rept. on Contract Nonr-375(01). 10 July 59, 18p. 2 refs. Rept. no. 110.
Order from LC mi$2.40, ph$3.30 PB 147 091

Water vapor losses measurements made during propagation studies in the frequency spectrum of 18.0 to 25.5 kmcs were found to have a maximum value of 0.0245 db/km/gram/m^3 near a frequency of 21 kmcs. Also observed was the possibility of a second maximum near 24 kmcs. The average value of signal strength fluctuations observed in the spectrum was ±0.38 db. The measurements were made between April 22 and May 29 of 1959 by transmitting one way over a 12 km path. (Author)

Electromagnetic Research Corp., Washington, D. C.
INVESTIGATIONS OF GROUND CLUTTER AND GROUND SCATTERING, by Martin Katzin, Edward A Wolff, and Joel C. Katzin. Final rept. on Contract AF 19(604)5198. 15 Mar 60, 97p. 26 refs. Rept. no. CRC-5198-4; AFCRC-TR-60-127.
Order from LC mi$5.40, ph$15.30 PB 146 910

The physical mechanisms which are of importance in ground clutter are discussed, and ground clutter measurements are shown which reveal the presence of these mechanisms. The significance and properties of the radar length tensor (or polarization matrix) are pointed out. The radar length tensor for small circular disks is determined, and curves are shown for certain ranges of aspect. These are used to explain some previously unexplained horizontal/vertical and cross-polarization characteristics of sea clutter. Methods for measuring the radar length tensor are discussed, and typical coherent radar systems for ground scattering measurements are described. A new calibration technique for coherent radars is described which allows ground scattering measurements to be placed on a quantitative basis. (Author) (See also PB 146 911)

Electromagnetic Research Corp., Washington, D. C.
A REVIEW OF THEORIES AND MEASUREMENTS OF RADAR GROUND RETURN, by Edward A. Wolff. Scientific rept. no. 1 on Contract AF 19(604)5198. 29 Feb 60, 67p. 26 refs. Rept. no. CRC-5198-2; AFCRC-TN-60-173.
Order from LC mi$3.90, ph$10.80 PB 146 911

A summary of the principal sea and ground clutter measurement programs is presented and their results are compared. The principal theoretical work is reviewed for both sea and ground return. The theories reviewed include the corrugated surface, drop, and facet theories of sea clutter and the slightly rough surface and thin lossy cylinder theories of ground clutter. In addition, several miscellaneous theories based upon hypothetical statistical descriptions of the surface (such as arrays of spheres) are discussed. A comparison of the theoretical conclusions with the experimental results is made for each theory and the present status of our understanding of ground return is reviewed. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
MILLIMETER SCATTERING RANGE AND PRELIMINARY MEASUREMENTS OF SCATTERING FROM METALLIC SPHERES, by C. I. Beard. Rept. on Contract DA 36-039-sc-75012. 2 May 58, 29p. 4 refs. Technical memo. no. EDL-M136. AD-200 299.
Order from LC mi$2.70, ph$4.80 PB 146 062

A millimeter-wavelength scattering range is described for measuring scattering from random volume and surface distributions. Calibration procedures are given including the angular measurement of scattering from metal spheres of ka = 14.9 and 20.

Electronics Research Lab., U. of California, Berkeley.
NEW RESULTS IN BACK SCATTERING FROM CONES AND SPHERIODS, by Andrejs Olte and Samuel Silver. Rept. on Contract N[7]onr-295(29). 15 July 59, 26p. 13 refs. Rept. no. 90; Series no. 60, issue no. 243; AD-225 150.
Order from LC mi$2.70, ph$4.80 PB 147 092

Experimental results are given for backscattering cross sections of cones, prolate spheroids, and oblate spheroids. A brief resume is given first of the image-plane technique used in measuring cross sections. Calibration data show that for cross sections of the order of that of spheres of 3 in. diameter the attainable accuracy is of better than 0.5 db. Cross section data for various aspects of the targets are compared with geometrical optics cross sections and those obtained by various other theoretical procedures. Some interpretation of the observed phenomena is made in terms of high frequency approximation techniques. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington.
CHARACTERISTICS OF MOON-REFLECTED UHF SIGNALS, by S. J. Fricker, R. P. Ingalls and others. Rept. on Contract AF 19(122)458. 22 Dec 58, 61p. 14 refs. Technical rept. no. 187; AD-204 519.
Order from LC mi$3.90, ph$10.80 PB 146 054

A UHF (412 Mcps) CW bistatic moon-reflection experiment is described in which measurements were made of the total received power, the Faraday rotation, the Doppler shift and the fading rate of the moon-reflected signals. From the results, an effective radar cross-sectioned area of the moon was estimated to be 7 x 10^{11} square meters. An explanation for the cause of the rapid fading of the signal, based on dynamical considerations alone, gives numerical results that agree well with the measured fading rates. (Author)

Michigan U. Coll. of Engineering, Ann Arbor.
STUDIES IN RADAR CROSS SECTIONS 36. DIFFRACTION OF A PLANE WAVE BY AN ALMOST CIRCULAR CYLINDER, by P. C. Clemmow and V. H. Weston. Rept. on Contract AF 19(604)4993. Sep 59, 56p. 10 refs. Rept. no. 2871-3-T; AFCRC-TN-59-955; AD-232 129.
Order from LC mi$3.60, ph$9.30 PB 145 969

The two-dimesional problem of an E-polarized plane wave incident on a perfectly conducting cylinder of almost circular cross section is treated, the maximum deviation of the perimeter of the cross section from a strict circle being regarded mathematically as an infinitesimal quantity whose second and higher powers are neglected. The method of solution uses infinite Fourier transform techniques, but an analysis involving a Watson transformation, more traditional in this type of problem is also given. Various Bessel function results are required, some of which are derived in appendices. Attention is for the most part directed to

the case in which the mean radius is large compared to the wavelength, and the form of the solution then appropriate is examined in some detail. In particular, initial terms of asymptotic expansions in inverse powers of the mean radius to wavelength ratio are obtained both for the specular and for the creeping contributions to the far field. (Author) (See also PB 137 260)

Michigan U. Coll. of Engineering, Ann Arbor.
STUDIES IN RADAR CROSS SECTIONS 38. NON-LINEAR MODELING OF MAXWELL'S EQUATIONS, by J. E. Belyea, R. D. Low, and K. M. Siegel. Rept. on Contract AF 19(604)4993. Dec 59, 49p. 6 refs. Rept. no. 2871-4-T; AFCRC-TN-60-106; AD-232 130.
Order from LC mi$3.30, ph$7.80 PB 145 967

Non-linear modeling was accomplished with regard to the simple harmonic oscillator, the non-linear spring equation, Euler's equation, the Boltzmann equation, a general non-linear oscillator equation, and the scalar wave equation. A method is included which shows how to non-linearly model Maxwell's equations by utilizing the non-linear modeling of the scalar wave equation. Despite the a priori expectation that non-linear modeling was at best mathematically very complex, if not impossible, it now appears possible to non-linearly model more difficult equations, such as the coupled set consisting of Maxwell's equations and the Boltzmann transport equation. (Author) (See also PB 145 969)

National Bureau of Standards, Boulder, Colo.
CARRIER FREQUENCY DEPENDENCE OF THE BASIC TRANSMISSION LOSS IN TROPOSPHERIC FORWARD SCATTER PROPAGATION, by Kenneth A. Norton. 12 May 60, 67p. 20 refs. Technical note no. 53.
Order from OTS $1.00 PB 161 554

A further interpretation is given of certain Lincoln Laboratory data obtained in an experiment using scaled antennas as presented in a recent letter to the Proceedings of the I.R.E. from Bolgiano (47, 331 (1959)). This paper has four objectives: first, to clarify the significance of these data from the standpoint of the engineer developing long-range tropospheric scatter systems; second, to apply a further statistical analysis to these data; third, to consider their significance as regards the theory of radio propagation through a turbulent atmosphere; and fourth, to describe a suitable method for the measurement of the meteorological parameters entering the theory. Based on this analysis of the Lincoln Laboratory data, it is concluded that the carrier frequency dependence of the basic transmission loss cannot be variable from hour to hour. (Author)

National Bureau of Standards, Boulder [Colo].
FIELD STRENGTH CALCULATIONS FOR E.L.F. RADIO WAVES, by James R. Wait and Nancy F. Carter. Mar 60, 37p. 26 refs. Technical note no. 52.
Order from OTS $0.50 PB 161 553

The mode theory of propagation of electromagnetic waves at extremely low frequencies (1.0 to 3000 c/s) is briefly reviewed in this paper. Starting with the representation of the field as a sum of modes, approximate formulas are presented for the attenuation and phase constants. At the shorter distances, where the range is comparable to the wavelength, the spherical-earth mode series is best transformed to a series involving cylindrical wave functions. This latter form is used to evaluate the near field behavior of the various field components. The effect of the earth's magnetic field is also evaluated using a quasi-longitudinal approximation which is particularly appropriate for propagation in the magnetic meridian. In general it is indicated that if the gyro frequency is comparable or greater than the effective value of the collision frequency, the presence of the earth's magnetic field may be important for E.L.F. In this case the attenuation may be increased somewhat. The influence of a purely transverse magnetic field is also considered. (Author)

National Bureau of Standards, Boulder, Colo.
QUARTERLY RADIO NOISE DATA, MARCH, APRIL, MAY 1959, by W. Q. Crichlow, C. A. Samson and others. 14 Mar 60, [67]p. 11 refs. Technical note no. 18-2.
Order from OTS $1.00 PB 151 377-2

Radio noise measurements are being made at 16 stations in a world-wide network. The attached tables are based on three parameters of the noise: (1) the mean power, (2) the mean envelope voltage, and (3) the mean logarithm of the envelope voltage. (See also PB 151 377)

Stanford Electronics Labs., Stanford U., Calif.
RADAR MEASUREMENTS OF METEOR ACTIVITY WITH APPLICATIONS TO COMMUNICATIONS, by R. F. Mlodnosky. Scientific rept. no. 7 on Contract AF 19(604)2193. 18 Apr 60, 119p. 30 refs. AFCRC-TN-60-363.
Order from LC mi$6.00, ph$18.30 PB 147 284

From two years of radar measurements of meteor ionization trails, new information has been obtained on the directions of arrival (radiants) of meteoric particles into the earth's upper atmosphere. This information has important application in several techniques of radio communication where information is sent over great distances by means of radio reflections from ionized meteor trails. The contributions of this report include: (1) new experimental results on the meteor radiant distribution; (2) a theoretical explanation of the salient features of this radiant distribution; (3) refinements in a technique of using radar (back-scatter) measurements to determine directional characteristics of forward-scatter, meteor-propagated communications; and (4) actual predictions of diurnal and seasonal variations of propagation characteristics of meteor communication systems based upon the long-term radar measurements.

Stanford Electronics Labs., Stanford U., Calif.
RESEARCH ON POLAR RADIO PROPAGATION BLACKOUTS, by R. D. Egan, A. M. Peterson, and D. S. Pratt. Scientific rept. no. 1 on Contract AF 19(604)4103. 28 Apr 60, 36p. 16 refs. AFCRC-TN-60-187.
Order from LC mi$3.00, ph$6.30 PB 147 360

Polar radio communication blackouts are a frequent result of ionospheric storms, which result from unusual solar activity. The study of communication outages is producing information on the geographical region of communication circuit failure associated with such disturbances. The current report analyzes signal amplitude data taken at Boston and Stanford during August, 1959. Through the use of hourly versus daily contour plots of signal strength and other statistical analysis of the data from each of the circuits involved, it has been found that a major disturbance will produce a communications blackout over the entire western polar region. More localized effects are noted during moderate storms.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Columbia U. School of Engineering, New York.
CONSTRUCTION OF ERROR-CORRECTING CODES USING FILTERING TECHNIQUES, by Thomas E. Stern. Technical rept. T-1/M on Contract Nonr-266(60). [1959] 38p. 11 refs. CU-4-59-Nonr-266(60); AD-218 673.
Order from LC mi$3.00, ph$6.30 PB 147 082

Nonlinear filtering techniques are used to develop systematic methods for the construction of close-packed multilevel single error-correcting codes, coders, and decoders. Coding and decoding are achieved through the use of linear modular sequential circuits followed by a nonlinear decision element. The synthesis of an appropriate decoding filter is based upon the selection of a matrix over the modular field GF(p), whose powers display a periodicity with maximal length period. The properties of these matrices are shown to depend upon the properties of the elements of a Galois field, and several theorems from Galois theory are used in the selection of the decoding filter. (Author)

Fairchild Camera and Instrument Corp., Syosset, N. Y.
DEVELOPMENT OF AERIAL DRONE NIGHT PHOTOGRAPHIC SYSTEM, by H. Korth. Final technical rept. for May 56-Aug 58 on Contract DA 36-039-sc-72350. Aug 58, 61p. SME-AB-10; AD-220 357.
Order from LC mi$3.90, ph$10.80 PB 147 020

A summary is presented of the activities involved in the design and development of an aerial night photographic system and its subsequent testing and installation in the drone. With respect to the design of the system, special emphasis had to be placed upon the film speed requirements during the FMC portion of the camera cycle and its coordination with illumination as provided by means of photoflash cartridges. Optical, operational, and environmental testing was performed according to the test specifications. Some difficulties were encountered during low temperature operation, particularly since heaters were not to be employed. (Research Methods--Photographic Equipment, Installation of the camera and its supporting equipment into the drone was accomplished without encountering any unusual difficulties. Development of an alternate motor and cartridge ejection pulse combination in order to enable the camera to operate at higher altitudes was accomplished. (Author)

Naval Ordnance, Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS, OCTOBER-DECEMBER 1959. Quarterly rept. [1959] 54p. 33 refs. NAVWEPS rept. 5981; NOLC rept. 487.
Order from LC mi$3.60, ph$9.30 PB 147 512

Contents:
Communication stochastics, by L. T. Long
High temperature polymer program, by C. M. Douglas, D. L. Herring and others
Magnetization reversal studies, by R. L. Conger and J. L. Tomlinson
Semiconductor physics, by D. L. Stierwalt
Small antenna studies, by J. R. Alday and J. G. Hoffman
(See also PB 144 479)

Ramo-Wooldridge, Canoga Park, Calif.
MACHINE TRANSLATION STUDIES OF SEMANTIC TECHNIQUES. Technical rept. no. 1, 21 Apr 59-21 Jan 60, on Contract AF 30(602)2036. 22 Feb 60, 141p. C72-OU4; RADC-TW-60-56.
Order from LC mi$7.20, ph$22.80 PB 146 772

The principal goal of this work is to produce a machine program for automatic translation of Russian into English of usefully high quality and within the framework of that goal to focus particularly on problems of semantics and multiple meaning.

SOCIAL SCIENCES

Applied Mathematics and Statistics Labs., Stanford U., Calif.
COMPETITIVE STABILITY UNDER WEAK GROSS SUBSTITUTABILITY: THE "EUCLIDEAN DISTANCE" APPROACH, by Kenneth J. Arrow and Leonid Hurwicz. Technical rept. no. 77 on Contract Nonr-225(50). 31 July 59, 21p. 7 refs. AD-220 502.
Order from LC mi$2.70, ph$4.80 PB 147 058

Previous studies on the global stability of the competitive equilibrium made assumptions which implied the existence of an equilibrium price vector with all components positive. These restrictions are removed in this analysis by an extension of the Euclidean distance argument. In conjunction with the other assumptions, the square of the distance to any equilibrium is shown sufficient to imply stability even if the equilibrium have some zero components.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
OPTIMAL INVENTORY DEPLETION, by Peter W. Zehna. Technical rept. no. 41 on Contract N6onr-251(26). 24 July 59, 84p. 6 refs. AD-220 507.
Order from LC mi$4.80, ph$13.80 PB 147 063

Optimal LIFO and FIFO policies for depleting stock are analyzed. A condition yielding LIFO as an optimal policy for all n for a convex, twice differentiable function L(s), is proved to be that $\frac{L''(S)}{L'(S)}$ is a nondecreasing function. This condition encompasses the special life functions found by Derman and Klein [Management Sci. 4 no. 4:450-456, 1958], and the theorem is applied to give an immediate generalization. LIFO is found optimal for a concave field life L(S) provided that $L'(S) < -1$ for all S. Investigation of the FIFO policy shows that Lieberman's condition [Management Sci. 5 no 1:102-105, 1958], $L'(S) \geq -1$ yielding FIFO as optimal for L(S) concave and monotone, may be extended to include nonmonotone functions and that for concave functions, the condition is necessary as well as sufficient. It is also proved that whenever L(S) is convex and $L'(S) \geq 1$, then FIFO is again optimal for all n. In the special case $L(S) = a + bS$ ($a > 0$, $-1 < b > 0$), so that $L'(S) > -1$, it is proved that FIFO remains the optimal policy for 2 demand sources. When L(S) is either convex or concave with $L'(S) < -1$ for all S, LIFO is optimal for 2 sources. A general theorem is proved whereby whenever LIFO or FIFO is the optimal policy for 2 demand sources, the same will remain true for any finite number of sources greater than 2.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
SOME REMARKS ON THE EQUILIBRIA OF ECONOMIC SYSTEMS, by Kenneth J. Arrow and Leonid Hurwicz. Technical rept. no. 76 on Contract Nonr-225(50). 23 July 59, 13p. 4 refs. AD-219 878.
Order from LC mi$2.40, ph$3.30 PB 147 057

The following theorem is proved: if the aggregate excess demand functions satisfy the weak axiom of revealed preference, then (1) the instantaneous adjustment process is stable (whether or not there is a numéraire, and (2) the set of equilibrium points is convex. A corollary is given that if all commodities are weak gross substitutes, the instantaneous process is stable and the set of equilibria is convex. Two examples are given of non-unique equilibrium in which the weak axiom of revealed preference holds for the aggregate excess demand functions.

California U., Los Angeles.
A HAND-COMPUTED VERSION OF UCLA EXECUTIVE DECISION GAME NO. 2, by K. R. MacCrimmon and J. R. Jackson. Rept. on Management Sciences Research Proj. Contract [Nonr 233(02)]. 5 May 59, 42p. Research rept. no. 59; AD-218 307.
Order from LC mi$3.30, ph$7.80 PB 147 128

California U., Los Angeles.
MULTIPLE SERVERS WITH LIMITED WAITING SPACE, by James R. Jackson. Rept. on Management Sciences Research Proj. [Contract Nonr-233(02)]. 27 Nov 57, 10p. 6 refs. Discussion paper no. 62.
Order from LC mi$1.80, ph$1.80 PB 137 921

The purpose of the present note is to clarify, for the simples "Poisson-exponential," multiserver systems, the relation connecting the proportion of customers requiring special treatment, the number of waiting spaces in the line, and the ratio of imposed workload to full-utilization capacity of the system. General relations are derived, and computational results are summarized in graphical and tabular form.

Documentation

Benson-Lehner Corp., Los Angeles, Calif.
A SUGGESTION FOR AN IMPROVED DATA BANKING SYSTEM, by Eberhard Weber. Rept. on Contract Nonr-2666(00). 15 July 59, 25p. 2 refs. Research rept. 59-8; AD-225 097.
Order from LC mi$2.70, ph$4.80 PB 147 093

The need for an improved data storage and retrieval system has led to entirely new solutions to the problem. This study has resulted in the suggestion of a parallel-parallel system in which the requirements for improvement were fulfilled. A possible method of implementing this suggested system has been described in terms which, thought not necessarily representative of the ultimate solution, will lead in the direction of the ultimate solution.

Hebrew U., Jerusalem.
SOME THEORETICAL ASPECTS OF THE MECHANIZATION OF LITERATURE SEARCHING, by Yehoshua Bar-Hillel. Technical rept. no. 3 on Contract N62558-2214. Apr 60, 81p. 67 refs.
Order from OTS $2.25 PB 161 547

Data-providing information systems are distinguished from reference-providing systems. References can be provided in (at least) four stages: accession numbers, citations, abstracts, and copies of the documents recommended as pertinent to a request. The problem of false drops loses much of its force for reference-providing in stages. Shortcircuiting reference-providing by directly scanning an encoded document collection with the help of high-speed electronic computers is rejected. Automatic indexing and extracting are criticized as either leading to inferior products or else as being uneconomical. It is also deemed not feasible to mechanize the formulation and reformulation of the request, perhaps in the form of a certain Boolean function over the topic terms, up to the printing of the reference list.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, June 60.
Order from OTS $1.25, $10.00/year PB 161 282

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Meteorological measurements in the South Atlantic, by Wave Propagation Branch Staff
X-ray photographs of the sun, by Ens. R. Blake and A. E. Unzicker
Review of recent work at NRL on irradiation effects in magnetic alloys, by E. I. Salkovitz and A. I. Schindler
Scientific program:
Astronomy and Astrophysics: Measurements of celestial sources at a wavelength of 10.2 cm. Variable intensity of wind turbulence in the troposphere and in the stratosphere
Chemistry: An improved dc interrupter for use in fundamental studies of electrode reactions
Mechanics: Fracture testing of high-strength sheet materials under conditions appropriate for stress analysis. Effect of chamfered bolt holes on bolts in shear under dynamic loads. NRL three-stage, high-velocity, light-gas gun
Metallurgy and Ceramics: The determination of chlorides in titanium metal. Effect of environment on the creep-rupture properties of aluminum alloys. Low-temperature thermoelectric power of palladium and palladium-nickel alloys containing absorbed hydrogen. The dependence of surface tensions of liquid metals on their energies of vaporization per unit volume. Preliminary neutron-flux survey of core facility at ORNL low-intensity test reactor
Radio: Phase control of high-power amplifiers. Instrumentation for the classification of space signals. Precision time and frequency standards for Naval radio station NPM
Solid State Physics: New thermoluminescent dosimeter has total linear range of eight decades. Energy conversion efficiency of cerium-activated glass. Tables of Einstein energy, specific heat, and derivative specific heat functions
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General

Air and ground inspection techniques for the detection of underground explosive tests. Preliminary report, by R. M. Foose and R. B. Hoy. Stanford Research Inst., Menlo Park, Calif., and Office of Naval Research, Washington, D. C. Jan 59. Decl. Nov. 2, 1959. 131p. Order from LC. Mi $6.90, ph $21.30. ITR-1715

A class of casualty functions with special application to circular targets. Sandia Corp., Albuquerque, N. Mex. Aug 54. 35p. Order from LC. Mi $3.30, ph $7.80. SCTM-32-54-1

Results of a force test of seven configurations of the ultra-altitude vehicle in the Sandia Corporation 12- x 12-inch transonic wind tunnel (program III-43), by J. W. Arnold. Sandia Corp., Albuquerque, N. Mex. Oct 59. 73p. Order from LC. Mi $4.50, ph $12.30. SCTM-324-59(51)

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Standard-man phantoms, by R. L. Hayes. Oak Ridge Institute of Nuclear Studies, Inc., Oak Ridge, Tenn. Apr 60. 13p. Order from OTS. 50 cents. ORINS-35

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Gross beta radioactivity of the algae at Eniwetok Atoll, 1954-1956, by R. F. Palumbo. University of Washington, Laboratory of Radiation Biology, Seattle, Wash. Aug 59. Contract AT (45-1)-540. 32p. Order from OTS. $1.00. UWFL-61(Del.)

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Chromatographic separation and ultraviolet analysis of polyphenyls, by W. W. West and K. L. Hall. California Research Corporation, Richmond, Calif. Jan 60. Contract AT(11-1)-174. 28p. Order from OTS. $1.00. AECU-4699

The molecular and viscous effusion of saturated vapors, by K. D. Carlson. Argonne National Laboratory, Argonne, Ill. Apr 60. Contract W-31-109-eng-38. 248p. Order from OTS. $3.50. ANL-6156

Specifications for cleanliness requirements. High Level Volatility Lab. 4507, by J. B. Ruch. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 57. 4p. Order from LC. Mi $1.80, ph $1.80. CF-57-6-6

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Reduction of plutonium (VI) with hydrogen peroxide, by M. N. Myers. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Aug 56. Decl. Nov 23, 1959. Contract W-31-109-Eng-52. 12p. Order from LC. Mi $2.40, ph $3.30. HW-44987

Fuels preparation department analytical laboratory manual. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. June 59. Contract AT(45-1)-1350. 104p. Order from LC. Mi $5.70, ph $16.80. HW-59868

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The colorimetric determination of boron in zirconium hydride, by G. R. Waterbury and C. F. Metz. Los Alamos Scientific Lab., N. Mex. July 54. Decl. Sep 29, 1959. Contract W-7405-eng-36. 35p. Order from LC. Mi $3.00, ph $6.30. LA-1844

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Controlled potential coulometric titration of plutonium--application to PRFR samples, by W. D. Shults. Oak Ridge National Laboratory, Analytical Chemistry Div., Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 27p. Order from OTS. $1.00. ORNL-2921

The dimensional properties of molded silicone rubbers related to O-ring design, by G. W. Dyckes. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 18p. Order from OTS. 75 cents. SC-4415(RR)

Transparent cold-shock-resistant epoxy casting resin, by B. Carroll and J. Smatana. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 34p. Order from OTS. $1.00. SCR-173

Minutes of the yttrium analytical conference, [held at Argonne National Laboratory], November 7-8, 1956, by C. J. Rodden. Atomic Energy Commission, New Brunswick Lab., New Brunswick, N. J. Jan 57. Decl. Oct 1, 1959. 108p. Order from LC. Mi $5.70, ph $16.80. TID-7533

Chloride complexes of ruthenium (III), by D. A. Fine (Thesis). University of California.

Lawrence Radiation Laboratory, Berkeley, Calif. Feb 60. Contract W-7405-eng-48. 81p. Order from OTS. $2.25. UCRL-9059

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Californium production in the high flux isotope reactor, by H. C. Claiborne and M. P. Lietzke. Oak Ridge National Laboratory, Oak Ridge, Tenn.. Aug 59. 24p. Order from LC. Mi $2,70, ph $4.80. CF-59-8-125

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The radiochemistry of americium and curium, by R. A. Penneman and T. K. Keenan. University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Jan 60. 62p. Order from OTS. 75 cents. NAS-NS-3006

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Retention of iodine in process solutions by mercuric salts, by C. H. Holm. Hanford Works, Richland, Wash. June 51. Decl. with deletions July 7, 1959. Contract W-31-109-Eng-52. 22p. Order from LC. Mi $2.70, ph $4.80. HW-21103(Del.)

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The recovery, purification, and concentration of plutonium by anion exchange in nitric acid, by J. L. Ryan and E. J. Wheelwright. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Jan 59. Decl. with deletions June 25, 1959. Contract W-31-109-Eng-52. 104p. Order from LC. Mi $5.70, ph $16.80. HW-55893 (Del.)

Preliminary chemical flowsheets for the decladding and dissolution of non-production fuels, by M. K. Harmon. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. 9p. Order from LC. Mi $1.80, ph $1.80. HW-61106

Rates of reaction of irradiated UO_2 and uranium metal with sulfuric acid, by J. L. Swanson. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 8p. Order from LC. Mi $1.80, ph $1.80. HW-61482

Plant modifications for reprocessing non-production reactor fuels. Design criteria for fuel element storage facility, building 221-U, by M. E. Yates. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 16p. Order from LC. Mi $2.70, ph $4.80. HW-61510

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Technical progress report for April through June 1959, Idaho Chemical Processing Plant, by C. E. Stevenson and others. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office, Idaho Falls, Idaho. Mar 60. Contract AT(10-1)-205. 73p. Order from OTS. $2.00. IDO-14494

Dissolution of zirconium and Zircaloy-2 in nitric-hydrofluoric acid mixtures at reflux temperatures, by E. M. Vander Wall, E. M. Whitener and D. L. Bauer. Phillips Petroleum Co., Atomic Energy Div., Idaho Falls, Idaho. Sep 59. Contract AT(10-1)-205. 29p. Order from OTS. 75 cents. IDO-14497

The chemical engineering of the radium process. Final report, by H. L. Rawlings. Mound Lab., Miamisburg, Ohio. June 51. Decl. Dec. 2, 1959. Contract AT-33-1-GEN-53. 56p. Order from LC. Mi $3.60, ph $9.30. MLM-609

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Investigation of plasma acceleration, Quarterly progress report for January 1, 1959 through March 31, 1959, by K. C. Rogers and others. Stevens Inst. of Tech., Hoboken, N. J. 1959. Contract DA-36-039SC-78097. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4344

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A capacitor monitor for high-energy capacitive storage banks, by J. L. Todd. Sandia Corporation, Albuquerque, N. Mex. Mar 60. 17p. Order from OTS. 75 cents. SCTM-45-60(13)

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Confinement time of a Lorentzian gas in a mirror machine, by G. Gibson and E. J. Lauer. University of California. Lawrence Radiation Lab., Livermore, Calif. Nov 59. Contract W-7405-eng-48. 25p. Order from OTS. 75 cents. UCRL-5696

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The analysis of flux-traverse measurements in the GWIN-Magnuson critical experiment, by E. Inonu. Oak Ridge National Lab., Oak Ridge, Tenn. Dec 59. 6p. Order from LC. Mi $1.80, ph $1.80. CF-59-12-2

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Minutes of criticality instrumentation meeting, Hanford Atomic Products Operation, August 17 and 18, 1959, by C. L. Brown. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract W-31-109-Eng-52. 13p. Order from LC. Mi $2.40, ph $3.30. HW-61931

Effect of neutron interaction on critical size, by J. W. Webster. Phillips Petroleum Co., Atomic Energy Div., Idaho Falls, Idaho. Nov 54. Decl. Mar 4, 1960. Contract AT(10-1)-205. 22p. Order from OTS. 30 cents. IDO-16201

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Power densities and flux distributions in two special subassemblies, by P. G. Roll. Westinghouse Electric Corp. Atomic Power Div., Pittsburgh, Pa. May 55. Decl. with deletions Mar 8, 1957. 11p. Order from LC. Mi $2.40, ph $3.30. WAPD-P-661(Del.)

Multi-region reactor lattice studies. Quarterly progress report covering period January 1 to March 31, 1960, by I. H. Coen. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh, Pa. Apr 60. Contract AT(30-1)-2176. 36p. Order from OTS. 75 cents. WCAP-1414

Criticality review of process for fabrication of fuel rods, by J. D. McLendon and J. W. Morfitt. Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn. Jan 53. Decl. with deletions May 7, 1957. Contract W-7405-eng-26. 6p. Order from LC. Mi $1.80, ph $1.80. Y-A2-104 (Del.)

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Hydraulic characteristics of a continuous solvent washer with critically safe dimensions, by H. J. Clark, Jr. and A. Tournas. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Lab., Aiken, S. C. Mar 60. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-459

Technical investigation of autoclave failure, by N. G. Wittenbrock, and others. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Nov 59. Contract AT(45-1)-1350. 37p. Order from LC. Mi $3.30, ph $7.80. HW-62715

Geology and Mineralogy

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Uranium occurrence at the crescent mine, Shoshone County, Idaho, by H. W. Norman. Salt Lake Branch Office, AEC. Grand Junction Operations Office, Salt Lake City, Utah. Dec 58. 18p. Order from OTS. 75 cents. RME-2020(Rev.)

Some uranium occurrences in northern Ferry County, Washington, by J. L. Barlow. Production Evaluation Div., Grand Junction Operations Office, AEC. Salt Lake City, Utah. Oct 58. 22p. Order from OTS. 75 cents. RME-2068

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Geologic investigations of radioactive deposits. Semiannual progress report for June 1 to November 30, 1959, by W. P. Puffett and others. Geological Survey, Washington, D. C. Dec 59. 123p. Order from OTS. $2.75. TEI-752

Health and Safety

Experimental evaluation of the radiation protection afforded by typical Oak Ridge homes against distributed sources, by T. D. Strickler and J. A. Auxier. Oak Ridge National Laboratory, Oak Ridge, Tenn. Jan 60. 51p. Order from OTS. 50 cents. CEX-59.13

Radiation hazards from recycled reactor fuel, by E. D. Arnold. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 59. 17p. Order from LC. Mi $2.40, ph $3.30. CF-59-6-39

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The sequential analysis of ten nuclides occurring in long range fallout debris, by G. A. Welford and others. New York Operations Office. Haalth and Safety Lab., AEC. N. Y. Mar 59. 43p. Order from LC. Mi $3.30, ph $7.80. HASL-57

Radiobiological studies of the Columbia River through December 1955, by J. J. Davis and others. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Nov 56. Decl. with deletions July 31, 1959. Contract W-31-109-Eng-52. 177p. Order from LC. Mi $8.70, ph $30.30. HW-36074 (Del.)

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Evaluation of buried conduits as personnel shelters. Preliminary report, by G. H. Albright. Bureau of Yards and Docks. Office of the Chief of Civil Engineers, Washington, D. C. Nov 57. Decl. July 9, 1959. 76p. Order from LC. Mi $3.90, ph $10.80. ITR-1421

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Report for 1959. Oak Ridge Institute of Nuclear Studies, Medical Division, by M. Brucer and others. Oak Ridge, Tenn. [1959] Contract AT-40-1-Gen-33. 81p. Order from OTS. $2.00. ORINS-34

An approximation of radiation dose resulting from an accidental release of tritium gas, by H. L. Rarrick and G. E. Tucker, Jr. Sandia Corp., Albuquerque, N. Mex. Dec 59. 5p. Order from LC. Mi $1.80, ph $1.80. SCTM-406-59-(33)

Radioactive fallout. A bibliography of selected United States Atomic Energy Commission reports, by H. E. Voress and others. AEC Technical Information Service Extension, Oak Ridge, Tenn. Aug 59. 74p. Order from OTS. $2.25. TID-3087

Radiation protection standards. A literature search, by W. E. Bost. AEC Technical Information Service Extension, Oak Ridge, Tenn. Apr 60. 28p. Order from OTS. 75 cents. TID-3551

Shipping and storage of radioactive materials. A literature search, T. F. Davis. AEC Technical Information Service Extension, Oak Ridge, Tenn. Apr 60. 20p. Order from OTS. 75 cents. TID-5748

A study of the possible relationship between radioactivity and toxicity in fishes from the central Pacific, by P. Helfrich. University of Hawaii, Marine Biology Laboratory, Honolulu, Hawaii. May 60. Contract AT(04-3)-235. 16p. Order from OTS. 50 cents. TID-5748

A compendium of information for use in controlling radiation emergencies. Including lecture notes from a training session at Idaho Falls, Idaho, by A. Brodsky and G. V. Beard. AEC Technical Information Service Extension, Oak Ridge, Tenn. Feb 60. 98p. Order from OTS. $1.00. TID-8206

The control of beryllium hazards, by C. L. Lindeken and O. L. Meadors. University of California. Lawrence Radiation Lab., Livermore, Calif. July 59. Contract W-7405-eng-48. 23p. Order from LC. Mi $2.70, ph $4.80. UCRL-5593

Penetration into concrete of gamma radiation from fallout, by W. F. Titus. Federal Civil Defense Administration, Battle Creek, Mich. Apr 60. 28p. Order from OTS. 75 cents. WT-1477

The internal environment of underground structures subjected to nuclear blast. II. Effects on mice located in heavy concrete shelters, by D. R. Richmond and others. Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Sep 59. 25p. Order from OTS. 50 cents. WT-1507

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Periodic interclaibration of temperature sensing elements. Section I. First performance. Duquesne Light Co., Shippingport, Pa. Nov 59. 24p. Order from LC. Mi $2.40, ph $4.80. AECU-4514

Servomechanisms with force feedback, by R. C. Arzbaecher. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 119p. Order from OTS. $2.50. ANL-6157

An automatic gas chromatograph for monitoring of reactor fuel failures. Part I. Design, by W. R. Kritz. E. I. du Pont de Nemours & Co. Explosives Dept. Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Apr 59. Contract AT(07-2)-1. 10p. Order from OTS. 50 cents. DP-356

A versatile recording potentiometer, by C. O. Ballou. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Feb 60. Contract AT(07-2)-1. 19p. Order from OTS. 75 cents. DP-441

A colorimeter for in-line analysis of uranium and plutonium solutions, by D. W. Colvin. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Mar 60. Contract AT(07-2)-1. 23p. Order from OTS. 75 cents. DP-461

A level indicator for liquified gases, by A. L. Burke and L. H. Cook, Jr. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Mar 60. Contract AT(07-2)-1. 8p. Order from OTS. 50 cents. DP-469

Rear face monitoring by television. Final report, by W. J. Morris. Hanford Works, Richland, Wash. Apr 53. Decl. March 21, 1960. Contract W-31-109-Eng-52. 30p. Order from OTS. 30 cents. HW-27544

In-line alpha monitor prototype performance, by N. T. Hildreth. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct 55. Decl. November 23, 1959. Contract W-31-109-Eng-52. 31p. Order from LC. Mi $3.00, ph $6.30. HW-37272

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High-speed saw tests. Power reactor fuels reprocessing development, by V. P. Kelly. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Nov 59. Contract AT(45-1)-

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A photoetching technique for the precision fabrication of waveguide antenna arrays, by R. J. Bittner and E. J. Wilkinson. Sandia Corporation, Albuquerque, N. Mex. Sep 59. Changed from OFFICIAL USE ONLY April 1, 1955. 20p. Order from LC. Mi $2.40, ph $3.30. SC-2974 (TR)

An application of correlation detection to electronic trajectory measurement, by B. J. Weston. Sandia Corporation, Albuquerque, N. Mex. Apr 58. 9p. Order from LC. Mi $1.80, ph $1.80. SCDC-727

Reliability in electronic equipment, by F. J. Given. Sandia Corporation, Albuquerque, N. Mex. June 54. 11p. Order from LC. Mi $2.40, ph $3.30. SCTM-60-54-53

High voltage mercury switch pulse generator, by F. M. McIver. Sandia Corporation, Albuquerque, N. Mex. Dec 55. 7p. Order from LC. Mi $1.80, ph $1.80. SCTM-156-55(51)

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Automatic test equipment used in testing thermal batteries in the nonactivated state, by F. H. Darugh. Sandia Corporation, Albuquerque, N. Mex. Aug 55. Changed from OFFICIAL USE ONLY October 21, 1959. 22p. Order from LC. Mi $2.70, ph $4.80. SCTM-172-55-53

A saturated slat solution hygrometer calibration system, by J. L. Chamberlin. Sandia Corporation, Albuquerque, N. Mex. Dec 59. 7p. Order from LC. Mi $1.80, ph $1.80. SCTM-295-59(16)

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Nuclear instrumentation. A literature search, by H. D. Raleigh and R. L. Scott. AEC Technical Information Service Service Extension, Oak Ridge, Tenn. Apr 60. 108p. Order from OTS. $2.25. TID-3550

An improved gamma detector using gamma moderation, by R. Fox. University of California. Lawrence Radiation Lab., Livermore, Calif. Sep 59. Contract W-7405-eng-48. 17p. Order from LC. Mi $2.40, ph $3.30. UCRL-5605

The theory and operation of shock-loaded ferroelectric transducers, by M. T. Abegg and others. University of California. Lawrence Radiation Lab., Livermore, Calif. Nov 59. Contract W-7405-eng-48. 43p. Order from LC. Mi $3.30, ph $7.80. UCRL-5772-T

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Nuclear materials control system (NMCS). Phase II. A gamma-ray scanner for safeguards use, by C. C. Webster. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh, Pa. Oct 59. Contract AT(30-1)-2176, Task I. 28p. Order from LC. Mi $2.70, ph $4.80. WCAP-6030

Metallurgy and Ceramics

High temperature corrosion study interim report for the period November 1958 through May 59, by C. F. Hale and others. Oak Ridge Gaseous Diffusion Palnt Oak Ridge, Tenn. July 59. 38p. Order from OTS. $1.25. AECD-4292

Quantitative correlation of irradiation growth with preferred orientation in uranium, by W. R. McDonell. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. May 60. Contract AT(07-2)-1. 27p. Order from OTS. $1.00. DP-420

A preliminary study of the mechanical properties of M-257, and aluminum-aluminum oxide alloy, by D. E. Johnson and D. A. Patterson. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Mar 57. 13p. Order from LC. Mi $2.40, ph $3.30. HW-47883

A microspark apparatus for the study of inclusions in metals, by F. M. Smith. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. Contract AT(45-1)-1350. 10p. Order from LC. Mi $1.80, ph $1.80. HW-61187

Filtering abrasive-wheel uranium cuttings, by A. K. Postma and J. D. McCormack. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 9p. Order from LC. Mi $1.80, ph $1.80. HW-61917

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Pyrophoricity of uranium in reactor environments, by G. E. Zima. Hanford Atomic Products Operation, Richland, Wash. Jan 60. Contract AT (45-1)-1350. 71p. Order from OTS. 80 cents. HW-62442

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A study of the high-temperature air oxidation of yttrium metal, by O. N. Carlson, F. A. Schmidt and R. L. Wells. Iowa State University of Science and Technology, Ames Laboratory, Iowa City, Iowa. Mar 60. Contract W-7405-eng-82. 32p. Order from OTS. $1.00. IS-117

Effect of heat-treatment on the corrosion of zirconium - 2 At.% tin - 2 At.% niobium, by D. L. Douglass and B. E. Dearing. General Electric Co. Knolls Atomic Power Laboratory, Schenectady, N. Y. Jan 60. Contract W-31-109-Eng-52. 13p. Order from OTS. 50 cents. KAPL-2071

Rate of alloying of uranium alloys with stainless steel (Part I. 1800 to 2300°F), by R. S. Neymark. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Jun 60. Contract AT(11-1)-GEN-8. 31p. Order from OTS. $1.00. NAA-SR-3278

Development of ferritic steels for high temperature sodium service. Part I: 2.25 CR - 1 Mo - 0.4 Cb - 0.4 Ti experimental alloy, by W. C. Hayes and A. J. Birkle. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT (11-1)-GEN-8. 38p. Order from OTS. $1.25. NAA-SR-4832

Separation of uranium from thorium by liquid metal extraction interim report, by F. W. Dodge, J. D. Chilton and L. A. Hanson. Atomics International. A Division of North American Aviation Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 24p. Order from OTS. 75 cents. NAA-SR-4942

The preparation and properties of dispersion hardened uranium powder products. Quarterly Technical report for period ending March 31, 1959, by W. Arbiter. Nuclear Development Corp. of America, White Plains, N. Y. Apr 59. Contract AT(30-1)-2303. 33p. Order from LC. Mi $3.00, ph $6.30. NDA-2112-1

Conceptual design and economic study uranium sponge fuel development, by G. A. Sofer and M. Raber. Nuclear Development Corporation of America, White Plains, N. Y. Jan 60. Contract AT(30-1)-2303. 52p. Order from OTS. $.50. NDA-2116-4

Corrosion of zirconium alloys in 900 and 1000°F steam, by J. P. Pemsler. Nuclear Metals, Inc., Concord, Mass. Mar 60. Contract AT(30-1)-1565. 25p. Order from OTS. 50 cents. NMI-1235

Aqueous corrosion of thorium alloys and Zircaloy-clad thorium alloys, by D. S. Kneppel. Nuclear Metals, Inc., Concord, Mass. Mar 60. Contract AT(30-1)-1565. 49p. Order from OTS. $1.25. NMI-1226

Stress-rupture properties of beryllium containing carbide and oxide dispersions, by J. Greenspan. Nuclear Metals, Inc., Concord, Mass. Mar 60. Contract AT(30-1)-1565. 23p. Order from OTS. 50 cents. NMI-1227

Yttrium fabrication, by E. S. Guidoboni, A. M. Huntress and P. Loewstein. Nuclear Metals, Inc., Concord, Mass. Oct 59. Contract AT (30-1)-1565. 58p. Order from OTS. $1.50. NMI-1228

The fabrication of clad massive UO_2 fuel elements by coextrusion. Second quarterly report, by F. S. Gardner and J. C. Hunt. Nuclear Metals, Inc., Concord, Mass. Jan 60. Contract AT(30-1)-1565. 35p. Order from OTS. $1.00. NMI-2505

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Summary report - Phase I: Graphite-matrix nuclear fuel elements. Volume I, by R. B. Wrinkle and others. National Carbon Co., Division of Union Carbide Corp., Cleveland, Ohio. Dec 59. Contract AT(40-1)-2560. 128p. Order from OTS. $2.75. ORO-240

Progress report, foundry metallurgy studies, by L. P. Wilson. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 11p. Order from OTS. 50 cents. SCDR-43-60

Quarterly technical progress report for period ending December 31, 1959, by J. L. Zambrow. Sylvania-Corning Nuclear Corporation, Bayside, Long Island, N. Y. Feb 60. Contract AT-30-1-Gen-366. 23p. Order from OTS. 50 cents. SCNC-306

Dimensional instability of uranium-IV. Final progress report for July 1, 1958 through March 31, 1959, by R. Resnick, L. S. Castleman and L. Seigle. Sylvania Research Laboratories, Sylvania Electric Products Inc., Bayside, Long Island, N. Y. Feb 60. Contract AT-30-1-Gen-366. 26p. Order from OTS. 50 cents. SEP-255

The formation and statistical evaluation of "diffusion bonded" brazed joints in Yankee fuel subassemblies, by P. P. King. Atomic Power Dept., Westinghouse Electric Corporation, Pittsburgh, Pa. Nov 59. Contract AT(30-3)-222. 34p. Order from OTS. $1.00. YAEC-160

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Bevatron operation and development. XXIII August, September, October, 1959, by W. D. Hartsough. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Mar 60. Contract W-7405-eng-48. 16p. Order from OTS. 75 cents. UCRL-9058

Linac injection for the 340-Mev Berkeley electron synchrotron: Part II - Experimental, by K. C. Crebbin and W. L. Everette. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Feb 60. Contract W-7405-eng-48. 21p. Order from OTS. 75 cents. UCRL-9103

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Fortran programming techniques for graph plotting on the IBM-704 computer, by C. E. Cohn. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 19p. Order from OTS. 50 cents. ANL-6161

The diffusion of radioactive fission products from porous fuel elements, by S. D. Beck. Battelle Memorial Institute, Columbus, Ohio. Apr 60. Contract W-7405-eng-92. 25p. Order from OTS. $1.00. BMI-1433

Neutron flux distributions in natural uranium tubes, by T. B. Ponder. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Mar 60. Contract AT(07-2)-1. 28p. Order from OTS. $1.00. DP-467

A statistical technique for predicting a two dimensional vector with application, by R. E. Vogel. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. May 60. Contract W-7405-ENG-36. 84p. Order from OTS. $2.25. LA-2380

Space, energy, and time distribution of neutrons at the ground-air interface. Calculated by Monte Carlo Code NHM, by W. A. Biggers, L. J. Brown, and K. C. Kohr. University of California Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Jan 60. Contract W-7405-ENG-36. 173p. Order from OTS. $3.00. LA-2390

The thermal expansion of plutonium metal below 300°K, by T. A. Sandenaw. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. May 60. Contract W-7405-ENG-36. 23p. Order from OTS. 75 cents. LA-2394

Collective oxtupole vibrations of deformed nuclei, by J. J. Griffin and L. Wilets. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. June 60. Contract W-7405-ENG-36. 32p. Order from OTS. $1.00. LAMS-2389

A summary of nuclear calculations for the organic moderated reactor experiment (OMRE), by R. O. Williams, Jr. and R. F. Wilson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 84p. Order from OTS. $2.25. NAA-SR-4066

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Mathematics panel progress report for period September 1, 1958 to December 31, 1959, by A. S. Householder. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 39p. Order from OTS. $1.25. ORNL-2915

High-explosive ditching from linear charges. Interim report, project Toboggan, Phase I, by R. H. Carlson. Sandia Corporation, Albuquerque, N. Mex. 57p. Order from OTS. $1.75. SC-4441(RR)

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Range-energy relation for heavy ions in metals, by E. L. Hubbard. University of California.

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The rubidium-85-rubidium-86 hyperfine-structure anomaly. Thesis, by N. Braslau. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Mar 60. Contract W-7405-eng-48. 150p. Order from OTS. $3.00. UCRL-9130

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Irradiation-capsule study of uranium monocarbide, by R. B. Price and others. Battelle Memorial Institute, Columbus, Ohio. Mar 60. Contract W-7405-eng-92. 38p. Order from OTS. 75 cents. BMI-1425

Radiation damage conference, March 23-24, 1953. Part I, by F. E. Faris and others. Oak Ridge National Laboratory. Oak Ridge, Tenn. Dec 54. Decl. with deletions August 10, 1959. Contract W-7405-eng-26. 219p. Order from OTS. CF-53-276(Pt. 1) (Del.)

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Irradiation effects on the surface reactions on metals metals, Summary report for October 1, 1958 to November 1, 1959, by J. L. White and others. General Dynamics Corporation, General Atomic Division, San Diego, Calif. Dec 59. Contract AT(04-3)-179. 39p. Order from OTS. $1.00. GA-1093

Proceedings of the lattice deffects in noble metals conference, held at Canoga Park, California on October 16 and 17, 1958, by J. A. Brinkman, C. J. Meechan and A. Sosin. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. [1958]. Contract AT(11-1)-GEN-8. 127p. Order from OTS. $1.25. NAA-SR-3250

Radiation effects. Bibliography, by Radiation Effects Division. Sandia Corporation, Albuquerque, N. Mex. Dec 59. 610p. Order from OTS. $8.00. SCR-140

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Removal of radioiodine from air streams by activated charcoal, by R. E. Adams and W. E. Browning, Jr. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 11p. Order from OTS. 50 cents. ORNL-2872

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Thermal shock tests of a plate-type nuclear superheater fuel element design, by R. J. Gariboldi. Argonne National Laboratory, Reactor Engineering Division, Argonne, Ill. Mar 60. Contract W-31-109-eng-38. 14p. Order from OTS. 50 cents. ANL-6086

Some steady-state thermal characteristics of a three-loop reactor power system, by T. R. Bump and H. O. Monson. Argonne National Laboratory, Reactor Engineering Division, Argonne, Ill. Mar 60. Contract W-31-109-eng-38. 22p. Order from OTS. 75 cents. ANL-6137

A preliminary design study of a boiling slurry reactor experiment, by M. Petrick and J. F. Marchaterre. Argonne National Laboratory, Argonne, Ill. Apr 60. Contract W-31-109-eng-38. 39p. Order from OTS. $1.25. ANL-6148

Sodium components test facility. Atomic Power Development Associates, Inc. Detroit, Mich. Nov 59. Contract AT(11-1)-772. 208p. Order from OTS. $3.50. APDA-134

Metal-water reactions: VI. Analytical formulations for the reaction rate, by L. F. Epstein. General Electric Co. Vallecitos Atomic Laboratory, Atomic Power Equipment Dept., Pleasanton, Calif. Sep 59. Contract AT(04-3)-189. 52p. Order from OTS. $1.50. GEAP-3272

Plutonium recycle test reactor - Final safeguards analysis. Supplement I: Additional studies, by N. G. Wittenbrock and others. Hanford Atomic Poroducts Operation, Richland, Wash. Apr 60. AT(45-1)-1350. 29p. Order from OTS. $1.25. HW-61236 SUP 1

Experimental and analytical studies of reflector control for the advanced engineering test reactor. Part A, by W. S. Delicate, M. J. Kornfeld, and A. M. Larson. Part B, by P. C. Bertelson, and T. L. Francis. Internuclear Company, Inc., Clayton, Mo. Oct 59. Contract AT(11-1)-688. 256p. Order from OTS. $4.00. INTERNUC-47(Pts. A and B)

Thermal cycling and leakage tests of 12-inch valves for sodium service, by C. J. Baroczy. Atomics International. A Division of North American Aviation, Inc., Canoga Park. Calif. May 60. Contract AT(11-1)-GEN-8. 50p. Order from OTS. $1.00. NAA-SR-4947

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Pathfinder Atomic Power Plant. Coolant distribution tests. Final report, by J. Wilson and R. Styles. Atomic Energy Division, Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Nov 59. Contract AT(11-1)-589. 18p. Order from OTS. 75 cents. ACNP-5920

Pathfinder Atomic Power Plant technical progress report for July 1, 1959 through September 30, 1959, by O. Burgreen and others. Atomic Energy Division, Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Nov 59. Contract AT(11-1)-589. 121p. Order from OTS. $2.75. ACNP-5924

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Nuclear prototype power plant installation in merchant ships. Ford Instrument Co., Division of Sperry Rand Corporation and Maryland Shipbuilding & Drydock Company. [nd.] Contract MA-1893. 191p. Order from OTS. $3.00. FICo -112

Army gas-cooled raactor systems program. Semiannual progress report for 1 July through 31 December 1959, by G. A. Linenberger. Aerojet-General Nucleonics, The Military Projects Division, San Ramon, Calif. Feb 60. Contract AT(10-1)-880. 158p. Order from OTS. $5.40. IDO-28549

Design considerations for a plasma thermocouple reactor, by B. E. Watt. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. May 60. Contract W-7405-ENG-36. 24p. Order from OTS. $1.00. LAMS-2386

Quarterly status report of the LASL plasma thermocouple development program for period ending March 20, 1960, by S. Glasstone. University of California. Loa Alamos Scientific Laboratory, Los Alamos, Calif. May 60. Contract W-7405-ENG-36. 18p. Order from OTS. 75 cents. LAMS-2423

PM-1 Nuclear Power Plant Program. 2nd quarterly progress report for 1 June to 31 August 1959, by J. S. Sieg and others. Martin Company, Nuclear Division, Baltimore, Md. Oct 59. Contract AT(30-1)-2345. 212p. Order from OTS. $4.00. MND-M-1813

OMRE fuel removal and shipping equipment, by P. J. Mallon, D. S. Duncan and R. C. Noyes. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Apr 60. Contract AT(11-1)-GEN-8. 48p. Order from OTS. $1.25. NAA-SR-3337

An advanced sodium-graphite reactor nuclear power plant, by J. R. Churchill and J. Renard. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Mar 60. Contract AT(11-1)-GEN-8. 162p. Order from OTS. $3.00. NAA-SR-3829

Natural uranium sodium-deuterium reactors. (Preliminary design and economic analysis), by L. Joseph, G. Sofer and L. Goldstein. Nuclear Development Corporation of America, White Plains, N. Y. Feb 59. Contract AT(30-3)-256. 235p. Order from OTS. $3.50. NDA-84-15

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Environmental analysis of NS "Savannah" operation at Camden, by W. B. Cottrell and others. Oak Ridge National Laboratory, Reactor Projects Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 113p. Order from OTS. $2.75. ORNL-2867

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Homogeneous reactor program quarterly progress report for period ending January 31, 1960, by R. B. Briggs and others. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 138p. Order from OTS. $3.00. ORNL-2920

Chemical shutdown system, by Z. M. Shapiro. Westinghouse Electric Corp., Atomic Power Div., Pittsburgh, Pa. Sep 54. Decl. with deletions April 29, 1957. Contract AT-11-1-GEN-14. 8p. Order from LC. Mi $1.80, ph $1.80. WAPD-C(PC)-23(Del.)

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Physics calculations for control rods in the first Yankee core, by W. H. Arnold, Jr. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh, Pa. Sep 59. Contract AT(30-3)-222. 47p. Order from OTS. $1.50. YAEC-62

Two-region critical experiments with water moderated slightly enriched UO_2 lattices, by P. W. Davison and others Westinghouse Electric Corporation, Atomic Power Dept., Pittsburgh, Pa. Nov 59. Contract AT(30-3)-222. 77p. Order from OTS. $2.25. YAEC-142

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Stable Isotope Separation

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Pilot plant studies of slag liners, Section VII of the series, "Uranium metal by bomb reduction, by T. O. Anderson. Mallinckrodt Chemical Works, St. Louis, Mo. Nov 52. Decl. October 7, 1959. 34p. Order from LC. Mi $3.00, ph $6.30. NYO-1348

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GENERAL RESEARCH PUBLICATIONS AND PRESENTATIONS, 1958. June 59, 29p. 64 refs. LMSD-49753.
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A list of papers in the following categories: gas dynamics, aerothermodynamics, structures and mechanics, nuclear physics, radiation physics, magnetohydrodynamics, space physics, propulsion chemistry, materials, electrochemistry, solid state, electromagnetic propagation, electrical communications, acoustics and instrumentation, applied mathematics, and logical design.

ASTRONOMY

High Altitude Observatory, Boulder, Colo.
CLIMAX CORONAL INTENSITIES, DECEMBER 12, 1941-MAY 21, 1944, by Donald E. Billings. Technical rept. no. 4 on Contract DA 23-072-ORD-929. 3 Sep 57, 53p. 3 refs. Rept. no. HAO-37; OOR rept. 1482.4; AD-153 815.
Order from LC mi$3.60, ph$9.30 PB 147 863

The coronal spectrograms were only partially analyzed at the time the observations were made. Subsequent studies of solar geomagnetic relationships and of long-term coronal changes made the analysis of these plates very desirable. Since the plates contained no photometric calibrations, it was necessary to devise means of extracting a calibration from the Fraunhofer lines, and using this calibration to translate photographic blackenings into intensities at each position angle around the solar limb. The table of coronal intensities thus obtained is submitted. (Author)

Warner and Swasey Observatory, Cleveland, Ohio.
RED STARS IN YOUNG STELLAR CONFIGURATIONS, by Victor M. Blanco. Final rept. on Contract Nonr-2545(00). 30 June 59, 3p.
Order from LC mi$1.80, ph$1.80 PB 146 282

Astrophysics

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
EXTENSIVE AIR SHOWERS AT SEA LEVEL, by Frank Sherb. Technical rept. no. 71 on Contract Nonr-1841(16) and National Science Foundation Grants G2055 and G3006. 31 Aug 59, 87p. 17 refs.
Order from LC mi$4.80, ph$13.80 PB 147 714

This thesis describes an experiment directed primarily at the determination of some properties of cosmic ray primary particles with energies greater than 10^{15}ev. In addition, some information has been obtained on high-energy nuclear cascades.

Maryland U., College Park.
PRESENT STATUS OF THE EARTH'S RADIATION BELT, by S. F. Singer. Scientific rept. no. 3 on Contracts AF 49(638)630 and AF 19(604)5575. Sep 59, 9p. 2 refs. Technical rept. no. 155; AFCRC-TN-59-766; AFOSR-TN-59-1029; AD-227 260.
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From theoretical considerations one expects to find two belts of trapped radiation around the earth. The following table, first presented by the writer in November 1958 at the San Antonio Symposium on the Physics and Medicine of Space, (in press, John Wiley and Sons, New York), lists the principal characteristics. These predictions have now been well supported by observations in satellites and space probes.

Rome Air Development Center, Griffiss AFB, N. Y.
ON THE POSSIBILITY OF SPACE SURVEILLANCE BY UTILIZATION OF SOLAR R-F ENERGY, by Joel S. Greenberg. Apr 60, 15p. 5 refs. RADC-TN-60-55.
Order from LC mi$2.40, ph$3.30 PB 147 514

The sun is a powerful transmitter which radiates a portion of its energy in the radio-frequency portion of the spectrum. The question naturally arises as to whether sufficient energy in the r-f portion of the spectrum is available from the sun so as to utilize the sun as a free transmitter in a space surveillance environment. This report discusses the possibility of utilizing the solar radiation for space surveillance; in particular, an analysis is performed for the conditions of noncoherent and coherent radiation, and the range capabilities for these two conditions are determined. (Author)

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
MANUAL APPLICATION OF IMPULSES WHILE TRACTIONLESS, by Ernest Dzendolet. Rept. on Human Performance on Advanced Systems. Feb 60, 16p. 3 refs. WADD Technical rept. 60-129.
Order from OTS $0.50 PB 161 804

The percentage of naive subjects who, while tractionless in a horizontal plane and anchored by one handhold, push in or pull out a plunger in one motion against various frictional forces and travel distances, decreases directly as the force and distance required. With large-force impulses, the impulse is linear and the situation can be described by the impulse-mementum theorem: $\int_0^t F dt = mv_1 - mv_0$. The shape of the impulse is saw-toothed, and its area approximated by taking three-fourths of the area of a rectangle whose base is the duration, and height, the force of the impulse. For this experiment, the maximum duration of an effective impulse for a required force of 40 pounds is 0.5 seconds for a push-in, and 0.3 seconds for a pull-out impulse. A subject, without a handhold, can seat the plunger with a push, and, in spite of the reaction to the impulse, remain attached to the equipment without unseating it. The technique is to allow the reaction to move the subject over as long a distance as possible and, since the total impulse is constant, thus reduce the force. The reduction in force allows the equipment to remain seated since the force is now less than the frictional force needed for seating. (Author)

Aerospace Medical Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
WALKING UNDER ZERO-GRAVITY CONDITIONS, by John C. Simons. Rept. on Human Engineering Design Criteria for Space Vehicles. Oct 59, 12p. 3 refs. WADC Technical note 59-327; AD-232 469.
Order from OTS $0.50 PB 161 814

Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.
STUDIES ON THE KINETIC DEPTH EFFECT AS A MEANS FOR PRESENTING THREE DIMENSIONAL INFORMATION. I. METHODOLOGY AND SELECTION OF FORMS FOR STUDY, by Charles Fried. Mar 60, 38p. 28 refs. Technical memo. 2-60.
Order from LC mi$3.00, ph$6.00 PB 146 160

In an introductory study on the Kinetic Depth Effect, twelve stationary shadow projections of each of nine forms were presented to ten subjects to determine which forms appeared flat or two dimensional and which appeared three dimensional. This study was done to select from the nine forms a small group, all of whose shadow projections would appear as two dimensional. The only forms that appeared two dimensional to all subjects in each of their twelve shadow projections were the wire rod and the helix. The helix on examination was revealed to undergo substantially the same changes as the wire rod. A historical account of the Kinetic Depth Effect illusion and its pertinence for three dimensional displays is presented. (Author)

Electronic Research Lab., Northeastern U., Boston, Mass.
DIGITAL SIMULATION STUDY OF GAME-THEORETIC MODELS OF AN AIR TRAFFIC CONTROL SYSTEM, by John E. Letson. Scientific rept. no. 4 on Contract AF 19(604)4573. 21 Apr 60, 78p. 33 refs. AFCRC-TN-60-384.
Order from LC mi$4.50, ph$12.30 PB 147 664

A generalized large-scale, complex system is analyzed. The relation of the man-machine unit to the overall system response is considered. A particular system is established so that the effect of various strategies in a game theoretic sense might be evaluated. A study of the human decision process if the man-machine unit is discussed and graphs indicating the behavior of this operator, given certain conditions, are shown.

Stanford Research Inst., Menlo Park, Calif.
HUMAN ENGINEERING TESTING AND MALFUNCTION DATA COLLECTION IN WEAPON SYSTEM TEST PROGRAMS, by Albert Shapero, Joel I. Cooper and others. Rept. on A Method for Performing Human Engineering Analysis of Missile Systems, Contract AF 33(616)5688. Feb 60, 52p. 2 refs. WADD Technical rept. 60-36.
Order from OTS $1.50 PB 161 832

An examination was made into the frequency of human error in nine Air Force missile systems. It was discovered that human error contributed significantly (20% to 53%) to system unreliability, and that present malfunction reporting procedures are inadequate. Systematic approaches to the conduct of human engineering performance testing and the collection of adequate human-initiated malfunction data are outlined. (Author)

Personnel and Training

American Inst. for Research, Pittsburgh, Pa.
A SURVEY TO DETERMINE INDOCTRINATION NEEDS FOR PERSONNEL AT ISOLATED ARCTIC SITES, by Leo R. Eibert. Jan 59, 24p. 2 refs. Technical note AAL-TN-59-2; AD-230 842.
Order from LC mi$2.70, ph$4.80 PB 146 119

Contents:
Survey procedures and findings
- Attitude toward the assignment
- Conditions associated with attitude change
- Information and rumors
- Adjustment problems
- Making the tour easier and more pleasant

Implications for indoctrination
- Indoctrination courses
- Familiarization training unit
- Motivation training unit
- Supplementary indoctrination needs

Harvard Graduate School of Education, Cambridge, Mass.
VOCATIONAL DEVELOPMENT, THE ELECTION OF A SECONDARY SCHOOL CURRICULUM, AND PUBLIC POLICY, by John C. Cass and David V. Tiedeman. Rept. no. 13 on Harvard Studies in Career Development, Technical rept. no. 9 on Contract Nonr-1866(31). Aug 59, 25p. 17 refs. AD-226 732.
Order from LC mi$2.70, ph$4.80 PB 147 715

The correlation of scholastic ability with college attendance is discussed. High school curriculum choices (College, General, Commercial, Home economics, Industrial arts, Agriculture) of 884 beginning freshmen were related to those aspects of pupils that are routinely and formally available to counselors (Otis quick-scoring mental ability test, Kuder preference record, Bennett and Fry mechanical comprehension test, Minnesota paper form board, age, sex, and family income) Results indicated that the sex variable dominates the first discriminant and clearly differentiates the 2 areas of vocational education for each sex. The second discriminant differentiates the college oriented group from the remainder, but largely in terms of age for grade, family economic circumstance, and orientation to academic areas. The third discriminant differentiates the 2 vocational education areas chosen by young men. Talent figured only lightly in curriculum choise. Results indicated that cultural changes are needed to influence sex roles, and parental orientations to school and learning. Some form of therapy or remediation may be required to change a pupil's image of school and of learning (age at grade) and to gain thoughtful consideration of the concept-application conflict which is the fundamental dichotomy of liberal and vocational education.

Harvard Graduate School of Education, Cambridge, Mass.
"YOU OUGHT TO STUDY....": METHODS AND RESULTS IN RELATION TO THE ELECTION OF A CURRICULUM IN SECONDARY SCHOOL, by Violet Kugris (Educational Research Corp.) and David V. Tiedeman. Rept. no. 11 on Harvard Studies in Career Development; Technical rept. no. 7 on Contract Nonr-1866(31). Aug 59, 46p. 27 refs. AD-226 733.
Order from LC mi$3.30, ph$7.00 PB 148 150

A way to conceptualize people which simultaneously anticipates choice and provides a means of assessing the appropriateness of the choice is sought. An individual's choice of curriculum, college major, or employment is usually considered appropriate when the prediction of success in the chosen endeavor conforms with a level acceptable to some judge. In order to force simultaneous consideration of proportionality, centroid, and dispersion, three judges were given a group of profiles representative of the pool of ability in boys and girls available to a high school in a given year. The judges apportioned the profiles to the curricula of the high school according to the curriculum most appropriate for a particular pattern of ability. The pool of profiles to be sorted provides a means for counselors to resolve differences of opinion. Sorting of a group of profiles of ability indicates how one intends to utilize talents. This method is also applicable to personnel assignments in industry and the Armed Services. If differences of opinion about personnel utilization can be resolved, multivariate distributions appropriate for a choice in a closed system of alternatives could be specified through analysis, and the relative appropriateness of a choice for a person could be reported in terms of the relative frequency with which one's characteristics are found among those for whom each choice is appropriate.

Northwestern U. [Evanston, Ill.]
INTERRELATIONSHIPS AMONG LEADERSHIP CRITERION MEASURES FOR A POPULATION OF AIR FORCE PILOT CADETS, by Donald T. Campbell. Rept. on Contract AF 18(600)170. June 57, 9p. AFPTRC-TN-57-70; AD-131 421.
Order from LC mi$1.80, ph$1.80 PB 148 278

Military Aptitude Ratings (MARs) using a 5-point scale were completed on each cadet by every classmate as well as every military training instructor and every flying training instructor. These three MARs were used to compute the cadet's final military training grade. Other data included grades on non-leadership aspects of training (flying training and academic training); records of demerits at the final training base, and nomination ballots of cadets on classmates who were extremes on leadership. Criterion data were secured on numbers ranging from 239 to 423 men.

Psychology

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
SPECTRAL SENSITIVITY OF THE EYE BASED ON VISUAL ACUITY, by John Lott Brown, Lester Phares, and Dorothy E. Fletcher. Rept. no. 12 on BuMed Task MR 005.13-6002.1. 26 Apr 60, 31p. 11 refs. TED ADC AE-5210; NADC-MA-6006.
Order from LC mi$3.00, ph$6.30 PB 147 785

Threshold relative energy measurements have been made with monochromatic light at 10 millimicron intervals between 400 and 710 millimicrons for threshold criteria which represent a series of visual acuities in addition to light detection. The data can be approximated by summing cone and rod sensitivities derived from earlier independent measurements of light detection by the dark adapted eye in the fovea and the periphery. The relation between the logarithm of threshold energy and visual acuity required by the criterion of threshold has been predicted from monochromatic energy data for several broad spectral distributions of illumination and predictions are compared with empirical data. (Author)

Aviation Psychology Lab., U. of Illinois, Urbana.
MAN-MACHINE TRACKING PERFORMANCE WITH SHORT-PERIOD OSCILLATORY CONTROL SYSTEM TRANSIENTS, by Frederick A. Muckler. Rept. for 1 Nov 54-1 Nov 56 on Human Factors in the Design of Operator Trainers, Contract AF 33(616)2725. Jan 60, 20p. 14 refs. WADD Technical rept. 60-3.
Order from OTS $0.50 PB 161 791

Six skilled subjects performed a single-dimension compensatory tracking task with apparatus incorporating oscillatory transients as control-system dynamics. The period of the transients was varied as the independent variable. System performance, as measured by time-on-target, improved as the transient period was increased from 1.0 to 3.5 seconds. The results are felt to be highly dependent upon specific subject task control techniques. (Author)

California U., Los Angeles.
EFFECTS OF DIFFERENT AMOUNTS OF TRAINING ON ORIGINALITY, by Irving Maltzman, Seymore Simon and others. Technical rept. no. 3 on Contract Nonr-233(50). Aug 59, 8p. 4 refs. AD-225 544.
Order from LC mi$1.80, ph$1.80 PB 148 129

Four groups of subjects received an initial and final free association test scored for originality, followed by the Unusual Uses Test. Group C received a single presentation of the initial list. Groups X_1, X_5, and X_{10}, received one, five, and ten, repetitions of the initial list with instructions to give a different response on each occasion. A fifth group, C_x, received the free association test of originality without the prior training list. The two control groups did not differ significantly on the free association test of originality. Each of the experimental groups was significantly more original than Group C, and Groups X_5 and X_{10} were also reliably more original than Group X_1. The three experimental groups were also significantly more original than Group C on the Unusual Uses Test, but they did not differ significantly from each other. These results were tentatively taken as supporting the hypothesis that originality is a form of learned behavior following the same principles as other forms of operant behavior. (Author)

California U., Los Angeles.
ON THE TRAINING OF ORIGINALITY, by Irving Maltzman. Technical rept. no. 5 on Contract Nonr-233(50). Aug 59, 14p. 31 refs. AD-225 545.
Order from LC mi$2.40, ph$3.30 PB 148 131

The basic problem in the training of originality is to devise a means of increasing the frequency of uncommon behavior. Once it takes place it may receive reinforcement and increase the probability that other original behavior will occur. Earlier attempts to devise training methods for originality were briefly mentioned, as well as related studies of problem solving. A series of experiments by Maltzman and his associates was reviewed and a procedure which consistently facilitated originality was described. This procedure involves the repeated presentation of a list of stimulus words in a modified free association situation accompanied by instructions to give a different response to each stimulus. Under these conditions the responses become more uncommon. When presented with new stimulus materials subjects receiving such training are reliably more original than subjects receiving no training. Tentative suggestions as to the behavioral bases for the training effect were also given. (Author)

California U., Los Angeles.
THE PERSISTENCE OF ORIGINALITY TRAINING EFFECTS, by Irving Maltzman, Seymore Simon and Leonard Licht. Technical rept. no. 4 on Contract Nonr-233(50). Aug 59, 7p. 3 refs. AD-225 741.
Order from LC mi$1.80, ph$1.80 PB 148 130

Two control groups received a single presentation of a free association list followed by free association and Unusual Uses tests of originality after delays of one-hour and two days respectively. Two experimental groups received comparable delays between repeated presentations of the initial list, originality training, and the originality tests. The main effects of training and delay were significant on the free association test of originality, while the main effect of training was significant in terms of unique responses on the Unusual Uses test. These results were interpreted as lending support to the hypothesis that originality is a learned form of behavior which does not differ in principle from other forms of operant behavior. (Author)

Connecticut U. [Storrs].
THE CONDITIONING OF VERBAL ASSOCIATIVE RESPONSES ELICITED BY NON-VERBAL STIMULI, by W. A. Bousfield, P. N. Herman, and G. A. Whitmarsh. Technical rept. no. 33 on Contract Nonr-631(00). Aug 59, 15p. 6 refs. AD-227 915.
Order from LC mi$2.40, ph$3.30 PB 148 147

A study is described which was designed for testing the experimental hypothesis that after a verbal CS and a non-verbal US have been repeatedly presented according to the requirements for classical conditioning, the subsequent presentation of the verbal CS should have the consequence of facilitating the occurrence of the verbal associative responses elicited by the non-verbal US. The method employed a single word as the verbal CS, and a flash of light as the non-verbal US. In the initial training, a memory

drum was used for exposing a list of stimulus words. The verbal CS appeared 14 times with 9 of these appearances reinforced by the flash of light. The remaining words, one of which also appeared 14 times, were not reinforced. Subsequent to this training a forced choice device was used for testing the effects of the initial learning. This involved the use of five tests of the following type for each of four stimulus words including the CS. For each of these words the S was instructed to select from five words the one the stimulus word most made him think of. For each such test one of the five words was a previously determined verbal associate of the non-verbal US. The analyses of the data of two related experiments indicated support for the experimental hypothesis. (Author)

Connecticut U., Storrs.
THE PARASITIC REINFORCEMENT OF VERBAL ASSOCIATIVE RESPONSES, by W. D. Kincaid, Jr., W. A. Bousfield, and G. A. Whitmarsh. Technical rept. no. 32 on Contract Nonr-631(00). Aug 59, 19p. 6 refs. AD-227 916.
Order from LC mi$2.40, ph$3.30 PB 148 146

Two experiments are described which were designed to test the hypothesis that the paired-associate learning of a meaningful response word to a nonsense syllable stimulus should have the consequence of establishing connections between the nonsense syllable and the members of a group of verbal associative responses of the learned response word. Ten nonsense syllable--meaningful word pairs were presented for paired-associate learning to 113 Ss in the first experiment and to 136 Ss in the second. The response words were selected from a set of stimulus words for which free-associated norms had been previously obtained from a population of 150 Ss. A forced-choice test was developed which involved presenting each S with the nonsense syllable stimulus followed by five words one of which was an associate of the learned word. The S was instructed to select the one word which he felt was most related to the nonsense syllable. The selection by the S of the given associate was assumed to demonstrate the prior establishment of a connection between the associate and the nonsense syllable. The results strongly supported the hypothesis. No significant functional relationship was found to exist between the choices of associates in the testing situation and their cultural frequencies of occurrence as responses to the meaningful words. (Author)

Educational Testing Service, Princeton, N. J.
THE INFLUENCE OF INSTRUCTIONS AND OF REPEATED MEASUREMENT ON PERSONALITY-INVENTORY SCORES, by John R. Hills. Rept. on Contract Nonr-2214(00). June 59, 15p. 10 refs. AD-227 346.
Order from LC mi$2.40, ph$3.30 PB 147 453

An experiment was conducted to determine if the measurement properties of an inventory were influenced by whether the examinees were instructed to answer rapidly or to answer deliberately and carefully. Also examined were the speed with which the test was taken and the Total Adjustment scores on the test. It was found that the instructions do change the meaning of the scores. Also, the second form of the test is taken much faster than the first, and the examinees' personalities appear to be more adjusted on the second administration. (Author)

Family Relations Center, San Francisco, Calif.
DISCRIMINANT ANALYSIS OF VARIABLES RELATED TO NONCONFORMITY IN NAVAL RECRUITS, by E. K. Gunderson. Technical rept. no. 11 on Rehabilitation Research, Contract Nonr-1535(00). 20 Aug 59, 14p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 147 688

The present report is concerned, primarily, with an analysis of the relationships among the non-offender control group and the offender sub-groups using Mahalanobis' generalized distance function (D^2) and, secondly, with the application of this analysis to the problem of maximizing separation of offenders and non-offenders.

Harvard Graduate School of Education, Cambridge, Mass.
CAREERS AND FAMILY ATMOSPHERES. AN EMPIRICAL TEST OF ROE'S THEORY, by Douglas Hagen. Rept. no. 10A on Harvard Studies in Career Development, Technical rept. no. 6 on Contract Nonr-1866(31). 22 July 59, 18p. 4 refs. AD-220 413.
Order from LC mi$2.40, ph$3.30 PB 147 701

An attempt was made to test the basic hypothesis of Roe's theory (J. Counseling Psychol. 4:212-217, 1957). The theory deals with the family atmosphere in which the parent and child interact. Roe predicts that (1) a child from a protecting climate will select a service occupation as an adult; (2) a demanding climate disposes a person towards a career in either business contact or general culture; (3) a child from a rejecting climate later chooses a scientific vocation; (4) a neglecting climate orients an individual toward an outdoor occupation; and (5) a person from a casual childhood atmosphere pursues a career in technology as an adult. Data from 245 participants indicated that with one possible exception, Roe's theoretical scheme in its literal translation and specific application has only limited validity. Except in the case of a casual family atmosphere, the posited relationships between specific family climates and a later career choice are not supported by the data.

Harvard Graduate School of Education, Cambridge.
CONCEPTIONS OF SELF AND PERCEPTION OF ROLE IN RELATION TO CONTINUATION IN SCHOOLS OF NURSING, by Anne K. Kibrick (Boston U.) and David V. Tiedeman. Rept. no. 12 on Harvard Studies in Career Development, Technical rept. no. 8 on Contract Nonr-1866(31). Aug 59, 20p. 9 refs. AD-226 734.
Order from LC mi$2.40, ph$3.30 PB 148 149

The perseveration of decisions directing vocational behavior was investigated. It was felt that vocational development is a matter of implementing a self concept and a job concept, and that incompatibilities of either concept give rise to dissatisfaction which in

turn cause one to leave an occupation. Using schools of nursing as a frame of reference, perseveration toward the goal of nursing was studied. All students, having passed aptitude and intelligence tests, were presumed to be capable of completing the course. The experimental postulate was that perseverance in working toward the objective of becoming a nurse is a direct function of the amount of correspondence existing between the images of student and supervisor when the student embarks upon her training. Scores from questionnaires indicated the amount of agreement between an entrant's concept of her task, her role, and herself and the standards of the superiors who would train her. The agreement scores were related to perseveration toward goal in each instance, but the relationship was not very high. Thus, incompatibility at entry with the expectations of those who set the role does not have a marked influence upon staying in a school of nursing for less than six months. However, the prediction of adjustment to a situation requires that the future reality be known at entry as well as possible. (Author)

Human Sciences Research, Inc., Arlington, Va.
A BIBLIOGRAPHY OF SMALL GROUP RESEARCH, by Anita Terauds, Irwin Altman, and Joseph E. McGrath. Rept. on Contract AF 49(638)256. Apr 60, 209p. 2155 refs. HSR-RR-60/2-Gn, supersedes PRA rept. 57-20; AFOSR-TN-60-365.
Order from LC mi$9.30, ph$31.80 PB 147 835

Interaction Lab., Yale U., New Haven, Conn.
GROUP SIZE AND SOCIAL ORGANIZATION, by Morris L. Berkowitz. Technical rept. no. 5 on Problem Solving and Social Interaction, Contract Nonr-609(16). 15 Nov 57, 74p. 143 refs.
Order from LC mi$4.50, ph$12.30 PB 138 123

This study constitutes an attempt to isolate experimentally the effects of group size upon social organization. Forty-two groups, seven each of sizes three, four, six, seven, nine and ten, were selected randomly from the student body of the Basic Submarine School of the United States Naval Submarine Base, New London, Connecticut. These ad hoc groups were trained in the "calculus task" developed by Moore and his colleagues. Following training, each group was placed in a problem-solving situation in which cooperation and agreement were necessary for problem solution. The experimental arrangement was designed in such a way that subjects could communicate only through the medium of a sound-powered phone system; they could not see each other. The data were analyzed through the use of variance techniques. Twenty variables were found to be related significantly to group size.

Louisiana State U., Baton Rouge.
EFFECTS OF MOTIVATION ON CONSISTENCY OF PERFORMANCE IN GROUPS, by Bernard M. Bass. Technical rept. 16 on Behavior in Groups, Contract N7onr-356(09). Feb 58, 8p. 4 refs.
Order from LC mi$1.80, ph$1.80 PB 138 285

A total of 255 ROTC cadets varying in motivation to perform well were given a "teamwork" test in groups of 5. Correlations between their judgements before and after discussions and the changes in these correlations provided measures of the social behavior of the Ss. On 3 of the 4 measures of attempted and successful leadership during a total of 10 trails, corrected split-half reliabilities were highest when motivation was lowest and lowest when motivation was highest. Reliability was never highest for any of the 11 related objective measurements when motivation was highest. It was highest at medium motivation for 5 of the measures and at low motivation for 6 of the measures of leadership, accuracy, stability and agreement with others. The results may be accounted for by the effects of stress on the variability of behavior.

Princeton U., N. J.
A METHOD OF STUDYING INTERACTION UNDER CONDITIONS OF INTERPERSONAL CONFLICT, by W. Peter Janicki and H. M. Schroeder. Technical rept. no. 6 on Contract Nonr-1858(12). Aug 59, 39p. 7 refs. AD-225 784.
Order from LC mi$3.00, ph$6.30 PB 147 694

A technique is described which provides a measure of behavior in interaction situations where an individual's response to an incongruent situation can be studied as a stimulus to another person. Data suggest the following effects: (1) college student dyads are more information oriented (i.e. pair's judgments are more independent of each other) and less normative or source oriented than high school student dyads; (2) for high school dyads friendship enhances an informational orientation, whereas for the college students friendship appears to make little difference in the relative stimulus vs. source weighting; (3) monetary reward for accuracy (information orientation) did not increase the information orientation in reward as opposed to non-reward dyads; and (4) medium IQ dyads are more source oriented, high IQ dyads more information oriented, and low IQ dyads fall in between these two groups.

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
AN EXPERIMENT ON ACTIVE AND PASSIVE RESISTANCE TO SOCIAL ORDER, Dorwin Cartwright, John R. P. French, Jr. and Edward Sampson. Technical rept. on Contract Nonr-1224(11). 12 Aug 59, 38p. AD-225 836.
Order from LC mi$3.00, ph$6.30 PB 148 148

The concept of resistance, especially as it results in what is called negative conformity, was analyzed by offering a scheme which seeks to elaborate upon the conditions under which such resistance will operate. Three main conditions were examined: (1) a situation of negative identification or negative attraction between the agent (O) and the person (P) in which P actively seeks to be maximally dissimilar from O; (2) a situation in which P perceives O as a false expert; and (3) a situation in which P perceives that O's influence attempt was an unsuccessful attempt to control his behavior and sets up an opposition between conformity and autonomy. From these theoretical concepts a series of hypotheses were derived and tested.

Vanderbilt U., Nashville, Tenn.
STUDIES IN ABSTRACTION LEARNING. I. A COMPARISON OF PERCEPTUAL VERSUS ABSTRACTION LEARNING, by Stanford C. Ericksen. Technical rept. no. 3 on Contract Nonr-2149(01). Aug 59, 19p. 7 refs. AD-220 929.
Order from LC mi$2.40, ph$3.30 PB 147 705

An attempt was made to provide a more explicit integration between thinking (abstraction) and perception as subcategories within the generic area of human learning. Two groups, each of which contained 14 human subjects, were compared in a 3-point, temporal walking maze. One group was blindfolded while the other group had no visual interference. The seeing subjects were labeled perceptual learners since they were free to use all available and relevant maze and room cues in learning to walk the correct temporal pattern via the 3 treadles. The blindfolded subjects were labeled abstraction learners since the external sensory cues were either not available or were irrelevent for controlling the required sequence of movements. The data indicated that seeing and blindfolded subjects can learn a 12-choice temporal walking maze with about equal efficiency. After a shift to a new starting point (rotating the maze) the blindfolded learners showed superior ability in adapting to the new demands of the 3 transfer tasks.

Vanderbilt U., Nashville, Tenn.
STUDIES IN ABSTRACTION LEARNING. II. THE RELATIVE DIFFICULTY OF "PLACE" AND "RESPONSE" LEARNING IN A HUMAN TEMPORAL MAZE, by Stanford C. Ericksen and Charles R. Porter (Master's thesis, Western Reserve U.). Technical rept. no. 4 on Contract Nonr-2149(01). Aug 59, 12p. 2 refs. AD-220 928.
Order from LC mi$2.40, ph$3.30 PB 147 706

A methodological study dominated by operationally defined conditions of perceptual (Place) learning and abstraction (Response) learning is described. The experimental objective was to compare the learning difficulty of a temporal series of Place versus Response decisions. Both tasks involved some degree of abstracting, at least counting, but the Place learners were required to utilize objective, environment cues while the Response learners ignored these external cues and controlled their learning by a self-generated set of directional cues, i.e. to go right or to go left. There were no significant differences in performance scores between the two groups being tested in these walking maze tasks. Within the limits of such a learning situation, it appears that the dependent variable responses that help define abstraction learning are no more difficult to acquire than are those responses, verbal or otherwise, which serve to define perception learning. The larger systematic importance of this series of studies on the abstraction process is believed to rest with the greater specificity given to the mediational processes which are hypothesized to account for the consistency of learning and problem solving in an ever changing environment, i.e. thinking. (Author) (See also PB 147 705)

Vanderbilt U., Nashville, Tenn.
STUDIES IN ABSTRACTION LEARNING. III. THE TRANSFER OF PERCEPTUAL VERSUS ABSTRACTION LEARNING, by Stanford C. Eriksen. Technical rept. no. 5 on Contract Nonr-2149(01). Aug 59, 53p. 9 refs. AD-220 930.
Order from LC mi$3.60, ph$9.30 PB 147 707

A laboratory procedure was developed to observe and measure perception and abstraction learning in a controlled setting. A 3-point walking maze (a 7 ft equilateral triangle) served as the spatial-temporal task in the original learning phase. All subjects learned the same sequence of 12 choices; that is, standing on one treadle, to which of the other two should he walk. Essentially, 2 transfer tasks were used: a 9-in push button finger maze triangle, and rotating the walking maze in the room. The rotation was accomplished by asking the subject to start his trial from a new and different treadle position in the room. The results show no essential difference in efficiency of original learning between the perception learning group (fixed start, normal vision) and the abstraction learners (blindfolded and/or variable start). The transfer testing clearly established the superior transferability and generality of abstraction learning. (See also PB 147 706)

Washington U., Seattle.
DIFFERENTIAL PREDICTION WITH INCOMPLETE CRITERION DATA, by Richard M. Johnson. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). Aug 59, 95p. 14 refs. AD-225 831.
Order from LC mi$5.40, ph$15.30 PB 147 695

The prediction of multiple criteria are considered when there are incomplete criterion data. The appropriate criterion is shown to be the conditional event, success given that individual i participates in criterion activity j. Also shown is that the multiple regression model which yields appropriate predictive information is the method of subgroups, which employs data from only the subgroup of individuals who participate in criterion activity j for the determination of regression weights for the prediction of activity j. Two variants of the method of total groups are discussed. The total group methods employ total group predictor data in the calculation of each vector of regression coefficients, thus removing the necessity of obtaining predictor intercorrelation matrices for all criterion subgroups. While the total group methods involve a substantial saving in computational labor, the extent to which their predictions approach the predictions of the method of subgroups is largely unknown. The method of subgroups and 2 total group methods are compared in a large-scale prediction study. Results show that: (1) the total group methods suffer slight disadvantages over the method of subgroups, which become marked only as the sizes of the subgroups increase; and (2) the total group methods are satisfactory for subgroups of size less than a few hundred. (Author)

Yale U., New Haven, Conn.
A SECOND EXPLORATION OF THE INTERRELATIONS AMONG SOME NON-INTELLECTUAL PREDICTORS OF ACHIEVEMENT IN PROBLEM SOLVING, by Paul C. Berry. Technical rept. no. 5, on Contract Nonr-609(20). May 59, 45p. 18 refs. AD-218 599.
Order from LC mi$3.30, ph$7.80 PB 146 298

The present study is an extension and partial replication of the study described in Technical Report 4 (Berry, 1958). In that earlier study six hypotheses were tested. The results confirmed the first and sixth hypotheses, which involved differences between men and women in achievement in problem solving, but gave only partial confirmation to the second and third, and failed to confirm the fourth and fifth. The present study was undertaken to provide another test of all but the first and sixth hypotheses.

BIOLOGICAL SCIENCES

Army Medical Research Lab., Fort Knox, Ky.
PHAGE-IMPREGNATED PAPER DISCS WITH A METABOLIC INDICATOR FOR THE RAPID TYPING OF RESISTANT STRAINS OF STAPHYLOCOCCUS AUREUS, by Elmo S. Dooley and E. H. Pine. Rept. on Environmental Physiology. 22 Apr 59, 10p. 7 refs. Rept. no. 388; AD-215 750.
Order from LC mi$1.80, ph$1.80 PB 146 267

Bacteriophage-impregnated paper discs containing tetrazolium chloride were used to type 40 strains of coagulase-positive Staphylococci aureus. The results obtained through the use of these phage discs were essentially the same as obtained by the conventional microdrop technique. The phage disc method has advantages over the conventionally used microdrop procedure in that large numbers of standardized discs can be prepared in advance, they may be used from storage as needed, and they reduce the work required to obtain satisfactory results. The use of phage discs places staphylococci typing within the capability of most hospital laboratories and makes the results of typing readily available to the epidemiologist. (Author)

Kansas U., Lawrence.
FLUCTUATIONS AND GENE-ENVIRONMENT INTERACTION OF PUPATION SITE IN DROSOPHILA MELANOGASTER, by Gunther Schlager. Master's thesis. Technical rept. on Gene-Environment Interaction in DDT-Resistance and Related Characters, Contract Nonr-583(08). 31 May 59, 76p. 21 refs; AD-218 329.
Order from LC mi$4.50, ph$12.30 PB 146 297

Fluctuations in the character pupation site of Drosophila melanogastor occur when flies are reared on several batches of corn meal-syrup-molasses-agar medium. A significant added variance component among batches was found under constant external environmental conditions and in the absence of microflora in the vials. These fluctuations are apparently due to the varying chemical changes of two components of the medium: Karo syrup and molasses. When these two components are replaced by pure sugar and salts, the fluctuations are greatly reduced or eliminated. The dry sugar medium was then used in an investigation of the reaction of two selected lines to the same environmental stimulus. These lines responded differently to variations in the amount of water in the medium. This component of the environment is linearly related to the amount of peripherality in both the peripheral line and the unselected parental strain. The central line responded in a manner indicating a resistance to increased peripherality under these conditions. (Author)

Anatomy and Physiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
HISTORY OF RESEARCH IN SPACE BIOLOGY AND BIODYNAMICS AT THE AIR FORCE MISSILE DEVELOPMENT CENTER, HOLLOMAN AIR FORCE BASE, NEW MEXICO, 1946-1958. [1958] 126p. 309 refs.
Order from LC mi$6.30, ph$19.80 PB 148 382

Contents:
The beginnings of research in space biology at the Air Force Missile Development Center, 1946-1952 (issued January 1958)
Major achievements in space biology at the Air Force Missile Development Center, 1953-1957 (issued March 1958)
History of research in subgravity and zero-G at the Air Force Missile Development Center, 1948-1958 (issued May 1958)
Major achievements in biodynamics: escape physiology at the Air Force Missile Development Center. 1953-1958 (issued June 1958)
Research accomplishments in biodynamics: deceleration and impact at the Air Force Missile Development Center, 1955-1958 (issued October 1958)
Administrative history of the Aeromedical Field Laboratory at the Air Force Missile Development Center, 1951-1958 (issued July 1958)

Army Medical Research Lab., Fort Knox, Ky.
SEASONAL ACCLIMATIZATION TO COLD IN MAN, by Thomas R. A. Davis, D. R. Johnston, and F. C. Bell. Rept. on Environmental Physiology. 25 May 59, 9p. 7 refs. Rept. no. 386; AD-216 006.
Order from LC mi$1.80, ph$1.80 PB 146 268

The decrease in shivering and heat production effected in man by seasonal change indicates that physiological acclimatization to climate takes place in man. Since similar physiological changes in animals are associated with an increase in resistance to cold, it is possible that man's resistance to cold can also be increased in like manner. Moreover the acclimatized man operates in the cold with greater economy as compared to the unacclimatized individual. It is proposed that this economy is achieved in large measure by a decrease in heat loss via the respiratory system. The seasonally acclimatized man shows evidence of the presence of non-shivering thermogenesis. The failure of heat acclimatization to change the criteria of cold acclimatization indicates that the two mechanisms are not mutually exclusive and de-acclimatization is due not to the presence of the other but to the absence of the adequate acclimatizing stimulus. (Author)

Army Medical Research Lab., Fort Knox, Ky.
SOME CHARACTERISTICS OF SHIVERING IN MAN, by T. R. A. Davis, D. R. Johnston, and F. C. Bell. Rept. on Environmental Physiology. 21 May 59, 17p. 13 refs. Rept. no. 383; AD-216 005.
Order from LC mi$2.40, ph$3.30 PB 146 269

The variability of the onset of shivering between individuals cannot be correlated with surface area, race of surface or core cooling, occupation, age, or latitude of origin. After its onset shivering is maintained in a cyclic manner which appears to bear no relationship to changes in skin temperature. The mean rise in shivering activity significantly correlates with the falling skin temperature and not at all with changes in rectal temperature. Short duration inhibition of shivering is readily obtained by physical and psychical means. (Author)

Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.
THE EFFECTS OF FOUR HOURS CONFINEMENT IN MOBILE ARMORED PERSONNEL CARRIERS ON SELECTED COMBAT RELEVANT SKILLS: A PILOT STUDY, by Samuel A. Hicks and Raymond M. Eckstrom. [1960] 38p. 7 refs. Technical memo. 3-60.
Order from LC mi$3.00, ph$6.30 PB 147 162

This study was undertaken to determine changes in general combat relevant performance as a result of four hours confinement in a maneuvering Armored Personnel Carrier (APC). Fifty enlisted men were tested both before and after confinement on tests designed to measure stamina, response time, gross motor coordination, arm steadiness, equilibrium and eye-arm coordination. The four-hour confinement period resulted in losses in all areas. The losses were statistically significant in three areas. Recommendations are included for future research. (Author)

Duke U. Medical Center, Durham, N. C.
RESPIRATORY AND CIRCULATORY RESPONSES OF THE HYPOTHERMIC ANIMAL TO CARBON DIOXIDE STRESS, by F. G. Hall and John Salzano. Rept. on Physiology of Flight, Contract AF 33(616)3821. Mar 60, 16p. 10 refs. WADD Technical rept. 60-82.
Order from OTS $0.50 PB 161 798

Some respiratory and circulatory responses to carbon dioxide stress during ice-water immersion hypothermia were studied in 13 dogs. Stresses were imposed by increasing the carbon dioxide tension of the inspired gas in 8 animals and by intravenous infusion of gaseous carbon dioxide in 5 other animals. It was found that, when compensation is made for the depressed ventilation exhibited at low body temperature, animals responded to the carbon dioxide stresses in essentially the same manner in the hypothermic as in the normothermic state. However, the responses are of a lower order of magnitude. (Author)

Karolinska Institutet, Stockholm (Sweden).
STUDIES OF THE PHYSIOLOGY OF DISTURBANCES OF MOTOR CONTROL, by Ottavio Pompeiano. Technical (Final) rept. on Contract AF 61(052)115. 30 Sep 59, 9p. 3 refs. AFOSR-TR-59-161; AD-232 389.
Order from LC mi$1.80, ph$1.80 PB 146 097

The first group of researches concerns the problem of the fast control of mammaliam muscle spindles. An early discharge was also elicitable from muscle spindle afferents when stimulating muscle nerve or ventral root. This early discharges was found to consist of two components, one appearing in advance of visible contraction. The other, at the foot of the contraction. The last research concerns the study of α types of 'release' in tension-extension diagrams from cat's forelimb extensor muscle (tricips).

Naval Research Lab., Washington, D. C.
ANALYSIS OF VISUAL SENSITIVITY TO DIFFERENCES IN VELOCITY, by R. H. Brown. Interim rept. 6 May 60, 18p. 51 refs. NRL rept. 5478.
Order from LC mi$2.40, ph$3.30 PB 145 720

This report analyzes the data of an extensive experimental literature. Visual sensitivity to differences in velocity has been commonly measured by presenting two objects which move at slightly different but constant speeds. The least detectable difference in speed is the differential threshold for the magnitude of velocity. The threshold $\Delta\omega$ varies in direct proportion to the speed ω over a range from 0.1 to 20 degrees of visual angle per second for nonsuperimposed objects. When the objects are presented so that they are viewed separately, $\Delta\omega/\omega$ is the constant 0.0768. When a single moving object instantaneously changed speed, $\Delta\omega/\omega$ is the constant 0.138. Special considerations are involved in the extremely low ratio found when one moving object is seen in front of another. The report concludes with an application of the constancy in velocity discrimination to tracking and other predictive behavior. (Author)

Naval School of Aviation Medicine, Pensacola, Fla.
IDIOPATHIC ORTHOSTATIC HYPOTENSION AND ITS RELATIONSHIP TO POSITIVE G TOLERANCE, by J. J. Zarriello. 21 May 59, 12p. 12 refs. Proj. NM 11 01 11 Subtask 1, Rept. no. 13.
Order from LC mi$2.40, ph$3.30 PB 147 635

This report concerns the problem of orthostatic hypotension occurring in supposedly normal, young males not having the classical, clinical symptoms of orthostatic hypotension, but having demonstrated a fall in blood pressure both systolic and diastolic on assuming the upright position. Two case histories are presented in which the individuals had no past history of dizziness or syncope on assuming the upright position but were rendered unconscious while performing aerobatic maneuvers that usually produce no untoward physiological symptoms in the normal pilot. These individuals demonstrated markedly reduced greyout, blackout, and unconscious tolerance to positive G when subjected to human centrifugation as compared to 115 normals. (Author)

Tulane U. School of Medicine, New Orleans, La.
STUDIES OF RESPIRATORY FUNCTION FOLLOWING THORACIC AND THORACO-ABDOMINAL INJURIES I. PULMONARY COMPLIANCE, by Morton M. Ziskind R. P. Cameron, and Oscar Creech, Jr. Rept. on Contract DA 49-007-MD-796. July 57, 9p. 10 refs. AD-212 764.
Order from LC mi$1.80, ph$1.80 PB 146 121

The pulmonary compliance of human subjects studied in the supine position was obtained from simultaneous intra-thoracic (intra-esophageal) and tidal volume changes. Strain gauge transducers were activated by these changes to produce loops upon a cathode ray oscilloscope screen. The loops were easily reproducible for a given subject and were permanently recorded on 35 mm. photographic film. Preliminary observations were made on normals, patients with diffuse pulmonary disease and patients before and after thoracotomy. The compliance values obtained were in agreement with those of other workers. Diffuse interstitial infiltrative disease decreased compliance but rarely affected the general contour of the loop. Pain and voluntary changes of respiration produced gross distortion of the loops. The compliance slope was reduced in the presence of intra-thoracic masses and chest wall incisions. The reduction of compliance following thoracotomy was usually reversed in one week. Initial studies of subjects with hemopneumothorax following stab wounds showed that the compliance was initially reduced but was almost invariably restored to the normal range following the aspiration of air and blood. (Author)

Biochemistry

Army Chemical Warfare Labs., Army Chemical Center, Md.
OBSERVATIONS ON SERUM AND GONAD CHOLESTEROL IN PIGEONS, by Roger A. Hoffman. Mar 60, 15p. 21 refs. CWLR 2374; AD-234 997.
Order from LC mi$2.40, ph$3.30 PB 147 628

Serum cholesterol of pigeons undergoes a seasonal cycle in concentration with maximal values present in April and minimal values in August. No sex differences were apparent and both sexes exhibited this yearly fluctuation in cholesterol concentration regardless of the state of activity of the reproductive organs. Consequently, a regulation of serum cholesterol by the gonads appears improbable. Cholesterol concentration is high in the small, undeveloped testis and declines rapidly when gonad development starts. This concentration is inversely proportional to the logarithm of relative testis weight. The logarithm of cholesterol content of the testis is directly related to the logarithm of testis weight. The data suggest that testicular cholesterol is involved in gonad growth and increased mass rather than in spermatogenesis or hormone production. (Author)

Mississippi U. Medical Center, Jackson.
THE EVALUATION OF METABOLIC AND TOXIC EFFECTS OF INTRAVENOUS FAT EMULSION IN PATIENTS, by Curtis P. Artz. Rept. for 1 May 58-31 Jan 59 on Contract DA 49-007-MD-930. Feb 59, 5p. 2 refs. AD-212 288.
Order from LC mi$1.80, ph$1.80 PB 146 122

Efforts have been directed toward three phases of investigation: (a) The effect of long-term administration of fat emulsion on liver function and the coagulation mechanism, (b) the use of intravenous fat emulsion as supplemental nutrition, (c) the effect of intravenous fat emulsion on survival of the red blood cell. From the various studies carried out in all three phases it appears that 10-14 units of intravenous fat emulsion are safe and effective. Should an increased amount be necessary for appropriate therapy, liver function tests and coagulograms should be done at regular intervals. Any deviation from normal values should warn of impending danger and therapy should be discontinued. When values return to normal, therapy might be reinstituted. Intravenous fat has proved very beneficial as a supplement to an inadequate oral intake.

Oak Ridge National Lab., Tenn.
STUDIES ON THE MOUSE HEMOGLOBIN LOCUS: IDENTIFICATION OF HEMOGLOBIN TYPES AND LINKAGE OF HEMOGLOBIN WITH ALBINISM, by Raymond A. Popp and W. St. Amand. Apr 60, 5p. 13 refs. AFSAM rept. 60-52.
Order from LC mi$1.80, ph$1.80 PB 147 779

The mouse hemoglobin locus is closely linked to albinism and on the opposite side of it from pink-eye. In mice heterozygous for different hemoglobin types, each hemoglobin type is present autonomously. This indicates that the inheritance of hemoglobin traits in mice may be similar to that in man. Differences among single-type hemoglobins have been reported, but whether these variations are controlled by different hemoglobin alleles or are caused by interactions of the hemoglobin locus with other loci remains to be established. The occurrence of different hemoglobin types in a small sample from a population of wild mice was also noted. (Author)

Oklahoma State U. Research Foundation, Stillwater.
ISOLATION OF CRYSTALLINE UREASE, by George Gorin, L. G. Butler and others. Technical note no. 5 on Studies on Urease, Contract AF 18(603)135. Feb 60, 19p. 17 refs. AFOSR-TN-60-238.
Order from LC mi$2.40, ph$3.30 PB 147 631

An account is presented of some experiences encountered in the course of preparing the crystalline urease. After many unsuccessful and partially successful attempts, several preparations of high activity (89-106 S. U./mg.) were obtained, and it is believed that a detailed description of the successful procedure, and a briefer discussion of related matters, should prove of value to other investigators interested in the preparation of the crystalline enzyme.

Botany

Marine Lab., U. of Miami [Coral Gables, Fla.]
SALT WATER FUNGI, by Ernest S. Reynolds and Samuel P. Meyers. Interim rept. on Contract Nonr-1811(00). 1 Aug 59, 23p. ML 59184; AD-225 175.
Order from LC mi$2.70, ph$4.80 PB 147 718

Uni-clonal cultures of selected marine Ascomycetes and Deuteromycetes on Manila cordage in 0.1% yeast extract sea water broth demonstrated extensive development of cellulolytic activity together with significant tensile strength reduction. The reduction of tensile strength of the cordage varied considerably between species, from 74 to 183 lbs. at the breaking point, compared to the average breaking point of the uninoculated control material of 260 lbs. The notable loss of strength by cordage when used as a growth substrate for the various lignicolous salt water fungi, demonstrates in positive fashion the destructive action of these fungi on wood fibers. The close similarity of cordage and wood in proximate analysis, except for the lower lignin content of the cordage, provides an especially favorable opportunity for strength test studies in relation to pertinent physiological and morphological characteristics of the various fungi. (Author)

School of Aviation Medicine, Brooks AFB, Tex.
BOTANIC ASPECTS OF POLLINOSIS IN THE AREA OF SAN ANTONIO, TEXAS, by Robert A. Davidson. Jan 60, 60p. 56 refs. Rept. 60-20.
Order from LC mi$3.60, ph$9.30 PB 147 777

The contents of this paper are divided into three interrelated parts: Part I takes up some of the features of pollen idiotoxic specificity and attempts to rationalize these in the light of certain fundamentals of plant evolution. The importance of the relationship between pollen allergy and botany is stressed. Part II is an accounting of what may be termed the "hay fever flora" of the San Antonio, Tex., area. Part III presents the data of an air-borne pollen survey which was conducted at Randolph Air Force Base. (Author)

Pathology

Chicago U., Ill.
EXPERIMENTAL OBSERVATIONS ON POSTURAL NYSTAGMUS: LESIONS OF THE NODULUS, by Cesar Fernández, René Alzate, and John R. Lindsay. Jan 60, 18p. 22 refs. AFSAM rept. 60-23.
Order from LC mi$2.40, ph$3.30 PB 147 459

This investigation supports the idea that the nodulus acts as an inhibitor of the vestibular centers. Disequilibrium and postural nystagmus in the vertical plane characterize the deficit following ablation of the nodulus. Unlike animals with lesions in the corpus cerebelli, these experimental animals exhibit no abnormalities in posture and no cerebellar ataxia. The occurrence of postural nystagmus requires the presence of signals from vestibular receptors indicating positional changes of the head, but disturbances of equilibrium do not. This indicates a dual function of the nodulus: inhibition of the vestibular centers and, in conjunction with other systems, maintenance of equilibrium.

University Coll., Dublin (Eire).
STABILITY OF ERYTHROCYTES IN ANAEMIA (SIC). Final Technical rept. no. 4 for 28 Jan 59-28 Feb 60 on Contract DA 91-591-EUC-1070. 4 May 60, 5p.
Order from LC mi$1.80, ph$1.80 PB 147 657

It has been possible to analyze the distribution and activity of several enzymes localized in the erthrocyte, which either hydrolyze or phosphorylize adenosine nucleotides. Distribution of the enzyme depends considerably on the method of preparing the haemolysis and particulate suspension from laked cells. Pursuit of the storage lesion indicated a necessary study of ATPase activity. This enzyme is magnesium activated and has special activator requirements. Closer study revealed the presence in the stroma of a very active adenylic acid kines which effects the conversion of two molecules of ADP into one of AMP and one of ATP. After a preliminary examination of the general properties of this enzyme, a more exact investigation has been concluded. In this series of investigations it has been possible to examine the series of degradations of enzyme induced type which can dismember components of the nucleotide pool.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECTS OF CONTINUOUS EXPOSURE OF ANIMALS TO ETHANOLAMINE VAPOR, by Maurice H. Weeks, Nelson P. Musselman and others. Technical rept. for Mar-Dec 57 on Health Hazards of Military Chemicals. Mar 60, 22p. 23 refs. CWLR 2366. AD-234 688.
Order from LC mi$2.70, ph$4.80 PB 147 549

Investigations were carried out to evaluate the toxicity of monoethanolamine (MEA) when inhaled continuously for long periods. Continuous exposure of dogs, rats, and guinea pigs to 12 ppm (or higher) MEA caused behavioral effects and skin irritation. Exposure to very high concentrations (66 ppm to 102 ppm MEA) caused death and produced lung inflammation and liver and kidney damage in dogs, rats, and guinea pigs. Exposure of animals to 5 ppm produced minimal toxic effects. (Author)

Army Chemical Warfare Lab., Army Chemical Center, Md.
TOXICITY AND PERSONAL DECONTAMINATION OF BORON HYDRIDE PROPELLANT FUELS, by Sidney Rothberg, Joseph L. Colbourn, and Robert Salvatore. Feb 60, 15p. 13 refs. CWLR-2355; AD-233 964.
Order from OTS $0.50 PB 161 772

A study was made of the toxicity of certain liquid boron hydride fuels (BHF) of the HEF-3 and HiCal class. The fuels were administered to rats, guinea pigs, rabbits, and cats by the intravenous, intraperitoneal, oral ocular, and skin routes. Materials were tested to find an effective skin decontaminant. Surgical glove material and several silicone-based ointments were tested for their ability to protect against skin penetration; neither gave adequate protection. An aqueous ammonia solution was found to be useful in reducing the toxicity of BHF, but its function appears to be that of solubilizing the fuel for easy removal rather than destruction of the toxic moiety. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE TOXICITY OF BORON OXIDE, by James L. Wilding, W. J. Smith, II, and others. Jan 60, 18p. 15 refs. CWLR-2334; AD-233 768.
Order from OTS $0.50 PB 161 771

A study has been made to determine the toxicity of aerosols of fine particles of boron oxide, chiefly by observations on rats and dogs that had inhaled the aerosol for periods up to 24 weeks. Even in very high concentrations, 470 mg/cu m, rats that were exposed showed no signs of poisoning or any pneumoconiosis. There were some significant changes in the urinary content and pH of the exposed rats. All groups of rats exposed to concentrations of 77 and 470 mg/cu m gained weight at about the same rate as their controls. No changes or toxic signs were noted in the mature female dogs exposed for 23 weeks to a concentration of 57 mg/cu m. Histological observations of rat tissues, and blood analyses of both rats and dogs, were similar to the controls throughout the test period. Topical application produced a transitory erythema on the wetted backs of rabbits, and conjunctivitis when applied to the eyes. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
TOXICOLOGY OF MONO- AND DI-ISOPROPENYLACETYLENE, by Leo Feinsilver, Sidney Rothberg and others. Feb 60, 18p. 3 refs. CWLR-2341.
Order from LC mi$2.40, ph$3.30 PB 147 683

Toxicity tests of two liquids, mono- and di-isopropenylacetylene (IPA and DIPA), were carried out on laboratory animals. Selected pharmacological studies with DIPA were also made. IPA and DIPA were more toxic by intravenous than by intraperitoneal administration. IPA was more toxic than DIPA by intravenous administration and about equally toxic by intraperitoneal administration. The vapor of DIPA was more toxic than IPA vapor. The cutaneous toxicity of both compounds was low and similar, as was their ocular toxicity. When administered by intravenous and intraperitoneal injection and by vapor inhalation, IPA and DIPA affected the central nervous system and caused pathologic changes in the respiratory tract. Intravenous administration of IPA and DIPA caused congestion or hemorrhage of several other internal organs. Repeated intraperitoneal injection and acute vapor inhalation of DIPA caused necrosis of the tubules of the kidney cortex of the mouse. Repeated application of IPA and DIPA to the skin of the rabbit caused necrosis of the epidermis. Application of IPA and DIPA to the eye of the rabbit caused marked damage but no corneal opacity. Intravenous injection of DIPA produced cardiac slowing, hypotension, reduction of the heart-contractile force, reduction in voltage of the encephalogram, and effects upon gut activity. (Author)

School of Aviation Medicine, Brooks, AFB, Tex.
EFFECTS OF SOMATOTROPIN ON METABOLIC RESPONSES TO COLD, HEAT, AND ALTITUDE, by Henry B. Hale and Roy B. Mefferd (Baylor U. Coll. of Medicine). Jan 60, 22p. 10 refs. Rept. 60-34.
Order from LC mi$2.70, ph$4.80 PB 147 458

The administered STH had, in many respects, corrective effects or augmented (reinforced) adaptive changes during chronic exposure or during the initial phase of recovery from chronic exposure. Sensitivity to the injected STH varied with environments, with the length of time in an environment, and with the metabolic functions themselves.

Radiobiology

Tulane U., New Orleans, La.
INVESTIGATIONS OF THE BIOLOGICAL EFFECTS OF MICROWAVE RADIATION, by Robert T. Nieset, Rene Baus, Jr. and others. Annual progress rept. for 1958 on Contract Nonr-475(03). [1959] 61p. 11 refs. AD-225 409 and 225 837.
Order from LC mi$3.90, ph$10.80 PB 147 69?

Investigations are reported of biological effects of microwaves other than those resulting from any major increase in overall body temperature. Studies of the effects of low intensity pulsed 10 cm radiation on the growth rate of mice provided negative results. Cold blooded animals were exposed to 45 mw/sq cm in a refrigerated environment to eliminate or reduce possible effects from previous gross overall heating. Under these conditions lizards survived 2 hr or more of exposure (such exposure would normally cause mice to die of hyperpyrexia in less than 10 min). Exposure with concurrent refrigeration to moderate levels or radiation appeared to provide localized heating effects. The reflection coefficient and the depth of penetration were calculated for various tissue combinations for 1, 3, and 10 cm radiation to further characterize thermal relationships coincident with the absorption of microwaves. The results of preliminary studies of dielectric saturation were negative. (See also PB 137 143)

Uppsala U. (Sweden)
RESEARCH ON "LOCALIZED RADIO-LESIONS". PART III. BLOOD VESSEL CHANGES FOLLOWING LOCAL IRRADIATION OF THE BRAIN WITH HIGH ENERGY PROTONS, by Börje Larsson. Technical rept. no. 1, Appendix 5, on Contract AF 61(514)1247. 1 Dec 59, 18p. 14 refs. AFOSR-TN-60-252; AD-233 375.
Order from LC mi$2.40, ph$3.30 PB 146 305

The cerebral cortex and thalamus in the brain of the rat were locally irradiated with a narrow beam of high-energy protons. The developing radiolesion was studied, with attention given to changes in capillary function. Three types of changes were graded: impairment of capillary circulation, increase of permeability of trypan blue through the blood-brain barrier system, and necrosis. Circulatory disturbances seem to precede the blue-staining of irradiated brain tissue. The mechanisms involved in the rapid development of lesions described here might be different from those involved in the production of late delayed radionecrosis. The results show that the detection of changes in the blood-brain barrier system with suitable dyes or radioactive compounds may be applied as a means of early diagnosis of the radiolesion. (Author)

CHEMISTRY

Analytical Chemistry

Industrial Lab., Mare Island Naval Shipyard, Vallejo, Calif.
ESTIMATION OF CHLORIDE CONCENTRATION IN HIGH PURITY WATER BY ION EXCHANGE, by W. C. Neuenschwander. 14 Aug 58, 16p. Research and Development rept. no. 3954-58.
Order from LC mi$2.40, ph$3.30 PB 146 036

A method for determining chloride concentrations in water by ion exchange techniques has been developed. The method utilizes a mixed bed ion exchange resin for collecting chloride ions from a large volume of sample. Subsequent elution with nitric acid and turbidimetric evaluation in a small volume completes the procedure. Chloride ion in water can be estimated to a value as low as 0.01 ppm in a one liter sample, or 0.003 ppm in four liters. A sample apparatus for performing the test has been developed. (Author)

Naval Ordnance Test Station, China Lake, Calif.
COOPERATIVE TEST PROJECTS OF THE JOINT ARMY-NAVY-AIR FORCE PANEL ON ANALYTICAL CHEMISTRY OF SOLID PROPELLANTS. PART I. INTRODUCTION TO THE FIRST TWELVE ROUND ROBINS AND ROUND ROBIN 1, by R. H. Pierson. 12 Feb 58, 60p. 9 refs. NOTS-1937, Part 1; AD-163 047.
Order from LC mi$3.60, ph$9.30 PB 148 055

Contents:
Instructions for JANAF-PACSP Round Robins
Round Robin 1, nitroglycerin in JPN and H9 propellants

Naval Research Lab., Washington, D. C.
MODIFICATIONS IN THE NRL COLORIMETRIC METHOD FOR THE DETERMINATION OF BIS(2-CHLOROETHYL)SULFIDE WITH DB-3, by A. Stamulis. Interim rept. 16 May 60, 13p. 6 refs. NRL rept. 5426.
Order from OTS $0.50 PB 161 066

A program was undertaken to study and improve the present NRL colorimetric method for the determination of bis(2-chloroethyl)sulfide, commonly known as mustard gas. That part of this program which has been directed toward improving sensitivity and color stability has established the fact that hexylene glycol and Methyl Cellosolve are more effective solvents than diethyl phthalate, especially when determining residual quantities of mustard in paint films. Inorganic alkalies such as aqueous solutions of sodium carbonate, potassium carbonate, and sodium hydroxide were found to be more stable than cyclohexylamine as developing agents. The effects of pH, age, water content, and heating time on the DB-3 solutions were determined and it was found that the only modification which improved the sensitivity was in the heating period of the mustard-containing DB-3 solution, and accordingly the heating period was changed from 5 to 4 minutes. (Author)

Rock Island Arsenal Lab., Ill.
RADIO-CHROMATOGRAPHIC DETERMINATION OF 12-HYDROXYSTEARIC ACID IN FATTY ACID MIXTURES, by Max T. Fisher and W. Dennis McHenry. 28 Apr 60, 45p. 9 refs. Rept. no. 60-911.
Order from LC mi$3.30, ph$7.80 PB 147 430

Vital to the worked and water stability properties of MIL-G-10924A type greases is their 12-hydroxystearic acid content. A chromatographic method was developed which separates 12-hydroxystearic acid from other fatty acids used in grease formulations. Fatty acid samples of known composition (50% 12-hydroxystearic acid) were eluted with n-hexane-chloroform and benzene-ethanol systems through two grades of silica gel. The separation efficiencies were obtained by melting point determinations and by the use of radioactive tracers. Radiometric determinations of doubly tagged samples (12-hydroxystearic acid-H^3 and stearic acid-C^{14}) were made by gas flow techniques using an appropriate absorber and a control sample. Complete separation of radioactively tagged materials was obtained by using a relatively nonporous, large surface area, partially deactivated silica gel (15% water) and eluting with benzene followed by benzene-ethanol (97:3). Apparent, but unsubstantiated, separation of 12-hydroxystearic acid from unsubstituted saturated monocarboxylic fatty acids containing 14 to 22 carbon atoms was also obtained. (Author)

Rutgers [State U.] New Brunswick.
THE CHANGES WITH TIME OF THE CHROMIUM IONS, ZINC IONS, AND PHOSPHORIC ACID IN THE WP-1 COMPOSITION, by E. R. Allen, Leo Ojakaar, and others. Final technical rept. for year ending 30 Nov 56 on Contract Nonr-404(07). 5 Dec 56, 147p 27 refs.
Order from LC mi$7.20, ph$22.80 PB 147 465

An insoluble chromium-phosphorus-resin complex (or mixture), gray green in color and insoluble in alcohol, distinctly different from the familiar bright-green chromium-phosphorus-resin complex, has been isolated. The fate of chromium in the WP-1 mix is viewed as follows: in the fresh, i.e., 1 hour, charge some chromium^{+6} has been reduced and most of the chromium^{+3} so produced enters into organic combination. The amount of chromium^{+6} reduced increases with time and the amounts of both types of complexes likewise increase, while the amount of chromium^{+3} remains small and approximately constant. An appreciable amount of phosphorus is present in the recovered pigmentary residues, presumably as phosphates of zinc and this increases slightly with time. Appreciable amounts of zinc occur in the aqueous extracts. The evidence from pH values of aqueous extracts raises doubts as to whether free phosphoric acid exists at the 1 hour stage. Zinc, chromium, and phosphorus unite with the resin in WP-1 mixtures. Changes in PVBA with time, including the resulting production of degredation products, are now viewed as of probable importance in the WP-1 deterioration. Phosphoric acid effects a change in the PVBA during film formation.

Inorganic Chemistry

College of the Holy Cross, Worcester, Mass.
STUDY OF A SERIES OF RELATED LIGANDS WITH SPECIFIC METALS AT CONSTANT IONIC STRENGTH AND AT THREE DIFFERENT TEMPERATURES, by Joseph A. Martus, Richard J. Hovey and others. Final rept. for 15 May 52-15 June 55 on Contract DA 19-020-ORD-1614. [1955] 17p. OOR rept. no. 347.6; AD-73 476.
Order from LC mi$2.40, ph$3.30 PB 147 854

The chelate stability constants are tabulated for α-mercaptobutyric acid and Cu, Ni, and Mn at 0°, 30°, and 60°C. No significant results were obtained with 2-hydroxybutyric acid and Cu, Mi, Mn, and Mg at 0° and 60°C. The results obtained with α-hydroxybutyric acid at 30°C are presented. Stability constants obtained for alanine and Cu, Ni, Zn, and Cd at 0° and 60°C are given.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
THE THERMAL STABILITY OF METAL AMMINES. I. PENTAMMINECHLOROCHROMIUM(III) CHLORIDE, by Norman D. Peschko and B. P. Block. Technical rept. no. 3 on Contract Nonr-2687(00). 1 Aug 59, 13p. 5 refs. AD-225 087.
Order from LC mi$2.40, ph$3.30 PB 148 133

Thermogravimetric analysis indicates the loss of two moles of NH_3 from $[Cr(NH_3)_5Cl]Cl_2$ at about 250° C. in air followed by a complete loss of NH_3 as the temperature is raised. At constant temperatures of 150, 200 and 300°C. in air, however, decomposition is essentially smooth with no arrests indicated for intermediate ammines. Nevertheless it is possible to isolate a homogeneous material with empirical composition $Cr(NH_3)_3Cl_3$ by careful thermal treatment of $[Cr(NH_3)_5Cl]Cl_2$ in air. This product differs from that formed by thermal treatment of $[Cr(NH_{3.5}Cl]Cl_2$ in anhydrous HCl. The latter is not a monomeric isomer of $Cr(NH_3)_3Cl_3$ as previously suggested. Decomposition temperatures obtained by thermogravimetric analysis should be interpreted with care because of the relatively rapid heating rates customarily employed. (Author)

Organic Chemistry

Florida U. Engineering and Industrial Experiment Station, Gainesville, Fla.
THE PREPARATION OF FLUORINE-CONTAINING COMPOUNDS, by R. D. Dresdner, J. A. Wethington and J. A. Young. Final rept. on Contract Nonr-580 (03). 31 Aug 59, 22p. AD-227 841.
Order from LC mi$2.70, ph$4.80 PB 148 172

Oxygen compounds: The electrofluorination of $O(CH_2CH_2COCl)_2$ was attempted as a first step in the synthesis of perfluorodivinyl ether, $(CF_2=CF)_2O$. Perfluoro ethyl ether was pyrolyzed at temperatures up to 800°C; the major products were COF_2 and C_2F_6. Nitrogen compounds: When $CF_3CF=CF_2$ was reacted in a flow system with NF_3 in about equimolar quantities over NaF, the main course of the reaction(s) suggested no catalytic activity but rather the fluorination of C_3F_6. Phosphonitrilic fluorides: $(PNF_2)_3$ and $(PNF_2)_4$ were prepared by passing either CF_3SF_5 or NF_3 over P_3N_5 heated to 700°C. Bis(trifluoromethyl) carbamyl fluoride, $(CF_3)_2$ NCOF, was prepared by an electrochemical process, and $(CF_3)_2$ NCF_2COOH was prepared by a cell process. Sulfur compounds: During the pyrolysis of cyclic perfluorothioxane tetrafluoride, SF_4 was produced and the residual free radical underwent ring closure so that perfluoro tetramethylene oxide was formed almost exclusively. The synthesis of SF_5CF_2COF was undertaken by electrochemical treatment of CH_3SCH_2COCl; however, the desired cleavage did not occur. Catalysts for fluorocarbon studies: Successful isotope exchanges were conducted with alkali fluorides containing F^{18} and $CF_3CF=CF_2$, C_4F_{10}, $(C_2H_5)_2O$, and CF_4.

Harvard U., Cambridge, Mass.
ANALYSIS OF THE RESULTS OF PREVIOUS NMR STUDIES ON SOME ORGANIC DERIVATIVES OF SILICON, GERMANIUM, AND TIN, THE SANDWICH COMPOUNDS, AND RELATED MOLECULES (I). IMPROVEMENTS OF THE NMR SPECTROMETER AND VARIABLE TEMPERATURE CRYOSTAT (II), by Nathan Ockman. Technical rept. on Contract Nonr-1866(13). Aug 59, 59p. 42 refs. AD-229 397.
Order from LC mi$3.60, ph$9.30 PB 147 703

Part I: A discussion is presented of the characterization of the molecular motions in solids by nuclear magnetic resonance (NMR), including the analysis of line shape and spin lattice relaxation time and the determination of barrier heights. The data obtained from the NMR studies of 48 compounds are reviewed. Part II: The RF oscillator in the NMR spectrometer was replaced by the latest modification of the Pound-Watkins oscillator. A 60-cycle rejection filter was inserted between the output of the oscillator and the input to the lock-in amplifier (LIA). Mulay's LIA was replaced by a modified Watkins LIA in which a twin-T filter with a narrower band width had been substituted. With this apparatus, proton resonance signals with signal to noise ratios of 50 or more were obtained in ferrocene at room temperature. A cryostat, based on a design by Mulay (AD-135 507), was built. A cylindrical glass tube was substituted for the liquid-He Dewar and a thin Cu tube, on which the heater was wound, was inserted about the RF coil tube and grounded to the RF ground of the oscillator. Using this apparatus, 20 watts of heater power raised the temperature of an H_2O sample from -165° to 50°C, with a thermal gradient at -50°C of 8°C/inch. A steady state condition at any temperature in this range was reached in about 15 min.

Johns Hopkins U., Baltimore, Md.
IODINE NUCLEAR QUADRUPOLE RESONANCE SPECTRA OF SOME BORON-IODINE COMPOUNDS, by William G. Laurita and Walter S. Koski. Technical note no. 13 on Boron Hydride Chemistry, Contract AF 18(600)1526. [1960] 14p. 9 refs. AFOSR-TN-60-471.
Order from LC mi$2.40, ph$3.30 PB 147 763

The 1/2 → 3/2 iodine nuclear quadrupole transitions in iododecaborane (4) and iodopentaborane (1) have been observed at 190.8 and 196.2 Mc./sec., respectively. The splittings of the iodine resonances in BI_3 were measured for the 1/2 → 3/2 and 3/2 → 5/2 transitions. These splittings were 24 ± 2 and 43 ± 3 Mc./sec., respectively. The corresponding splittings in the iodoboranes are believed to be smaller than the resolution of the equipment and consequently have not been detected. The quadrupole coupling constants are interpreted in terms of the electronic structure of the boron-iodine bonds. The splittings of the resonances in BI_3 were found to be in reasonable agreement with theoretical expectations. (Author)

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
SOME STUDIES ON CERTAIN METHYL DERIVATIVES OF SILICON, GERMANIUM AND TIN, by Michael P. Brown. Technical rept. on Contract Nonr-1866(13). Aug 59, 31p. 33 refs.
Order from LC mi$3.00, ph$6.30 PB 147 716

Contents:
Dimethylgermanium oxide and dimethylgermanium sulfide, by M. P. Brow and E. G. Rochow
The infrared spectra of some methyl derivatives of germanium and tin, by M. P. Brown, R. Okawara and E. G. Rochow
Nuclear magnetic resonance studies of some methyl derivatives of the Group IVB elements, by M. P. Brown and D. E. Webster

Massachusetts Inst. of Tech., Cambridge.
STUDIES IN ORGANOMETALLIC CHEMISTRY, by D. Seyferth, N. Kahlen and M. A. Weiner. Technical rept. no. 2 on Contract Nonr-1841(43). 5 Aug 59, 41p. 10 refs. AD-225 334.
Order from LC mi$3.30, ph$7.80 PB 147 691

The preparation and some reactions of vinyllithium (Pub. in Chemistry and Industry, 402, 1959). The oxymercuration of trimethylvinylsilane (Pub. in Zeitschrift für Naturforschung 14b:137, 1959). Group IV (Iso) cyanides I. Trimethyl (iso) cyanogermane and trimethyltin (iso) cyanide (Submitted for pub. in the Journal of the American Chemical Society). Trimethyl (iso)cyanogermane was prepared by the reaction of isopropyl germanium iodide with AgCN in the presence of C_6H_6. Trimethyltin (iso)cyanide was prepared by the reaction of AgCN with trimethyltin bromide in the presence of C_6H_6, in 62% yield, and by the reaction of aqueous KCN with trimethyltin iodide in ether, in 20% yield. Group IV (Iso)cyanides II. (Iso)cyanides of silicon, germanium and tin as ligands in iron carbonyls (Submitted for publication in the Journal of The American Chemical Society). Trimethyl(iso)cyanisolane and trimethyl(iso)cyanogermane reacted with iron pentacarbonyl to form yellow, crystalline, sublimable and extremely air-sensitive $(CH_3)_3SiN{=}C\text{-}Fe(CO)_4$ and $(CH_3)_3GeN{=}C\text{-}Fe(CO)_4$ in good yield. Trimethyltin (iso)cyanide reacted with iron pentacarbonyl, but the analogous $(CH_3)_3SnN{=}C\text{-}Fe(CO)_4$ was formed only in very low yield, while anionic iron carbonyl species were formed in a side reaction.

Mellon Inst., Pittsburgh, Pa.
STEREOREGULARITY IN THE FREE RADICAL POLYMERIZATION OF VINYL ACETATE (PART I). MODELS OF STEREOREGULAR POLYMERS (PART II). THERMALLY STABLE POLYMERS CONTAINING THE TRIAZINE RING (PART III). ON THE ANOINIC POLYMERIZATION OF STYRENE BIPHENYL-SODIUM, A NEW INITIATOR (PART IV). ANIONIC POLYMERIZATION (PART V), by T. G. Fox, R. Donald Spencer and others. Technical rept. no. 2, 28 Feb-31 Aug 59, on Contract Nonr-2693(00). [1959] 73p. 34 refs. AD-230 119.
Order from LC mi$4.50, ph$12.30 PB 147 725

Part I: Preliminary evidence indicated that the observed differences in IR absorption and/or in solubility of polyvinyl acetate prepared under different conditions may be due to differences between various samples in OH content or in the concentration of impurities. Part II: Vinyl acetate was polymerized in the presence of chain transfer agents: trimethyl orthoformate (I), $CHCl_3$, and AcH. A chain transfer constant of 0.00076 was obtained for I and an approximate value of 0.01 for $CHCl_3$. Part III: A 50% yield of triphenyl triazine was obtained by the pyrolysis benzamidine. The bracketing of the reaction conditions favoring triazine ring-closure was somewhat successful. Conditions which favor the formation of benzonitrile and NH_3 were also learned. Part IV: A one-stage low-temperature polymerization of styrene with Na-naphthalene did not lead to an extremely sharp molecular weight distribution. Part V: Two-stage polymerization of styrene in tetrohydrofuran with Na-naphthalene, the polymerization of styrene with butyllithium, and alkali metal-initiation polymerization of α-methylstyrene are discussed. (See also PB 144 900)

Naval Ordnance Test Station, China Lake, Calif.
MICRO DETERMINATION OF NITROGEN IN ORGANIC COMPOUNDS, by E. M. Bens. 29 Apr 58, 30p. 41 refs. NOTS-1988; NAVORD rept. 5865; AD-162 637.
Order from LC mi$2.70, ph$4.80 PB 148 030

A micro method, which is of particular interest to propellant chemists, has been developed for the determination of nitrogen in organic compounds. The method is a modification of the Dumas method that utilizes a nickel oxide-nickle combustion tube filling heated to 1000°C, a supply of pure oxygen for the combustion of difficult samples, hopcalite for the oxidation of carbon monoxide, and a weight nitrometer. The oxygen supply, the combustion tube filling, and means for the removal of excess oxgyen have been changed from previous methods. (Author)

Naval Ordnance Test Station, China Lake, Calif.
SYNTHESIS AND REDUCTION OF METHYL-VINYLNITROSAMINE AND RELATED COMPOUNDS, by N. Neil Ogimachi and Howard W. Kruse. 1 Sep 59, 20p. 7 refs. NOTS TP-2303; NAVORD rept. 6578; AD-225 489.
Order from LC mi$2.40, ph$3.30 PB 148 031

The synthesis and reduction of methylvinylnitrosamine are described. Starting with β-methylaminoethanol, it was possible to prepare methylvinylnitrosamine through a sequence of reactions involving nitrosation, chlorination, and dehydrohalogenation. The reduction of methyl-1-vinylhydrazine. Depending upon the reducing agent, the reduced products obtained were methylethylnitrosamine, methylamine, methylhydrazine, and 1-methyl-1-ethylhydrazine. Attempts to prepare 1-methyl-1-vinylhydrazine from β-methylaminoethanol through alternative routes are also described. (Author)

Naval Research Lab., Washington, D. C.
WETTING PROPERTIES OF TETRAFLUOROETHYLENE AND HEXAFLUOROPROPYLENE COPOLYMERS, by Marianne K. Bernett and W. A. Zisman. Interim rept. 24 May 60, 7p. 13 refs.
NRL rept. 5471.
Order from LC mi$1.80, ph$1.80 PB 145 397

It has been shown that the determining factors in the wetting of low-energy solid surfaces are the nature of the atoms in the surface and their physical packing. Of all solid organic polymers polytetrafluoroethylene is known to have the lowest surface energy and thus the lowest critical surface tension of wetting (γ_C). In this study the wettability of a series of copolymers of tetrafluoroethylene with hexafluoropropylene by a variety of organic and inorganic liquids was examined. The results show that these solid plastics have critical surface tensions which are even lower than that of solid polytetrafluoroethylene. As anticipated, the progressive increase in the proportion of perfluoromethyl side chains in the polymer introduces a higher concentration of exposed $-CF_3$ groups in the surface, which in turn progressively reduces γ_C. By extrapolation γ_C of a polyhexafluoropropylene has been calculated to give the value 15 dynes/cm. (Author)

North Dakota U., Grand Forks.
ORGANOMETALLIC CHEMISTRY OF TRANSITION METALS, by Lawrence Summers and Shan-Pu Tsai. Interim technical rept. no. 5, 1 June 56-31 May 57, on Contract Nonr-582(00). 27 Dec 57, 17p.
Order from LC mi$2.40, ph$3.30 PB 138 076

Investigations on bis-(cyclopentadienyl) compounds of zirconium and chromium, and the reaction of diphenyl bis-(cyclopentadienyl)-titanium with excess phenyllithium.

Richmond Research Lab., Stauffer Chemical Co., Calif.
INORGANIC POLYMERS PROGRAM, by A. J. Laffler, E. G. Teach and others. Semi-annual technical rept. for 1 July 57-1 Jan 58 on Contract Nonr-2259(00). [1958] 18p. 17 refs.
Order from LC mi$2.40, ph$3.30 PB 138 264

Work is continuing on the efficient preparation of fluorocarbon diiodides and dinitriles for monomers. No satisfactory dehydration of perfluoroglutaramide to the nitrile has been found but work is continuing on this and also on the preparation perfluoroadiponitrile. The new compound tris(trimethylsilyl) phosphine has been prepared and its reaction with diborane has been studied. (See also PB 135 554)

Yale U., New Haven, Conn.
SYNTHESIS AND STUDY OF NON-BENZENOID AROMATIC HYDROCARBONS, by William von Eggers Doering. Final narrative summary rept. for 10 May 52-30 Apr 58 on Contract DA 19-059-ORD-1562. [1958] 8p. OOR rept. no. 542. 3C; AD-137 086,
Order from LC mi$1.80, ph$1.80 PB 147 858

The synthesis of other members of the non-benzenoid aromatic hydrocarbons besides fulvene and azulene was attempted. A successful synthesis of fulvalene involved a reaction of sodium cyclopentadienide with iodine at low temperatures to give an unstable dihydrofulvalene (I). Compound I was converted to the dilithium salt. Pentance solutions of pure fulvalene were obtained by passing O into a suspension of the dianion. Heptafulvalene was synthesized by a simple sequence of reactions starting with tropylium bromide. Heptafulvene was prepared by a long tedious route involving a final Hofmann elimination. Neither sesquifulvalene nor heptalene could be prepared.

Physical Chemistry

Battelle Memorial Inst., Columbus, Ohio.
A METHOD FOR MEASUREMENT OF THE HEAT OF FORMATION OF SILICON CARBIDE, by J. W. Droege and J. F. Foster. Final rept. for 15 May 59-30 Apr 60 on Contract AF 19(604)5720. 30 Apr 60, 21p. AFCRC-TR-60-139.
Order from LC mi$2.70, ph$4.80 PB 148 094

Sodium peroxide calorimetry has been investigated as a method for the determination of the heat of formation of SiC. Zirconium was found to be a suitable container material; corrosion losses amounted to no more than a few milligrams in each experiment. Reaction with the fuels SiC, Si, and C was not complete, but the reaction product could be analyzed for unreacted sample. Benzoic acid was used as a combustion aid and oxygen at 5 atm as an oxidation promotor. The method seems well suited to the SiC determination. (Author)

California U., Berkeley.
THE PHOTOLYSIS OF CARBON DIOXIDE, by Bruce H. Mahan. Rept. on Contract AF 49(638)01. 9 May 60, 23p. 8 refs. AFOSR-TN-60-472.
Order from LC mi$2.70, ph$4.80 PB 147 837

The vacuum ultraviolet photolysis of carbon dioxide has been investigated. Kinetic data and quantum yield measurements indicate that electronically excited (^1D) oxygen atoms are produced in the primary process at 1470 A and 1236 A. Such a primary process is consistent with the tentative spectral assignments which have been made for carbon dioxide. (Author)

Catalysis Research Lab., Alfred U., N. Y.
A STUDY OF THE CORRELATION BETWEEN THE DEFECT SOLID STATE AND CATALYSIS, by Thomas J. Gray. Annual summary rept. for Feb 59-Feb 60 on Contract AF 49(638)288. [1960] 16p. 12 refs
AFOSR-TN-60-410.
Order from LC mi$2.40, ph$3.30 PB 147 496

The effects of radiation from a carbon arc lamp on the adsorption of oxygen on zinc oxide and zinc sulfide (in both pure and copper-activated forms) were studied. It was shown that oxygen was chemisorbed on all of the samples examined. Pure and copper-activated zinc oxide exhibited reversible photodesorption, preceded in the latter case by an initial photoadsorption. Pure zinc sulfide exhibited irreversible photoadsorption but the copper-activated sulfide was qualitatively analogous to the activated oxide. Preliminary experiments indicate that ethylene may be polymerized over irradiated zinc oxide and apparatus has been constructed to extend these observations and to examine the oxidation and hydrogenation of organic materials in the vapor phase over irradiated zinc oxide. (Author)

Colorado U., Boulder.
THEORY OF MICROWAVE ABSORPTION BY COMPRESSED OXYGEN GAS, by Masataka Mizushima. Rept. on Contract Nonr-1147(05). [1959] 19p. 11 refs. AD-219 927.
Order from LC mi$2.40, ph$3.30 PB 148 144

A theoretical explanation of the deviation between observed microwave absorption by high pressure oxygen gas and the prediction by the simple Van Vleck Weisskopf theory is attempted. Non spherical part of the intermolecular force is considered and distortion of energy levels and wave functions is calculated. It is found that the non-resonant absorption vanishes and a low frequency ($\sim$ 10 kMc) resonance appears at high pressure, while the 60 kMc resonance does not change much. This theory can explain the observed data. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
ELECTRODE KINETICS OF OXIDATION-REDUCTION COUPLES, by A. P. Bond and D. Singman. 15 Apr 60, 32p. 13 refs. TR-835.
Order from LC mi$3.00, ph$6.30 PB 146 398

Electrode kinetics of several oxidation-reduction couples were investigated by means of polarization measurements at platinum, carbon, titanium, and tantalum electrodes. The Ti^{+++}-TiO^{++} and Br_2-Br^- couples were found suitable for use at the anode and cathode, respectively, of a redox fuel cell using carbon electrodes. The use of these couples with porous carbon electrodes, through which the active solutions were circulated, led to a voltage drop, caused by electrode polarization, of 0.18 v at the anode and 0.09 v at the cathode at a current density of 200 ma/cm^2. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
A STUDY OF THE ALTERATION OF WATER DROPLET SUPERCOOLING BY FOREIGN VAPORS, by Joseph C. Mullins, Warren P. Hendrix and others. Scientific rept. no. 1 on Contract AF 19(604)4970. 29 Feb 60, 38p. 9 refs. AFCRC-TN-60-505.
Order from LC mi$3.00, ph$6.30 PB 147 488

An investigation was made of the freezing temperature of small water droplets in the presence of nitrogen, air, methane, argon and a mixture of nitrogen and argon. An expansion chamber was employed, and droplet temperatures at the moment of freezing were calculated being careful to correct for the latent heat of condensation. Freezing temperatures were found to vary slightly depending on the ambient gas. With nitrogen the freezing temperature was -45.5°C; methane, -44.6°C; air, -42.9°C; and an approximately equal mole per cent mixture of nitrogen and argon, -43.0°C. Argon did not give consistent results; freezing temperatures with it varied from -41.0 to -51.0°C. (Author)

Indiana U., Bloomington.
CHEMICAL REACTIONS OF IONIC BEAMS, by Walter J. Moore. Final rept. on Contract DA 33-008-ORD-891. Nov 57, 3p. 6 refs. AD-155 402; OOR rept. no. 1010.3; AD-155 402.
Order from LC mi$1.80, ph$1.80 PB 147 865

Research was undertaken to develop techniques and methods for studying the reactions of gaseous ions in the form of monoenergetic ion beams. Emphasis was placed on studying the sputtering phenomena.

Institute of Mathematical Sciences, New York U., N. Y.
THREE-BODY RECOMBINATION OF OXYGEN ATOMS, by Ernest Bauer and Morris Salkoff. Rept. on Contract AF 19(604)4555. Apr 60, 34p. 74 refs. Research rept. no. CX-47; AFCRC-TN-60-404.
Order from LC mi$3.00, ph$6.30 PB 147 292

A quantum mechanical perturbed stationary state calculation has been made of the rate of recombination of oxygen atoms in the presence of an oxygen molecule as third body. The recombination is considered to take place into highly excited vibrational levels (v = 9, 10) of the $A^3\Sigma^+$ state of O_2. There are no adjustable parameters in the calculation: for the interaction potential the results (for O_2 $X^3\Sigma^-_g$) obtained in a previous calculation have been used; these results were obtained by comparison with experimental measurements of vibrational relaxation times in oxygen. At temperatures of the order 300 - 3000°K, the calculated recombination coefficient into these two vibrational levels is of the order 2 - 10 x 10^{-33} cm^6/sec, which agrees to within better than a factor of 3 with recent experimental measurements.

Johns Hopkins U., Baltimore, Md.
KINETICS OF THE DEUTERIUM EXCHANGE BETWEEN DIBORANE AND DIMETHYLAMINODIBORANE, by J. S. Rigden and W. S. Koski. Technical note no. 14 on Boron Hydride Chemistry, Contract AF 18(600)1526. [1960] 26p. 10 refs. AFOSR-TN-60-470.
Order from LC mi$2.70, ph$4.80 PB 147 764

The kinetics of the deuterium exchange between diborane and dimethylaminodiborane have been studied. The course of the reaction was followed by means of gas density measurements. The concentrations of both reactants were varied over a 20-fold range in order to establish the orders of the reaction. The reaction was found to be first order with respect to dimethylaminodiborane and half-order with respect to diborane. The activation energy was found to be 27.8 ± 3 kcal. By variation of the surface-to-volume ratio it was determined that, to within experimental error, the reaction is homogeneous. A mechanism has been proposed in which the rate-determining step is the reaction between the intermediate BH_3 and dimethylaminodiborane. The rather high activation energy is consistent with a postulated symmetrical intermediate in the rate-determining step. (Author)

Kansas U., Lawrence.
RESEARCH AND DEVELOPMENT ON THE EQUILIBRIUM CONSTANTS AND ACTIVITY COEFFICIENTS OF ION EXCHANGE RESINS, by William J. Argersinger, Jr. Final rept. for 1 Sep 51-1 Sep 54 on Contract DA 23-072-ORD-222. 30 Sep 54, 126p. 10 refs. OOR rept. no. 84.3; AD-42 310.
Order from LC mi$6.30, ph$19.80 PB 147 853

The Ag-Na, Zn-H, and Ag-H exchanges on Dowex at 25°C were extensively investigated. A theoretical treatment of the solvent H_2O activity in exchange equilibrium is presented and applied to the Na-H exchange system. The basic principles of a method of determining solution activity coefficients from cation exchange data are discussed, and an approximate treatment was used to determine activity coefficients of $AgNO_3$ and $NaNO_3$ in their mixed solutions from the ion exchange measurements. The determination of individual mean activity coefficients, and their appropriate rations, from electromotive force measurements on suitable galvanic cells containing mixed electrolyte solutions is discussed. The method was applied to the study of $ZnCl_2$-$CdCl_2$ and $ZnCl_2$-HCl mixed aqueous solutions.

Laboratori di Elettrochimica, Chimica Fisica e Metallurgia del Politecnico di Milano (Italy).
RESEARCHES ON HYDROGEN OVERVOLTAGE ON METALLIC SINGLE CRYSTALS: SILVER AND LEAD, by L. Peraldo Bicelli and B. Rivolta. Rept. on The Structure and Properties of Interfaces, Contract AF 61(052)144. Apr 60, 27p. 23 refs. WADC Technical note 59-393.
Order from OTS $0.75 PB 161 801

Hydrogen overvoltage on silver and lead single crystal cathodes oriented following the (100), (110) and (111) planes has been measured, in sulfuric acid solutions for silver, and perchloric acid and sulfamic acid for lead. Tafel law holds true, the parameters are coincident for all of the silver electrodes, while they are different for the different lead electrodes. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
AN APPLICATION OF ABSOLUTE RATE THEORY TO DIFFUSION IN THE SOLID STATE, by R. W. Armstrong, J. P. Hirth, and G. M. Pound. Rept. on Contract Nonr-760(08). [1959] 9p. 9 refs. AD-220 511.
Order from LC mi$1.80, ph$1.80 PB 147 709

Fick's first law is derived from absolute rate theory for diffusion of a component in solid solution in order to determine the correct thermodynamic factor in the equation for intrinsic diffusivity. This factor is found to be $\gamma_i[1 + (d \ln \gamma_i / d \ln c_i)]$, and it is concluded that the mobility must be proportional to activity coefficient γ_i. The resulting expression for the self-diffusion coefficient D_i^R of a component in a homogeneous alloy is used to evaluate coefficients γ_i of the activated species from observed values of D_i^R and γ_i in the system Ni-Ag (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
EFFECT OF ELASTIC STRAIN ON THE ELECTRODE POTENTIAL OF METALS, by Ling Yang, G. T. Horne, and G. M. Pound. Technical rept. on Contract Nonr-760(08). [1959] 18p. 13 refs. AD-225 050.
Order from LC mi$2.40, ph$3.30 PB 148 141

The relationship is reviewed between stress and chemical potential to see how the unexpectedly large potential shifts and their change in sign between tension and compression may be explained in terms of thermodynamics. Only accretion constraints are applicable for reversible transport of substance to an elastically stressed pure solid, or for reversible transport of a substitutional solute to an elastically stressed solid solution. These constraints lead to an equation for increase in chemical potential at an X surface of a pure solid upon isothermal application of stress in the Y and/or Z directions and to an equation for the reversible electrode potential shift at that surface. An equation is formulated which expresses the increase in chemical potential of a substitutional solute upon isothermal application of non-hydrostatic elastic stress to a solid solution. Only absorption constraints are applicable for reversible transport of interstitial solute to an elastically stressed solid solution. The chemical potential of an interstitial solute is independent of direction of the solid surface and increases on compression but decreases on tension. Conclusion is reached that the only possible thermodynamic explanation is that the observations relate to transport of interstitial impurities between metal electrode and electrolytic solution. Hydrogen ion is suggested as a likely impurity. Only extremely high stresses, such as those which occur about line imperfections, would contribute appreciable to the corrosion rate of metals or alloys.

Naval Radiological Defense Lab., San Francisco, Calif.
STABILITY OF RADICALS PRODUCED BY IRRADIATION, by T. H. Anderson and R. S. Alger. 6 July 59, 13p. 3 refs. Research and Development Technical rept. USNRDL-TR-342; AD-220 313.
Order from LC mi$2.40, ph$3.30 PB 148 057

The concentration of free radicals in methanol at -196°C produced by electron bombardment cannot go above 1/2 M percent because the back reaction speeds up and the species crowd close enough to react with each other. These cage effects show up as the temperature goes up or down. (Author)

Oxford U. (Gt. Brit.)
RECOMBINATION OF ATOMS AT SURFACES. PART 7. HYDROGEN ATOMS AT SILICA AND OTHER SIMILAR SURFACES, by M. Green, K. R. Jennings and others. Rept. on Contract AF 61(514)1117. Feb 60, 28p. 22 refs. AFOSR-TN-59-869.
Order from LC mi$2.70, ph$4.80 PB 147 499

The recombination coefficients for hydrogen at a silica surface and a number of others such as boric oxide have been determined at temperatures between 20° and 600°C. The effect of washing and treating the silica surface in different ways has also been examined. It is possible to account for the results that have been obtained by reasonable assumptions regarding the mechanism of the recombination process, the nature of the silica surface and the changes that occur in it as a result of various treatments. (Author)

Pennsylvania State U., University Park.
THE EFFECTS OF m- AND p-SUBSTITUENTS ON THE POLAROGRAPHIC OXIDATION OF ANILINE. EVIDENCE FOR THE SUBSTITUTED BENZENE RADICAL-ION INTERMEDIATE, by Irwin Fox, Robert W. Taft, Jr. and J. M. Schempf. Technical rept. no. 22 on Contract Nonr-656(05). June 59, 38p. 53 refs. AD-218 587
Order from LC mi$3.00, ph$6.30 PB 146 280

Attempts were made to establish whether or not the trends noted in a plot of $\Delta E1/2(E1/2^{\text{meta or para substituted aniline}} - E1/2^{\text{unsubstituted aniline}})$ vs Hammett σ values for one line defined by the points for m-CH_3, m-Cl, m-NO_2, and H, and a second line, approximately parallel to the first but displaced downward, defined by the points for the p-OCH_3, p-Cl, and p-NO_2 substituents could be placed on a quantitative basis. Efforts were also made to determine unambiguous substituent effects on the polarographic oxidation of aniline and several N, N-dimethylaniline derivatives.

Pennsylvania U., Philadelphia.
IONS IN LIQUID HELIUM, by K. R. Atkins. Technical rept. no. 3 on Contract Nonr-551(28) [1959] 34p. 20 refs. AD-220 497.
Order from LC mi$3.00, ph$6.30 PB 147 721

The mobility of an ion in liquid He^4 is known to be appreciably less than the mobility of a He^3 atom. This is explained by the suggestion that electrostriction effects increase the liquid density in the immediate vicinity of the ion so that the ion drags around with it about 50 He^4 atoms. If an almost free electron can exist in the liquid there may be an additional effect which results in a still greater effective mass. The way in which these concepts might be used to calculate the mobilities is briefly discussed. Various experimental consequences of this picture of an ion are suggested. (Author)

Princeton U., N. J.
SURFACE DIFFUSION AND RECOMBINATION HYDROGEN ATOMS ON GLASS, by Kin Tsu (Doctoral thesis) and Michel Boudart. Rept. on Contract AF 49(638)32. [1959] 37p. 26 refs. AFOSR-TN-60-195.
Order from LC mi$3.00, ph$6.30 PB 147 660

A kinetic study of the recombination of hydrogen atoms on glass has been carried out. At low temperatures, the catalytic rate appears to be limited by the adsorption process on the entire surface. At higher temperatures, it becomes controlled by the surface diffusion of adsorbed atoms to uniformly distributed active sites. At still higher temperature, reaction takes place directly and exclusively on the active sites. A theory is presented that describes the transition between the kinetic regimes and the regime of surface diffusion. The experimental data, characterized by a complicated Arrhenius behavior, are explained by this heretofore unexplored mechanism of heterogeneous catalysis. (Author)

Reaction Motors Div., Thiokol Chemical Corp., Denville, N. J.
IONIZATION IN ROCKET FLAMES, by J. Nichol, V. Siminski and H. G. Wolfhard. Rept. on Contract AF 49(638)305. [1960] 17p. 12 refs. AFOSR-TN-60-285.
Order from LC mi$2.40, ph$3.30 PB 147 545

The temperature in the combustion chamber of a rocket motor can be sufficiently high to maintain a relatively large degree of thermal ionization when small quantities of an alkali metal are added to the flame gases. This paper describes a series of measurements of ion concentrations obtained under various conditions in a rocket motor combustion chamber.

Rensselaer Polytechnic Inst., Troy, N. Y.
PRECISE MEASUREMENT OF DENSITY AND SURFACE TENSION AT TEMPERATURES UP TO 1000°C IN ONE APPARATUS, by Max R. Lorenz and George J. Janz. Technical rept. no. 3 on Contract Nonr-591(10). Aug 59, 20p. 9 refs. AD-226 420.
Order from LC mi$2.40, ph$3.30 PB 147 712

A method for the precise measurement of surface tension and density of molten salts in one apparatus at temperatures up to 1000°C is reported. The essential features of the apparatus are a density bob of special design to enable surface tension data to be gained simultaneously, and a continuously variable height crucible arrangement for the liquid sample. A description of the apparatus and the calibration procedures are given in detail. The results for molten potassium nitrate up to 470°C are reported to illustrate the method. (Author)

Stanford Research Inst., Menlo Park, Calif.
PHOTOCHEMISTRY IN THE SOLAR FURNACE, by Rudolph J. Marcus and Henry C. Wohlers. Final rept. on Contract AF 19(604)3477. 28 Dec 59, 57p. 16 refs. SRI Proj. SU-2508; AFCRC-TR-60-223.
Order from LC mi$3.60, ph$9.30 PB 147 489

The solar furnace can be used as a cool, intense light source. Equipment has been designed for use of this light source for photochemical reactions in the liquid phase. Evidence is presented on the stoichiometry and mechanism of the photoreduction of ceric perchlorate as it proceeds in the solar furnace. Light from the focal spot of the furnace also has been obtained as parallel light in order to make spectral

and energy measurements. The use of a furnace with front-silvered optics is described. Two energy storing reactions have been studied with this light source. Of these, the cerous-ceric reaction does not produce measurable quantities of hydrogen, and the photolysis of nitrosyl chloride will require a flow system in order to avoid back reactions. It is obvious that other and better energy-storing reactions need to be investigated, using this novel light source. (Author)

Technical U., Vienna (Austria)
THE ADSORPTION OF TOBACCO SMOKE: HOW FAR IS A CIGARETTE ITS OWN FILTER? by Alfred Dobrowsky. [Final rept. pt. H, 1 Dec 58-30 Sep 59, on Behavior of a Streaming Aerosol and its Interaction with Solid Obstacles] Contract DA 91-591-EUC-1011. [16 Nov 59] 7p. 2 refs. AD-230 180.
Order from LC mi$1.80, ph$1.80 PB 148 312

An experimental program was conducted to determine the ability of tobacco for absorbing tobacco smoke aerosol. A 100-g, 68-mm cigarette was smoked by forcing 40 cc of air through it in 2 sec; the process was repeated 2 times per minute. This smoke was passed through a second cigarette of identical size and finally into wadding traps. The tobacco aerosol was elutriated from the tobacco of the second cigarette and from the wadding with di-n-octyl phthalate. Repeated experiments established that an average of 61.4% of the aerosol was trapped by the tobacco in the second cigarette and 38.6% by the wadding. It was estimated that a 15 mm cellulose acetate filter adsorbs the same amount of tobacco aerosol as 17 mm of tobacco.

Technical U., Vienna (Austria)
AEROSOLS OF HCL-H_2O AND SO_3-H_2O. PART I. ISOTHERMIC PROCESS, by Alfred Dobrowsky. [Final rept. pt. B, 1 Dec 58-30 Sep 59, on Behavior of a Streaming Aerosol and its Interaction with Solid Obstacles] Contract DA 91-591-EUC-1011. [16 Nov 59] 13p. 6 refs. AD-230 178.
Order from LC mi$2.40, ph$3.30 PB 148 310

Assuming that the stability of an aerosol is given by the equality of the components partial pressures above the liquid aerosol and in the gasroom the systems H_2O and SO_3-H_2O are considered. In the HCL-H_2O system we have two partial vapor pressures. HCL and H_2O. In the SO_3-H_2O system part of the water vapor is consumed in transforming SO_3 into H_2SO_4. A further part of water vapor is consumed in diluting the said H_2SO_4 until the water partial pressure of the H_2SO_4-H_2O aerosol is equal to the partial pressure of the remaining gaseous water vapor. Formulas are given for the aerosol masses as a function of the HCL or SO_3 mass and temperature and relative humidity in an isothermic process. The aerosol masses are tabulated for 9 meteorological conditions, i.e., for 0°, 15°, 30°, each at 70, 85, 100% relative humidity and each for 6 different masses of HCL or SO_3. (Author)

Technical U., Vienna (Austria)
AEROSOLS OF HCl-H_2O. PART II. ADIABATIC PROCESS, by Alfred Dobrowsky. [Final rept. pt. C, 1 Dec 58-30 Sep 59, on Behavior of a Streaming Aerosol and its Interaction with Solid Obstacles, Contract DA 91-591-EUC-1011]. [16 Nov 59] 11p. 5 refs. AD-230 174.
Order from LC mi$2.40, ph$3.30 PB 148 311

Into an air volume of 22400cm^3 at 0°, 15° and 30° and a relative humidity of r=70% and 100% a mass of 18, 72 and 288mg HCl gas is introduced, i.e., 1/2, 2 and 8 millimol. In every case the aerosol mass generated by an isothermic process is bigger than by an adiabatic process. The aerosol mass generated by small amounts of HCl surpasses the HCl mass many times (e.g. 18mg HCl, 0°, r=100%: isothermic 68mg fog, adiabatic 49mg). In the contrary a big amount of HCl gives a relatively small amount of fog (e.g. 288mg HCl, 0°, r=100%: isothermic 126mg fog, adiabatic 54mg). Aerosol's HCl concentration is high at low temperatures (e.g. 18mg HCl, r=100%, adiabatic: 0°, 22, 7% HCl; 30° 16, 5%) and dry air (e.g. 18mg HCl, r=70%, 0°, adiabatic: 24, 5% HCl). Rise of temperature by adiabatic process is greatest with warm and damp air (e.g. 18mg HCl, r=100%: 0° Δt=3, 8°; 30° Δt=5, 5°) and high HCl masses (e.g. 288mg HCl, r=100%, 30°: Δt=11°). When r=70% becomes Δt only circa the half of the said values. The proportion between isothermic and adiabatic fog masses is at 0° circa 1, 4: 1, at 30° circa 3:1 and heat generated by the said processes is nearly in the same proportion. Regularly the HCl concentration is bigger in an isothermic generated fog than in an adiabatic one. Only small amounts of HCl give the contrary effect. (Author) (See also PB 148 310)

Technical U., Vienna (Austria)
AEROSOLS OF SO_3+H_2O. PART III. by Alfred Dobrowsky. [Final rept. pt. D, 1 Dec 58-30 Sep 59, on Behavior of a Steaming Aerosol and its Interaction with Solid Obstacles] Contract DA 91-591-EUC-1011. [16 Nov 59] 11p. 3 refs. AD-230 179.
Order from LC mi$2.40, ph$3.30 PB 148 309

Aerosols generated by different amounts of sulfur trioxide gas and air of different temperatures and humidities are considered. The aerosol mass, acid concentration, specific density and normality are calculated. The rising of temperature by adiabatic process is computed, as heat is produced by condensation of SO_3 and H_2O gas, compounding H_2SO_4 and dissolving it with further water approaching from gaseous status. (Author) (See also PB 148 310, PB 148 311)

Technical U., Vienna (Austria).
THE DISTRIBUTION OF PARTICLE SIZES IN AEROSOLS, by Alfred Dobrowsky. [Final rept. pt. A, 1 Dec 58-30 Sep 59, on Behavior of a Streaming Aerosol and its Interaction with Solid Obsticles] Contract DA 91-591-EUC-1011. [16 Nov 59] 20p. AD-230 176.
Order from LC mi$2.40, ph$3.30 PB 146 055

Boltzmann's equation gives the energy distribution among a multitude of particles, and the expression

$W(\varepsilon) = B.\varepsilon^{-h.A(\varepsilon)} . d\varepsilon$ gives the probability $W(\varepsilon)$ of finding a particle at an energy level $A(\varepsilon)$. Upon dispersal of a mass the surface area will increase. To increase the surface, energy has to be extended

against the surface tension. Therefore a mass divided into very small particles will assume a higher energy level. By taking for a certain particle size a certain energy level we are able to find the size distribution law of an aerosol. The time of fall depends upon particle size according to Stokes' law. So for a certain size distribution we can compute the sedimentation rate, and vice versa, we also can prove the theory's results by experimental means. (Author)

Technical U., Vienna (Austria)
EFFICIENCY OF SOME MATERIALS FOR AEROSOL FILTERING, by Alfred Dobrowsky. [Final rept. pt. G, 1 Dec 58-30 Sep 59, on Behavior of a Streaming Aerosol and its Interaction with Solid Obstacles] Contract DA 91-591-EUC-1011. [16 Nov 59] 6p. 2 refs. AD-230 203.
Order from LC mi$1.80, ph$1.80 PB 148 306

Experiments were made with tobacco smoke to determine the aerosol-filtering efficiencies of various materials as compared to cellulose acetate filters. Pressure drop, streaming velocity, and filter space were kept constant. Wood fibers, wadding, crepe paper, cellulose acetate fibers in irregular arrangement, and bird feathers were superior to ordinary cellulose acetate filters, while silica gels and ground glass were inferior.

Technical U., Vienna (Austria)
POTENTIAL FLOW'S ACCELERATION FIELD AROUND A CYLINDER, by Alfred Dobrowsky. [Final rept. pt. F, 1 Dec 58-30 Sep 59, on Behavior of a Streaming Aerosol and its Interaction with Solid Obstacles] Contract DA 91-591-EUC-1011. [16 Nov 59] 6p. AD-230 177.
Order from LC mi$1.80, ph$1.80 PB 148 307

Technical U., Vienna (Austria)
SCATTERING OF LIGHT IN COLLOIDS. THE PLOTNIKOW EFFECT, by Alfred Dobrowsky. [Final rept. pt. E, 1 Dec 58-30 Sep 59, on Behavior of a Streaming Aerosol and its Interation with Solid Obstacles] Contract DA 91-591-EUC-1011. [16 Nov 59] 10p. 4 refs. AD-230 175.
Order from LC mi$1.80, ph$1.80 PB 148 308

In the Tyndall-effect the incoming light is scattered by colloid particles. Generally the intensity of the scattered light is not sufficient to cause secondary scattering effects observable by the common means used. Using infrared light and colloids of larger particle size the secondary scattering effect dissipating over the whole colloid volume is easy to detect (Plotnikow - effect) by films for infrared light. In this paper a theory about the Plotnikow effect is advanced and the calculation for the intensity field is given and the connection between the Tyndall and Plotnikow effects is discussed. (Author)

EARTH SCIENCES

Danish National Committee of URSI.
THE CORRELATION BETWEEN EARTH CURRENTS AT GODHAVN AND MAGNETIC DISTURBANCES, by Eigil Ungstrup and Arne R. Pedersen. Technical note no. 1 on Contract AF 61(514)1309. 31 July 58, 7p. 1 ref. AFCRC TN-58-641; AD-231 805.
Order from LC mi$1.80, ph$1.80 PB 146 136

An investigation is presented of correlation between earth currents, as determined by orientating measurements at Godhavn during the months of August, September, and October, 1957, and geomagnetic disturbances. A distinct correlation is shown to exist between the daily variations (average values for a month) of the earth currents and the geomagnetic disturbances, the latter being expressed by the local K-index for Godhavn. A graphical representation of 3-hourly values of earth currents, local K-indices, and planetary K_p-values suggests a good correlation between all of these quantities. (Author)

Danish National Committee of URSI.
RESEARCH ON RELATIONSHIPS BETWEEN NATURAL ATMOSPHERIC RADIO PHENOMENA AND GEOMAGNETIC FIELD, by Jorgen Rybner and Eigil Ungstrup. Technical (Final) rept. on Contract AF 61(514)1309. July 59, 14p. 3 refs. AFCRC TR-59-275; AD-231 803.
Order from LC mi$2.40, ph$3.30 PB 146 135

The investigation consists in recording audio-frequency radio-wave phenomena at Godhavn, Greenland, in cooperation with the U.S. National Committee of U.R.S.I. at the request of the American Committee which has erected a chain of stations along the East Coast of America. The work consists in recording for two minutes every hour the electro-magnetic atmospherics of audio-frequencies by means of a special equipment consisting of an aerial, an amplifier, and a specially built tape recorder. The equipment has been built and designed at the laboratories of the Royal Technical University of Denmark.

Climatology and Meteorology

Air Force Cambridge Research Center [Bedford] Mass.
THE FEASIBILITY OF THE IDENTIFICATION OF HAIL AND SEVERE STORMS, by D. Atlas and R. J. Donaldson, Jr. Jan 55, declassified 6 May 60. 95p. 37 refs. Air Force Surveys in Geophysics no. 65; AFCRC-TN-55-21.
Order from LC mi$5.40, ph$15.30 PB 148 036

Some properties of hail felt to be important for its remote detection and identification have been discussed. A number of techniques for detecting and possibly identifying hail have been proposed: (1) Measurement of the difference in returned signal intensity between vertical and horizontal polarization. (2) Absolute echo intensity. (3) Echo intensity contour mapping of a suspected hail region. (4) Pulse-to-pulse echo fluctuations. (5) Detection of electrical activity in thunderstorms. (6) Geometry of the radar echo. Of the techniques listed, the polarization and echo fluctuation methods offer possibilities for uniquely identifying the presence of hail.

Air Force Cambridge Research Center [Bedford] Mass.
RESULTS OF CONTROLLED-ALTITUDE BALLOON FLIGHTS AT 50,000 TO 70,000 FEET DURING SEPTEMBER 1952, by Richard A. Craig and Thomas

O. Haig. Feb 53, 291p. Air Force Surveys in Geophysics no. 30; AFCRC-TR-53-4.
Order from LC mi$11.10, ph$45.60 PB 148 034

Army Signal Research and Development Lab., Fort Monmouth, N. J.
CALCULATOR FOR TEMPERATURE-HUMIDITY COMPUTATION, by Gwendolyn L. Killen and Leonard E. Evenson. 24 Nov 58, 29p. 4 refs. USASRDL Technical rept. 2010. AD-227 103.
Order from LC mi$2.70, ph$4.80 PB 147 995

Measurement of atmospheric humidity and temperature from aircraft using a stagnation-type measuring system with a resistance-type humidity sensor, such as humidity-temperature measuring set AN/AMQ-7 and humidity element ML-476( )/AMT, presents computational problems in reducing the readout data to true free-stream values. The theory, design criteria, and operation of a circular slide-rule type calculator designed to facilitate these computations are described. The device simply and effectively provides for a lock-in adjustment for the humidity sensor, conversion of the output function of this sensor to dewpoint temperature, and application of the necessary aerodynamic corrections to the indications from the measuring set. Pressure altitude and calibrated airspeed (or Mach number) are used in the computations. The final readout gives the true free-stream conditions of temperature and dewpoint temperature. The calculator is intended for use at aircraft speeds below Mach number 1.0. By modification of the appropriate scales, the design can be easily adapted for use with other equipments of similar design. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
AN EXPERIMENTAL PICTURE COMPARATOR FOR USE IN EVALUATING WEATHER RADAR SCOPE PHOTOGRAPHS, by Ewart F. Annet. 15 July 59, 12p USASRDL technical rept. 2057; AD-220 784.
Order from LC mi$2.40, ph$3.30 PB 148 114

Because of the importance of weather radar photographs in analyzing storms, there is a need for a device for rapidly comparing and evaluating many photographs of the same storm situation taken at various time intervals. A comparator is described and its limitations listed. An experimental refractive system which was developed is also described and its advantages listed. Results indicate that the comparator is not fully satisfactory and that work should continue on development of an improved refractive system. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
AIR TEMPERATURE AND PRECIPITATION ON THE GREENLAND ICE CAP, by Marvin Diamond. Oct 58, 13p. 16 refs. Research rept. 43.
Order from LC mi$2.40, ph$3.30 PB 148 469

Charts of mean annual air temperature and precipitation over the ice cap are constructed on the basis of snow-profile studies at 8 locations, data collected for several years after 1953 at two U.S. Air Force weather stations, and records from expeditions since 1930. The warming trend in the Arctic appears to have occurred to a lesser degree on the ice cap, possibly because of the effect of the snow cover. The lowest mean annual temperature in South Greenland is estimated to occur within the area bounded by the 2500 m contour and the -18C isotherm; mean annual temperature at 2700 is estimated as -20.9C. In North Greenland, the mean annual temperature at 1700 m is estimated at -22C. The presence of ice glands in the snow and daily max summer temperatures, estimated from records of coastal stations, indicate a potentially high incidence of melting at about 1300 m elevation and some melting at 1700 m in North Greenland, and melting up to 2700 m in the South. Annual accumulation is 2-3 times as great at 2500 m on the west side of the ice cap as at the crest. South of 66°N, precipitation may be about twice as great on the east side of the crest as in the west. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
INVESTIGATIONS OF FOG WHITEOUT, by Howard Reiquam and Marvin Diamond. July 59, 23p. 35 refs. Research rept. 52; AD-226 992.
Order from LC mi$2.70, ph$4.80 PB 148 471

The results of studies on the physical properties of fog whiteout, as it occurred at Site 2 on the Greenland Ice Cap in the summers of 1956 and 1957, are reported. The instruments, methods of measurement, and data-reduction techniques used are described. Attempts at dissipating whiteout by AgI seeding are discussed briefly. Emphasis was given to measurements of fog-particle size distribution, liquid-water content, relative humidity, visibility, and atmospheric nuclei. The synoptic situations for 2 selected cases of fog whiteout at relative humidities of less than 100% (possibly because of the presence of salt solutions) are described. The balance between the rate at which water is made available in the air as it is lifted over the Ice Cap and the rate of water flux to the snow surface is computed. Efforts at fog dispersal by AgI seeding from the ground were inconclusive. (Author)

Avco Corp., Wilmington, Mass.
RESEARCH CONCERNING FORECASTING ANOMALOUS PROPAGATION AT HIGH LATITUDES. ANOMALOUS foF2 VARIATIONS IN THE ANTARCTIC, by G. E. Hill. Scientific rept. no. 5 on Contract AF 19(604)4092. Apr 60, 43p. 7 refs. Technical rept. RAD-TR-60-13; AFCRC-TN-60-362.
Order from LC mi$3.30, ph$7.80 PB 147 658

The daytime minimum in the F2-layer critical frequency, which is often observed in the Antarctic, is explained on the basis of a vertical shear in the horizontal wind (neutral air) and the resulting movement of charged particles in the presence of the earth's magnetic field. The diurnal variation of the F2-layer critical frequency, as expressed by the noon minus the midnight value, D, is normally positive, but in the case of the daytime minimum, is negative. A three-level model of the F region has been developed for the purpose of demonstrating the effect of a vertical wind shear on the electron concentration. The results of electron-density computations for several cases have shown that the characteristic F2-layer critical frequency variations can be explained on the basis of a wind shear of the order of 25 to 50 meters per second per 100 kilometers. The wind shear can account for most of the "anomalous" behavior in the Antarctic.

Minnesota U. School of Physics, Minneapolis.
METEOROLOGICAL STUDIES USING CONSTANT ALTITUDE BALLOONS, by Homer T. Mantis and William F. Huch. Technical rept. no. AP-14 on Atmospheric Physics Program, Contract Nonr-710(22). Aug 59, 69p. 12 refs.
Order from LC mi$3.90, ph$10.80 PB 147 696

In the course of a project to investigate the behavior of plastic balloons, a number of balloon flights were made in the upper troposphere with very accurate positioning and precise altitude control. These balloon flights yielded what is believed to be unique information on wind structure at intermediate scale. This report consists of three separate papers; the first is a description of the balloon system used for precise trajectories the second summarizes the information on wind structure at intermediate scale and the third reviews the work on the relationship between synoptic forces and constant altitude balloon trajectories.

Weather Forecasting Research Center, U. of Chicago, Ill.
STUDIES IN WEATHER ANALYSIS AND FORECASTING, ed. by Sverre Petterssen. Final rept. for 1957-1959, on Contract AF 19(604)2179. Feb 60, 507p. 18 refs. AFCRC TR-60-232; AD-234 282.
Order from LC mi$11.10, ph$77.40 PB 146 368

Contents:
The evolution of energy gain by the atmosphere through contact with the ground or ocean
Evaporation from the oceans
Outline of a project to investigate the effects of heat sources and sinks on the development of weather and motion systems
On the influence of heat exchanges on motion and weather systems (a short summary published by the National Academy of Sciences, vol. 45, no. 12, pp. 1655-1663, 1959, under the title "Heat exchange and weather forecasting"
On some weather influences due to warming of the air by the Great Lakes in winter
On the heat sources and sinks associated with mobile cyclones
Moisture analysis and water budget in some non-developing cases
Computation of precipitation from large-scale vertical motion
A meteorological coordinate system in which the earth's surface is a coordinate system
On summer cyclogenesis in western Canada associated with upper cold lows
An investigation of nighttime thunderstorms in the central United States
Investigation of cold waves at Chicago, Illinois
An investigation of the existence of an Aleutian low singularity
The thermal field of the arctic stratosphere near 80° W in January

Frost Science

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
DEEP CORE DRILLING IN ICE, BYRD STATION, ANTARCTICA, by R. W. Patenaude, E. W. Marshall, and A. Gow. July 59, 11p. Technical rept. 60; AD-227 121.
Order from LC mi$2.40, ph$3.30 PB 148 467

The preliminary results of core examinations and drill-hole temperature studies from Nov 1957 - Jan 1958 are reported, and the drilling equipment and techniques are described. Drilling was accomplished with a Failing model 314 rotary skid-mounted well-drilling rig with a 38-ft mast, powered by a 43-bhp Buda gasoline engine. Two types of bits, both cutting a 3 7/8-in. core and a 5 3/4-in. hole, were used. The speed of rotation was varied from 40-75 rpm, and the rate of penetration ranged from 2.5-10 in./min. Compressed air was used as the drilling fluid. Good quality cores were obtained down to 1013 ft with a 98% recovery. Examination of the cores revealed the presence of a detailed stratigraphic sequence down to a depth of 400 ft, consisting of alternating layers of coarse and fine-grained snow associated with ice bands 4 mm thick, which appeared singly or in closely spaced groups at regular intervals. Below this depth the ice was very homogeneous, except for thin ice bands which persisted to the bottom. The mean densities for meter increments to a depth of 150 ft, densities determined from spot samples at 5 points from 400-721.5 ft, and drill-hole temperatures down to 1000 ft are tabulated. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
FLEXURAL STRENGTH OF CLEAR LAKE ICE, by Robert D. Hitch. Master's thesis. July 59, 12p. 5 refs. Technical rept. 65; AD-231 914.
Order from LC mi$2.40, ph$3.30 PB 148 477

Values for the modulus of elasticity and strength of fresh-water lake ice in flexure were determined by laboratory experiments on 63 beams tested under various rates of loading at -5C and -20C. The results were obtained by measuring the center deflection of the test beam and the load simultaneously. Third point loading was used in order to develop a more favorable distribution of bending stresses in the middle third of the beam than with a simple beam. The experiments indicate that properties of ice vary according to loading rate, temperature, and crystal size. Specifically the results show: (1) lower temperatures give higher values of the modulus of elasticity and strength, (2) ice with larger crystals will have a higher modulus of elasticity but little difference in strength, and (3) the rate of loading increases the modulus of elasticity but has little effect on the strength except at low temperatures where higher strength values are obtained with a faster rate of loading. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
GLACIOLOGICAL INVESTIGATIONS IN THE THULE RAMP AREA, by Valter Schytt. Rept. on Northwestern U. Contract DA 11-190-eng-12. Apr 55, 93p. 5 refs. SIPRE rept. 28.
Order from LC mi$5.40, ph$15.30 PB 148 465

During the 1954 field season, from 19 June to 29 August, accumulation and ablation measurements were made on the Ramp and farther inland to Mile 20 (from Thule Take-off). Meteorological measurements were obtained for correlation with the glaciological work. Accumulation on the Ramp averaged 55 cm of snow and varied considerably, showing high values on concave slopes and low values on convex slopes. Farther inland, the order of magnitude of winter snow depths was 100 cm from Mile 4 to Mile 7; 150 cm from Mile 8 to Mile 14; and 100 cm from Mile 15 to Mile 20. Except for a narrow belt of winter accumulation just inside the edge of the glacier, the Ramp below 700 m belonged to the area with net ablation. Studies were made on formation of superimposed ice; debris features in the moraine area; and ice movement and structure in the vicinity of Thule Take-off. Some observations on trafficability of the route are included. (Author) (Also included in PB 146 024)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
INSTRUMENTATION OF ICE CAP STATIONS, by B. Lyle Hansen. Preliminary rept. Apr 55, 7p. SIPRE rept. 23.
Order from LC mi$1.80, ph$1.80 PB 148 462

Two stations on the Greenland Ice Cap were instrumented as follows: (1) copper resistance thermometers were installed to determine the effect of the buildings on the subsurface temperatures; (2) a recording bench mark was installed and the elevations of selected points in the buidlings were determined by leveling from the bench mark; (3) reference points were established at which diameters of the tubes are measured and from which the orientation of the tubes can be determined by observations with a transit; and (4) various types of pressure cells were installed in order to determine some of the forces causing deformation of the buildings. (Author) (Also included in PB 146 024)

[Army] Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
PENETRATION OF SHAPED CHARGES INTO FROZEN GROUND, by Robert Benert. Apr 57, 23p. 3 refs. Technical rept. 45; AD-141 808.
Order from LC mi$2.70, ph$4.80 PB 148 470

Tests were conducted in 1955-56 at Fort Churchill (Man.) with 6 standard and experimental shaped charges to determine their usefulness in producing holes to receive explosives for the excavation of foxholes. The typical hole produced in sandy silt with a 12-in. peat cover consisted of a crater surrounding a narrow deep hole. Max. penetration depths ranged from 108 in. for the 40-lb M3 charge to 22 in. for the 2.75-oz Du Pont jet tapper. The M2 (10 lb). M2A3 (15 lb), and M3 met the min. hole-dimension requirements (5 ft deep by 2 in. wide); the 20-lb and 5-lb experimental charges were inadequate. Performance of the jet tapper indicated that further experiments with charges of this design are advisable. Buried boulders, though sometimes shattered by the jets, more frequently blocked them, and incomplete tests on natural ice indicated a relatively greater penetrability than the tests on frozen ground. The theory, methods, and equipment of the tests are described in detail, and the data obtained are tabulated and graphed. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
RADIATION MEASUREMENTS ON THE GREENLAND ICE CAP, by M. Diamond and R. W. Gerdel. Oct 56, 26p. 9 refs. Research rept. 19.
Order from LC mi$2.70, ph$4.80 PB 148 468

Measurements were made of global and net radiation between 6 July and 7 August 1955 at a site on the Greenland Ice Cap located near 78°N. latitude and at an elevation of 6800 ft. Diffuse sky radiation amounted to only 19% of all incoming global radiation measured at the Ice-Cap research site. Incident global radiation was reduced by 6% in the presence of a 0.5 cloud cover. The long-wave radiation balance at this site on the Ice Cap was always negative during the period covered by this study. Errors associated with the measurement of solar radiation at the low sun angles which prevailed at the research site were found to be about -3%. During periods of blowing and drifting snow, 6% more global radiation was measured at 1.25 m above the snow surface than at 5.7 m elevation. The atmospheric transmission coefficient at the Ice Cap site was found to be 0.968. The heat balance of the snow cover as computed from the radiation measurements and a temperature profile in the snow was found to be 7.6 ly/day at the Ice-Cap site. (Also included in PB 146 023)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
ROLE OF THE ELECTRIC DOUBLE LAYER IN THE MECHANISM OF FROST HEAVING, by L. A. Cass and R. D. Miller. Rept. on Cornell U. Contract DA-11-190-eng-23. Aug 59, 27p. 21 refs. Research rept. 49.
Order from LC mi$2.70, ph$4.80 PB 148 466

It is suggested that the osmotic activity of the electrical double layer on mineral particles can account for the heaving phenomenon in soils, and equations are given relating the osmotic pressure (and freezing temperature) of water at the base of a growing ice lens to overburden pressure, depth of water table, depth to the conducting stratum, hydraulic conductivity of soil, and rate of heave. Water flows to the ice face ordinarily by hydraulic conduction, but by diffusion in the unfrozen film between the upper-most particles and the underside of the ice lens. Coarse materials show little heave because of diffusion limitations on recharge of the unfrozen film. The theory of Jackson and Chalmers that super-cooling is required for heaving is denied, and a "solution model" is proposed in which heaving can occur in the absence of soil. Various methods of modifying or controlling frost heaving are reviewed in the light of the theory, and experiments are proposed for evaluating the theory. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
SCIENTIFIC WORK OF PARTY CRYSTAL, 1954, by Carl S. Benson. Preliminary rept. Apr 55, 12p. SIPRE rept. 24.
Order from LC mi$2.40, ph$3.30 PB 148 463

Party Crystal, a small mobile scientific party, conducted snow studies during the summer of 1954 on the Greenland Ice Cap eastward from Thule, Greenland. Work included measurements of elevation, snow accumulation, summer melting, and snow properties. Final results of the season's work will be combined with the work of 1952 and 1953 and published at a later date. The average annual accumulation is approximately 60 cm of water equivalent for the first segment of the trail (58.5 mi); drops to 20 cm in the next 30 mi and remains low for approximately 45 mi; rises to nearly 40 cm for the next 85 mi; then decreases again to the east. Along the first 40 mi of the trail, the year's accumulation of snow becomes completely soaked during the melt season, making a very poor surface for vehicles. Beyond that point, the depth of soaking decreases rapidly. Ice masses due to percolation of melt water are very common and frequently large along the first 58.5 mi, decrease in size along the next 60 mi, and occur very infrequently farther east. (Author) (Also included in PB 146 022)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
STUDIES ON VEHICULAR TRAFFICABILITY OF SNOW. PART II, by John J. Lanyon. July 59, 27p. 6 refs. SIPRE rept. 35.
Order from LC mi$2.70, ph$4.80 PB 148 460

The results are reported of investigations during the winters of 1955, 1956, and 1957 at the Keweenaw Field Station (Mich.) and in summer 1956 in N. Greenland to determine the relationship between certain meteorological parameters and the traffic-supporting capacity of snow cover. The vehicles used in the studies included an M-7 Ordnance snow tractor, a 4-pontoon Tucker Sno-Cat, and an M-29C weasel. A Bombardier Muskeg Tractor was modified and instrumented for use as a testing dynamometer vehicle. Max. drawbar pull for the M-7 tractor loaded with concrete blocks was obtained at a mean ground pressure of 1 psi. Max. efficiency of the tractor was between 10 and 20% slip. The efficiency coefficient of the Sno-Cat exceeded that of the M-7 tractor by 4%. Both face-angle grousers of the Kamm type and iron angle grousers of the same profile were tested on the track pads of the M-7 tractor. An increase of 30% in drawbar pull was obtained with supplemental grousers, but the overall results did not appear to justify the use of face-angle grousers. More tractive force was developed on the rear than on the front pontoons of the Tucker Sno-Cat. Tests in Greenland indicated that drawbar pull is directly related to both the density and hardness of the top 50 cm of snow. No relationship was found between air temperature and snow trafficability, drawbar pull and snow temperature, and snow hardness and density. (Author)

Dartmouth Coll., Hanover, N. H.
THE ABSORPTIVITY OF ICE: A CRITICAL REVIEW, by J. B. Lyons and R. E. Stoiber. Scientific rept. no. 3 on Contract AF 19(604)2159. 31 Oct 59, 14p. 22 refs. AFCRC-TN-59-656; AD-230 753.
Order from LC mi$2.40, ph$3.30 PB 146 195

The literature on ice absorptivity determination is critically evaluated in the light of new measurements. Clear flawless ice has transmissivities close to those of distilled water, with the infrared absorption bands offset slightly toward higher wavelengths. Bubbly ice, the variety commonly encountered in nature, has absorptivities in the range of 100 times greater than those for flawless ice; this effect is largely due to scattering. In the visible and near infrared range polycrystalline ice has transmissivities close to those for single ice crystals. The differential absorptivity for the e and o-rays is shown to be non-existent. (Author)

Villanova U., Pa.
ICE CONTROL ON AIRFIELD RUNWAYS, by G. N. Quam. Progress rept. on Contract NBy-4303. 30 Sep 56, 27p.
Order from LC mi$2.70, ph$4.80 PB 137 412

A particularly appealing method of controlling ice on airfields is to be able to push all the ice that forms off of the runways with an ordinary snowplow, roadscraper, or street sweeper. Accordingly, a search for a suitable coating that will almost eliminate adhesion of ice to the runway in being made. The adhesion of ice to a variety of coatings and other surfaces is being measured by both tensile and shear techniques. Attempts to synthesize ionic polymers, expected to be ice-phobic, are being made.

Geodesy

Chicago Aerial Industries, Inc., Melrose Park, Ill.
PRINTER, PROJECTION, PHOTOGRAPHIC EN-29A( ), by Carvyn Ellman, Gary Lynn and others. Final rept. on Contract AF 30(602)1750. Jan 59, 28p. RADC-TR-59-22; AD-210 722.
Order from LC mi$2.70, ph$4.80 PB 146 123

The EN-29A( ) Photographic Projection Printer, hereinafter referred to as an orthophotoscope, is an instrument used to convert perspective aerial photographs into a negative which, when printed, is the equivalent of an orthographic projection in which all horizontal distances appear in the same scale. Since the scale of an aerial photograph is constant only if the terrain has a constant elevation, objects on a variable elevation terrain that are of higher elevation appear larger than equal size objects of a lower elevation. Accurate scaling of aerial photographs is impossible.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
PHOTOGRAMMETRY (SUPPLEMENT TO CTR-335). May 60, 7p. 92 refs. OTS Selective Bibliography 416.
Order from OTS $0.10 OTS SB-416

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed cover photogrammetry and aerial photography, as well as general research on maps and mapping.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
A STUDY OF THE APPLICATION OF ELECTRONIC SCANNING AND COMPUTER DEVICES TO THE ANALYSIS OF GEOGRAPHIC PHENOMENA, by James P. Latham. Final rept. on Contract Nonr-551(29). 31 Aug 59, 6p. 1 ref. AD-227 256.
Order from LC mi$1.80, ph$1.80 PB 148 143

Progress is summarized in connection with the utilization of electronic scanning devices to measure and record the linear distance of the intercepts resulting when traverses sample a mapped distribution. Determinations were made which indicate the feasibility of scanning mapped, and aerially photographed, distributions in a manner which discriminates phenomena differentiated by gray tones or color. Capabilities of the flying spot scanner are summarized with reference to: (a) counting of the occurrences of a particular phenomenon within a scanned field; (b) counting occurrences by other phenomena with differentiating gray tone expressions; (c) performing above functions in one second for fields 4 1/2 x 4 1/2-in. by utilizing 1000 parallel scanning lines composed of 1000 elements each; (d) altering direction of scanning lines crossing field; and (e) reading out counts on display panels or printed tape. Modifications of the flying spot scanner is shown to increase capabilities with regard to measuring and counting the number of occurrences falling within diameter size classes, measuring and counting the intercepts by scanning lines with the occurrences of a phenomenon, and tripling the refinement of the scanning process.

Oceanography

Acoustica Associates, Inc., Plainview, N. Y.
TESTS OF ULTRASONIC INHIBITION OF MARINE GROWTH. Final rept. on Contract Nonr-2764(00). 11 Aug 59, 11p. Document DO-787; AD-226 998.
Order from LC mi$2.40, ph$3.30 PB 148 182

The effect of ultrasonic energy on the rate of marine growth was investigated. A stainless steel sonar dome was submerged in Biscayne Bay, Miami, Florida. An Acoustica, Model DR-500, 500-w ultrasonic generator and 2 Acoustica Model AT-1600 magnetostructive transducers provided the ultrasonic energy to the dome. Tests indicated that the attachment of marine growth on a stainless steel surface was not inhibited by the ultrasonic excitation in frequency region of 26 kc at any practical intensity level.

Chesapeake Bay Inst., Johns Hopkins U. [Annapolis, Md.]
BALTIMORE HARBOR CRUISES I - XVI, JULY 1958-NOVEMBER 1959. Dec 59, 222p. Data rept. 31; Ref. 59-4; AD-231 588.
Order from LC mi$9.90, ph$34.80 PB 146 275

Data were collected in the Baltimore Harbor and the adjacent area of the Chesapeake Bay during 16 survey cruises. The surveys were conducted to determine the distribution of temperature, salinity, and foreign waste acid in the area. The data furnish information on the rate of exchange of portions of Baltimore Harbor with each other and with the Chesapeake Bay. (Author)

Chesapeake Bay Inst., Johns Hopkins U. [Annapolis, Md.]
PHYSICAL AND CHEMICAL HYDROGRAPHY OF THE MAGOTHY RIVER, by D. W. Pritchard and R. E. Bunce. Rept. on Contract Nonr-248(20). Mar 59, 104p. 2 refs. Technical rept. 17; Reference 59-2.
Order from LC mi$5.70, ph$16.80 PB 146 343

The Magothy River is a tributary estuary of the Chesapeake Bay, located on the western shore of the Bay between the Patapsco River (Baltimore Harbor) to the north and the Severn River to the south. The name "river" is in fact a misnomer. The Magothy is a drowned valley of a small drainage system, with a water surface area of 8.74 square miles (statute) and a drainage area of 31.12 square miles. The entire Magothy estuary is shown, together with the land drainage area supplying fresh water run-off to the estuary. The length of the estuary, taken along the course of the channel from the mouth at Mountain Point to the head of tide, is 7.0 miles. The maximum width, which occurs in the vicinity of Sillery Bay, is 2.2 miles, though the width at the mouth is only 0.4 miles. As a result of the constricted entrance, tidal currents maintain a short scour channel at the mouth of the Magothy with a maximum depth of 40 feet. This scour channel extends less than 0.4 miles into the estuary, and depths within the Magothy are otherwise less than 20 feet. The 12 foot submarine contour has been entered on figure 2, and the depths at selected points along the channel are also indicated. The mean depth of the estuary is approximately 10 feet. (Author)

Engineer Corps, Washington, D. C.
TIDAL FLOW IN ENTRANCES, by John L. French. Jan 60, 68p. 20 refs. Technical bulletin no. 3, AD-232 302.
Order from LC mi$3.90, ph$10.80 PB 146 211

Two analytical studies are described. In the first, the methods of potential theory applied to the problem of determining the velocities in the approaches to a canal connecting an ocean with a lagoon or bay. Entrances with and without jetties extending into the ocean are considered. The streamlines are determined and velocities along the streamlines are given in a form suitable for simple application to engineering problems. In the second study, Tollomien's analyses for (1) the free jet boundary and (2) jet efflux from a linear slot are applied to the problem of the efflux of a 2-dimensional jet from a slot of definite width with particular reference to jet flow from a channel into a region of surrounding quiet water, such as an ocean. The literature was searched for appropriate experimental data, and the constant of Tollmien's theory is evaluated accordingly. The streamlines are determined, and velocities along the streamlines computed and presented in a manner susceptible of simple application to practical engineering problems. (Author)

National Research Labs, Ottawa (Canada).
THE N. R. C. PRESSURE-TYPE TIDE RECORDER, by E. H. Bowler. Jan 60, 40p. 1 ref. Mechanical engineering rept. MI-820.
Order from LC mi$3.00, ph$6.30 PB 147 736

This report describes a tide recorder, operable either from a battery or 115-volt 60-c. p. s. line power supply, suitable for use in remote locations (including the Arctic), for periods up to ten days without attention. The water level is determined by a hydrostatic pressure measurement with a submerged resistance potentiometer type transducer, which transmits a signal, through interconnecting cable, to a shore-based servo-balanced recorder. Atmospheric pressure variations and gravity wave effects are compensated in the system. Pressure accuracies of ±1/4 foot of water are achieved at temperatures down to +15°C and to ±1/2 foot to -20°C. (Author)

Naval Ordnance Test Station, China Lake, Calif.
FAST PHOTOGRAPHIC SPECTROPHOTOMETER FOR UNDERWATER USE, by Julian L. Thompson. 15 Feb 60, 19p. 6 refs. NOTS TP-2429; NAVORD rept. 7040.
Order from OTS $0.50 PB 161 774

An underwater photographic spectrophotometer has been constructed at the U. S. Naval Ordnance Test Station and tested for the direct measurement of the spectral composition of transmitted and scattered light at various ocean depths. By utilizing a wedge interference filter as the analyzing element, relatively high photographic recording speed and simultaneous recording of intensities throughout the visible spectrum have been achieved. The photometer has been tested to depths of 200 ft and has yielded data compatible with that published by others. Tests and design refinements are continuing toward the goal of eventual use at great depths. (Author)

Texas A. and M. Research Foundation, College Station.
OCEANOGRAPHY AND METEOROLOGY OF THE GULF OF MEXICO, by Hugh J. McLellan. Annual rept. for 1 May 57-30 Apr 58, on Contract N7onr-487(02). 1 May 58, 16p. 15 refs. Reference 58-7A.
Order from LC mi$2.40, ph$3.30 PB 146 333

Physics of the Atmosphere

Aeronutronic, Newport Beach, Calif.
ELECTRON CAPTURE IN THE IONOSPHERE BY DUST PARTICLES, by Raymond J. Munick and Robert T. Folk. Rept. on Contract AF 19(604)5486. 10 Mar 60 36p. 18 refs. Pub. no. U-823; AFCRC-TN-60-186
Order from LC mi$3.00, ph$6.30 PB 147 548

The dust particles rather rapidly acquire an equilibriun charge, which depends upon the balance between photoemission in the sunlight and the collection of positive ions and electrons. Available photoelectric current densities vary over so wide a range that charge of either sign can be acquired. This charging process provides a transitory increase or decrease of electron density. Positively charged particles have little effect on the electron density, but negatively charged particles continue to collect electrons in appreciable numbers. The general conclusion is that dust in amounts which can be raised by rocket can have significant effects upon the electron density of the ionosphere. (Author)

Allied Research Associates, Inc. [Boston, Mass.]
AN EVALUATION OF OZONESONDES, by Arnold H. Glaser, Frederic E. Hatch, and William Stevens, Jr. Final rept. on Contract AF 19(604)3493. 29 Feb 60, 96p. 97 refs. AFCRC-TR-60-243.
Order from LC mi$5.40, ph$15.30 PB 147 557

Available sounding instruments capable of measuring atmospheric ozone are evaluated to ascertain their suitability for use on a semiroutine basis over an extended network. The Paetzold Ozonesonde is an optical instrument which determines the amount of ozone between the sonde and the sun by differential absorption of two ultraviolet wave lengths. The Mast Ozonesonde is an American adaptation of the successful Brewer chemical sonde. The Regener Ozonesonde carries the standard potassium iodide-sodium thiosulfate titration of ozone into sonde form. Further development of any of these sondes seems to be required for extended network use. It would appear that the required development can most readily be accomplished with the Paetzold principle.

Army Signal Research and Development, Fort Monmouth, N. J.
DOUBLE THEODOLITE WIND-MEASURING SET FOR ROCKETS, by A. C. Barichivich, A. E. Weisner and others. 15 Mar 59, 87p. 4 refs. USASRDL Technical rept. 2019; AD-217 543.
Order from LC mi$4.80, ph$13.80 PB 146 265

A double theodolite wind set that provides a low-level wind measurement weighted for rockets was developed. Operational and computational procedures are given. An error analysis was performed, and estimates are presented of set errors under field conditions. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE MEASUREMENT OF TEMPERATURES, DENSITIES, PRESSURES, AND WINDS OVER FORT CHURCHILL, CANADA, BY MEANS OF THE ROCKET GRENADE EXPERIMENT, by W. R. Bandeen, R. M. Griffith and others. 2 Nov 59, 71p. 13 refs. USASRDL technical rept. 2076; AD-228 466.
Order from LC mi$4.50, ph$12.30 PB 147 998

Ten successful Aerobee rocket firings carrying the Signal Corps-University of Michigan rocket-grenade experiment were conducted at Fort Churchill, Manitoba, Canada (59°N). One hundred and fifty-three values of temperatures and winds between 25 and 94 km were measured in summer and winter, both during the day and at night, using the improved tracking and sound-ranging techniques required to make the grenade experiment an all-weather experiment. New facts about the arctic upper atmosphere were revealed. Temperatures in winter are unexpectedly high above

60 km with a second temperature maximum occurring between 70 to 80 km. Summer temperatures as low as 165°K at 80 km were recorded. The temperature maximum lies at about 50 km and in summer is greater than in White Sands, while in winter these temperatures are lower. Densities and pressures were also calculated from these data. The winds show a pattern similar to that in the middle latitudes: strong and westerly in winter, weaker and easterly in summer. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
UPPER ATMOSPHERE ROCKET SOUNDINGS ON THE ISLAND OF GUAM (IGY PROJECT 10.18) by W. Nordberg. 2 Nov 59, 142p. 9 refs. USASRDL technical rept. 2078; AD-228 443.
Order from LC mi$7.20, ph$22.80 PB 147 999

The performance of the rocket-grenade experiment on Guam during November 1958 is reviewed. Nine rockets (6 Nike-Cajuns and 3 Aerobee 75's) were launched successfully. A total of 43 data points, each representing one value for temperature, wind speed, and direction, was obtained. The measurements were spread over the period between local sunset and sunrise and cover an altitude range from about 30 to 80 km. Radiosonde data below 30 km are available. (Author)

Denver U., Colo.
INSTRUMENTATION FOR BALLOON-BORNE INFRARED SPECTRAL TRANSMISSION MEASUREMENTS OF THE ATMOSPHERE, by David G. Murcray, James N. Brooks and others. Scientific rept. no. 3 on Contract AF 19(604)2069. 8 Feb 60, 28p. 5 refs. AFCRC-TN-60-264.
Order from LC mi$2.70, ph$4.80 PB 147 648

Balloon-borne instrumentation for recording atmospheric absorptions of the near infrared from 1μ to 15μ is described and the performance of this equipment on several flights is discussed. (Author)

Denver U., Colo.
A STUDY OF THE 1.4u, 1.9u AND 6.3u WATER VAPOR BANDS AT HIGH ALTITUDES, by David G. Murcray, Frank H. Murcray and others. Scientific rept. no. 4 on Contract AF 19(604)2069. 18 Feb 60, 33p. 8 refs. AFCRC-TN-60-265.
Order from LC mi$3.00, ph$6.30 PB 147 647

On March 13, 1959, the infrared solar spectrum from 1 to 10μ was recorded at altitudes up to 90,000 ft by means of a balloon-borne spectrometer flown in conjunction with a biaxial pointing control. The amount of water vapor present at these altitudes was also measured by means of a frost point hygrometer. The absorptions were calculated for the 1.4μ, 1.9μ and 6.3μ bands using both expressions, the hygrometer data and the laboratory data of Howard et al. Comparison of the calculated and observed absorptions indicates that the expression using $u_e = \int_{h_1}^{h_2} \left(\frac{p}{p_s}\right)^k \rho \, dh$ gives better agreement with the observed values.

Ionospheric Research Lab., Pennsylvania State U., University Park.
VERTICAL INCIDENCE EQUIVALENT HEIGHT RECORDING AT 75 KC/S, by D. J. O'Brien and W. J. Ross. Scientific rept. no. 110 on Ionospheric Research, Contract AF 19(604)3875. 1 Sep 58, 94p. 6 refs. AFCRC-TN-58-637.
Order from LC mi$5.40, ph$15.30 PB 138 261

The results of vertical incidence pulse sounding of the ionosphere at 75 kc/s from October 1955 to February 1957 are presented in tabular form. Median curves are drawn and discussed briefly. Comparisons are made with the records taken previously at 150 kc/s. The main classes of complex echoes are shown and discussed briefly and compared with similar records at 150 kc/s. (Author)

Johns Hopkins U., Baltimore, Md.
THE FIRST AND SECOND POSITIVE BANDS OF N_2, by G. H. Dieke and D. F. Heath. Rept. on Contracts AT(30-1)-1447 and AF 19(604)5516. Dec 59, 194p. 30 refs. Spectroscopic rept. no. 17; AFCRC-TN-60-230; AD-233 489.
Order from LC mi$8.70, ph$30.30 PB 146 250

The first and second positive groups of N_2 were photographed with a low pressure discharge cooled with liquid nitrogen and better resolution achieved than in previous work. The rotational analysis of 21 bands of the first and 9 of the second positive group has yielded the energy levels of $A^3\sum$ to v = 12, of $B^3\Pi$ to v = 18 and of $C^3\Pi$ to v = 4 to within about 0.01 cm^{-1} relative to each other and to within about 1 cm^{-1} with respect to the normal state of the molecule. With these levels the lines in all other bands can be calculated to within the limits of experimental errors. In the second positive group a number of weak satellite branches were found that have not been observed before. Exposures at higher temperatures and an afterglow in argon yielded more information about the perturbations of the $C^3\Pi$ state. The anomalous intensities in these perturbations were interpreted as abnormal occupation of the upper states rather than abnormal transition probabilities. The deviations from thermal equilibrium promise interesting information about the excitation mechanism of the second positive group. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
MEAN ABSORPTION COEFFICIENTS OF AIR, NITROGEN, AND OXYGEN FROM 22,000° TO 220,000°, by B. H. Armstrong. 15 July 59, 81p. 2 refs. LMSD-49759; AD-225 756.
Order from LC mi$4.80, ph$13.80 PB 147 677

The results of calculations of mean electromagnetic radiation absorption coefficients and of the ionic composition of nitrogen, oxygen, and air are described, and graphs of the results presented. The temperature range of the calculations is 2 to 20 ev, and the density range is approximately 10^{-8} to 10^{-2} gm/cm. (Author)

Michigan U. Coll. of Engineering, Ann Arbor.
FALLING-SPHERE INSTRUMENTATION DEVELOPMENT, by J. W. Peterson, D. A. Robinson, and H. F. Schulte. Final rept. on Contract AF 19(604)2415. Feb 60, 87p. 9 refs. 2649-9-F; AFCRC-TR-60-247.
Order from LC mi$4.80, ph$13.80 PB 147 762

Work on the continuing development of the falling-sphere technique for measuring upper-air density and temperature is described. The factors limiting the performance of the transit-time accelerometer were investigated, and a design concept was reached which, it is anticipated, will improve the performance. The data-reduction process for the sphere experiment was completely computerized and is reported. An investigation of the phenomenon of antenna breakdown in flight is described. (Author) (See also PB 143 040)

Stanford Research Inst., Menlo Park, Calif.
IONOSPHERIC ABSORPTION INVESTIGATIONS AT HAWAII AND JOHNSTON ISLAND, by A. Fredriksen and R. B. Dyce. Scientific rept. no. 1 on Contract AF 19(604)3462. Jan 60, 17p. 3 refs. AFCRC TN-60-136; AD-233 726.
Order from LC mi$2.40, ph$3.30 PB 146 325

Measurements of ionospheric absorption by the cosmic-noise monitoring method show that, at certain tropical latitudes, an irregular component of absorption is often present in the evening hours. If the variable absorption is present at one observing site (Johnston Island), then variations are also likely to be present at another station about 1325 kilometers away (Hawaii). However, the individual variations of absorption as a function of time are not correlated at the two stations, suggesting that the scale of the patches causing the absorption must be less than about 1000 kilometers.

ENGINEERING

Brown U. Div. of Applied Mathematics, Providence, R. I.
LIMIT STRENGTH OF THIN WALLED PRESSURE VESSELS WITH AN ASME STANDARD TORISPHERICAL HEAD, by R. T. Shield and D. C. Drucker. Technical rept. no. 31 on Contract Nonr-562(10). Feb 58, 27p. 8 refs. C11-31.
Order from LC mi$2.70, ph$4.80 PB 138 132

Results are presented for the maximum pressure an unfired vessel with an ASME standard torispherical head can withstand before appreciable plastic deformation will occur. The effect of flanges on strength is considered. Although the procedures outlined permit variation of pressure in the axial direction to be taken into account fully, for convenience the calculations are based upon the assumption of uniform interior pressure. Work-hardening is not of much significance for thin-walled vessels of the usual steels and is ignored.

Aeronautical Engineering

Aeronautical Accessories Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
THE RESPONSE OF MECHANICAL SYSTEMS TO RANDOM VIBRATION AS DETERMINED BY ANALOG COMPUTER, by Virgil Clinton McIntosh. Rept. on Environmental Simulation Methodology. Feb 60, 49p. 9 refs. WADC Technical note 59-193.
Order from OTS $1.25 PB 161 794

This report is concerned with the determination of the responses of mechanical systems to random vibration. Systems are chosen which are difficult or impractical to analyze by analytical methods but which may be conveniently analyzed by an electronic analog computer. The responses of nonlinear single-degree-of-freedom systems and linear two-degree-of-freedom systems to both random and sinusoidal vibration are determined, and the inputs required to produce equal root-mean-square responses are compared. For the three types of nonlinearities studied, increasing the nonlinearity causes the rms response to a random input to increase relative to the response to a sinusoidal input. In a two-degree-of-freedom system, varying the mass ratio or the damping ratio causes similar effects in the response to either sinusoidal or random inputs. (Author)

Air Force Cambridge Research Center [Bedford] Mass.
THE SUPPRESSION OF AIRCRAFT EXHAUST TRAILS, by C. E. Anderson. Nov 54, declassified 18 Jan 57. 43p. 18 refs. Air Force Surveys in Geophysics no. 58; AFCRC-TN-54-24.
Order from LC mi$3.30, ph$7.80 PB 148 035

The suppression of contrails appears to be possible theoretically by controlling the amount of water in the exhaust gases. From an examination of the effect such control systems would have on engine performance, it does not seem possible to restrict the water without serious interference. Present trends in turbo-jet engineering offer little hope in the way of increased temperature/water ratio in the exhaust gases, at least for the next ten years. A possible solution may be the development of methods to control the size and number of condensation particles.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
CRITERIA FOR DESIGNING RUNWAYS TO BE SURFACED WITH LANDING MAT AND MEMBRANE-TYPE MATERIALS, by A. B. Thompson and C. D. Burns. Apr 60, 88p. 1 ref. Technical rept. no. 3-539.
Order from LC mi$4.80, ph$13.80 PB 147 738

Accelerated traffic tests simulating aircraft taxiing operations were conducted on test sections, having a range of subgrade and base course strengths, that represented unsurfaced or membrane-surfaced airstrips and runways surfaced with standard M6, M8, and M9 landing mat. Load carts applied traffic simulating single-wheel loads of 10,000 to 50,000 lb (tire pressures of 40 to 300 psi) and multiple-wheel assembly loads of 50,000 and 100,000 lb. CBR, water content, and density of base and subgrade before and during traffic, and behavior of the test sections were recorded. Traffic continued until test section failed or until 700 coverages had been completed. Design curves, developed by applying the test data to bituminous pavement design curves, are considered adequate for use in designing landing strips surfaced

with M6 or M8 mat, and for properly fabricated M9 mat. Curves applicable for unsurfaced or membrane-surfaced strips, and curves for estimating surface-strength requirements for 1 to 100 coverages of such strips were also developed. (Author)

Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.
DETECTION OF RANDOM LOW-ALTITUDE JET AIRCRAFT BY GROUND OBSERVERS, by William Wokoun and Otho C. Wolfe. June 60, 56p. 6 refs. Technical memo. 7-60.
Order from LC mi$3.60, ph$9.30 PB 147 962

This study investigated the efficiency of the human ground observer in detecting and identifying jet fighter aircraft, as a function of size of sector observed and aircraft altitude, when targets appeared essentially at random. Particular emphasis was place on allowing the subjects minimal information about when and where aircraft might appear. The evaluation included four search sector sizes (360°, 180°, 90°, and 45°). Three types of jet aircraft (T-33, F-86, and F-100) approached along six courses at two altitudes (500 and 1500 feet). Results include cumulative probability curves indicating the likelihood that aircraft will be detected or identified at any given distance for the various combinations of search sector size and altitude, as well as supplementary analyses of day-to-day variations in detection efficiency, the effect of intertrial interval, variation due to aircraft course and terrain, variation due to cross-over range, and accuracy of identification. (Author)

Bell Helicopter Corp., Fort Worth, Tex.
PERFORMANCE AND WEIGHT AND BALANCE SUBSTANTIATION FOR THE TWO-PLACE OBSERVATION HELICOPTER STUDY, by A. Shultz and G. Osborne. Rept. on Contract DA 44-177-tc-420. 30 Sep 57, declassified 28 Apr 58, 75p. 8 refs. Rept. no. D233-099-002.
Order from LC mi$4.50, ph$12.30 PB 146 337

This report presents the methods and analysis used for performance and weight evaluation of the Two-Place Observation Helicopter Study. (See also PB 146 338)

Bell Helicopter Corp., Fort Worth, Tex.
TWO-PLACE OBSERVATION HELICOPTER DESIGN STUDY, by John A. DeTore. Summary rept. on Contract DA 44-177-tc-420. 29 Oct 57, declassified 28 Apr 58, 118p. Rept. no. D233-099-001.
Order from LC mi$6.00, ph$18.30 PB 146 338

This report summarizes the results of the design study of inexpensive, lightweight, helicopters to meet the Army Two-Place Observation Helicopter requirements. The following three solutions are discussed in detail. (1) A modified H-13H helicopter powered by a Lycoming VO-435 piston engine derated to 200 hp. Gross weight is 2256 lbs. (2) The D233, a smaller helicopter, having a 28 ft diameter rotor and powered by a Lycoming O-360 piston engine rated at 180 hp - NRP. Gross weight is 1693. (3) The D234, a still smaller helicopter, having a 25 ft diameter rotor and powered by a Lycoming PLT 11E-1 free turbine engine rated at 233 hp - NRP. Gross weight is 1637 lbs.

Bolt, Beranek, and Newman, Inc., Cambridge, Mass
PERFORMANCE OF INTENSE ACOUSTIC FACILITY FOR FLIGHT VEHICLE AND ELECTRONIC RESEARCH, by George W. Kamperman, Clayton H. Allen and others. Rept. for May-Oct 59 on Aeroelasticity, Vibration and Noise, Contract AF 33(616)5274. Mar 60, 42p. WADD Technical rept. 59-12.
Order from OTS $1.25 PB 161 781

A unique sonic failure research facility has been constructed for testing flight vehicle structures and electronic systems in the presence of high intensity sound. The siren sound source will produce pure tones or narrow bands of noise throughout the frequency range from 50 to 10,000 cps with controlled amplitude modulation from 0 to 50 cps. The maximum acoustic power output is 22,000 w to produce a sound pressure level of approximately 174 db in the 1 ft square progressive-wave test section. This report discusses the performance of the facility. (Author)

Cook Research Labs., Morton Grove, Ill.
A STUDY TO INVESTIGATE ALL PROBLEMS RELATED TO A TACTICAL HIGH DENSITY LANDING SYSTEM FOR THE PURPOSE OF RECOMMENDING A SYSTEM WHICH WILL FULFILL THE ARMY'S REQUIREMENTS IN 1962, by R. T. Brumbaugh. Quarterly progress rept. no. 1, 15 June-1 Dec 59, on Contract DA 36-039-sc-84513. [1959] 29p. P-1842.
Order from LC mi$2.70, ph$4.80 PB 147 413

This report deals with the preliminary investigation of the operating environment which may be expected for Army air operations in the post-1962 tactical situation. From this investigation the requirements for an Interim High Density Landing System will be resolved. Principal requirements of the system will be the ability to land two aircraft per minute, the capability to handle all types of Army aircraft, and all-weather operation. Concern is given to the various situations which may be encountered as well as the various aircraft and electronic equipments which may be employed. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
BOUNDARY-LAYER DISPLACEMENT AND LEADING-EDGE BLUNTNESS EFFECTS IN HIGH TEMPERATURE HYPERSONIC FLOW, by H. K. Cheng, J. Gordon Hall and others. Rept. on Contract AF 18(603)10. Jan 60, 82p. 66 refs. Rept. no. AD-1052-A-9; AFOSR TN-59-1193; AD-233 867.
Order from LC mi$4.80, ph$13.80 PB 146 370

Two important features of hypersonic flow over slender or thin bodies are the displacement effect of the boundary layer and the large downstream influence of leading-edge bluntness. The present paper contributes new theoretical and experimental results on this problem.

Lockheed Aircraft Corp. [Burbank, Calif.]
HIGH ENERGY RATE METAL FORMING, by A. F. Watts and Glen N. Rardin. Interim technical engineering rept. no. 7, 1 Oct-31 Dec 59, on Contract AF 33(600)35543. [1960] 17p. LR 14204; AD-231 387.
Order from LC mi$2.40, ph$3.30 PB 146 287

The hoop stresses induced in the walls of a small water filled explosive forming tank with various insulating materials are presented. Air, as an energy absorbing medium, was found to be the most effective. (Author) (See also PB 144 411)

National Research Labs., Ottawa (Canada).
A COMPARISON BETWEEN THE SPANWISE AND CHORDWISE SHEDDING METHODS OF ROTOR BLADE DE-ICING, by J. R. Stallabrass and G. A. Gibbard. Jan 60, 39p. 4 refs. Aeronautical rept. LR-270.
Order from LC mi$3.00, ph$6.30 PB 147 504

Flight tests in an artificial icing cloud were made on two sets of helicopter rotor blades equipped with deicing heater mats embodying the spanwise and chordwise shedding principles. The tests demonstrated a decided performance advantage for the spanwise shedding systems, although the chordwise shedding system had the advantage of greater constructional simplicity. (Author)

National Research Labs., Ottawa (Canada).
THE ICING OF DELTA WINGS OF UNITY ASPECT RATIO HAVING LEADING EDGE SEPARATION, by C. K. Rush. Dec 59, 40p. 6 refs. Aeronautical rept. LR-268.
Order from LC mi$3.00, ph$6.30 PB 147 537

Tests were made in an icing wind tunnel of two models, and the resulting ice formations are described and illustrated. The significance of scale is discussed, and it is shown that the tests are representative of icing conditions with large droplets and high speeds. (Author)

National Research Labs., Ottawa (Canada).
TURBOJET THRUST AUGMENTATION: FLIGHT MEASUREMENTS OF THE TURBINE BLADE COOLING ACCOMPANYING THE PRE-TURBINE INJECTION FUEL WITH AN ORENDA 14 ENGINE IN A SABRE 6 AIRCRAFT, by E. P. Cockshutt, G. G. Levy, and C. R. Sharp. Jan 60, 47p. 5 refs. Aeronautical rept. LR-271
Order from LC mi$3.30, ph$7.80 PB 147 333

Turbine blade temperature data, obtained with a thermocouple-slipring instrumentation system, are presented for an Orenda 14 engine, which was flight tested both with and without reheat at altitudes ranging from 20,000 to 50,000 feet. The blade temperatures in the unreheated engine were found to be determined primarily by the variation in the turbine outlet (gas) temperature with flight condition. The first-stage turbine blades were cooled by the pre-turbine injection of the reheat fuel by a maximum of 150°C under sea-level-static conditions; as had been predicted from simple heat transfer theory, the maximum cooling declined to about half this value at 50,000 feet. No significant cooling of the second-stage turbine blades was detected at any flight condition. The instrumentation system operated without serious difficulties throughout the test program. (Author)

Naval Air Development Center, Johnsville, Pa.
UNDERWATER ESCAPE PROGRAM: TESTS OF F8U-1 PILOTS' SURVIVAL EQUIPMENT FOR POSSIBLE USE IN NAVDEVCEN AUTOMATIC DITCH SYSTEM, by Daniel L. Lorch. Rept. on TED Proj. ADC-AE-6307. 2 Oct 58, 15p. 8 refs. NADC-ED-5828; AD-231 390.
Order from LC mi$2.40, ph$3.30 PB 147 493

The F8U bailout oxygen system with the modified Firewel Regulator (1732-3) and the MK-3C life preserver were tested to determine if this equipment might be utilized in an automatic water-crash escape system now under consideration. The tests indicate that this equipment is satisfactory for underwater escape from a depth of 100 feet. (Author)

Sikorsky Aircraft Div., United Aircraft Corp., Stratford, Conn.
REDUCTION OF EXTERNAL NOISE OF A YH-19 HELICOPTER, SERIAL NO. 49-2015A EQUIPPED WITH A PRATT & WHITNEY R-1340 ENGINE, by E. R. Wood. Rept. on Contract Nonr-1773(00). 31 Dec 57, 113p. Rept. no. SER-55034.
Order from LC mi$6.00, ph$18.30 PB 146 180

An investigation of the external noise field of a YH-19 helicopter including a study of methods and operational techniques by which this noise can be reduced or masked. (Author)

Chemical Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
INVESTIGATION OF A LONG-BURNING PLASTIC-BONDED, COLORED-SMOKE MIXTURE, by Woodrow W. Reaves and John H. Hassmann. Jan 60, 22p. CWLR 2339; AD-233 750.
Order from LC mi$2.70, ph$4.80 PB 147 627

The object of the work described in this report was to develop a long-burning, plastic-bonded, colored-smoke formulation that could be adapted for use in the Naval Floating Drift Signal, Mark 7. Various polyester resins were investigated for use as binders and fuels for pyrotechnic smoke mixtures. Mixtures capable of extrusion into various configurations were investigated to obtain longer burning times. (Author)

Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF THE ZONE-PURIFICATION PROCESS AS A METHOD OF PREPARATION OF PORTABLE WATER FROM SEA WATER, by R. C. Himes, S. E. Miller and others. Rept. on Contract no. 14-01-001-80. May 60, 32p. Office of Saline Water Research and Development rept. no. 36.
Order from OTS $1.00 PB 161 818

Experimental evidence has definitely linked periodic salt entrapments (characteristically observed along ingots grown in this research program) with breakdown of constitutional supercooling. The shape of the solid-liquid interface and crystallization rates at various solution concentrations are important factors in the zone

refining and directional freezing of salt water. Crystallization-rate studies have established an upper limit for the growth rate of ice crystals from salt solutions. The technical feasibility of multiple-stage zone-freezing conversion of sea water has been demonstrated. Preliminary engineering evaluation of several multiple-stage, continuous freezing systems has indicated that at least one may be economically feasible.

Blaw-Knox Co., Pittsburgh, Pa.
SALINE WATER CONVERSION BY DIRECT FREEZING WITH BUTANE, by George Karnofsky and Paul F. Steinhoff. Rept. for 29 June-30 Oct 59 on Contract no. 14-01-001-176. 1 July 60, 78p. Office of Saline Water Research and Development Progress rept. no. 40.
Order from OTS $2.00 PB 161 819

This report includes an engineering study, and laboratory work on which the study is based, of a plant to produce 10,000,000 gallons per day of fresh water from sea water. The process is that of direct freezing brought about by the evaporation of a hydrocarbon refrigerant (butane) in contact with sea water; washing the ice free of saline liquor; and melting the ice to potable water by the condensation of butane vapor. The results of the engineering study showed that the total cost, conservatively estimated for a plant based on electric motor drive, is $10,524,000, and the corresponding cost of producing fresh water is 55.5 cents per 1000 gallons. For a plant based on gas engine drives for the compressors, the capital investment is $11,874,000, and the cost of water produced is 50.7 cents per 1000 gallons.

Massachusetts Inst. of Tech., Cambridge.
THE EVAPORATION OF WATER AT HIGH HUMIDITIES, by Thomas K. Sherwood and Oliverio Phillips. (Doctoral thesis). Final rept., Part III, on Mass Transfer into Gas Streams at Low Pressures and High Velocities, Contract DA 19-020-ORD-3244. 15 Apr 57, 233p. 87 refs. OOR rept. no. 887 4C; AD-133 277.
Order from LC mi$10.20, ph$36.30 PB 147 856

An investigation was made of the factors by which changes in concentration of the diffusion compound affect the rates of mass transfer between a gas and a wet surface. A 2-ft-long, 0.813-in.-id glass wetted-wall tower and a kieselguhr porous wet cylinder 0.658 in. in diameter and 1.069 in. long were used to study the evaporation of water into steam-air mixtures. The results obtained in both the wetted-wall tower and the wet cylinders indicated that concentration changes affect the turbulent and molecular transfer processes and confirm the inverse proportionality between k_G and p_{BM}. A theoretical discussion of diffusion in the evaporation process is presented. Negligible liquid film resistance to mass transfer in the wetted-wall tower was observed.

Civil Engineering

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
INVESTIGATION OF THE ADEQUACY OF CONSTRUCTION EQUIPMENT AND TECHNIQUES UNDER ARCTIC WINTER CONDITIONS FOR ROADS AND AIRFIELDS CONSTRUCTION PURPOSES, by Paul A. Beigbeder and Stanley H. Robertson. 2 Nov 54, 46p. 1 ref. Rept. 1380; AD-67 311.
Order from LC mi$3.30, ph$7.80 PB 148 052

An investigation was conducted (1) to develop a suitable cross section for use in constructing expedient roads and airfields during the winter in permafrost regions using frozen road materials; and (2) to determine the limitations of the available equipment in excavating and placing frozen road materials. Traffic tests were conducted on 5 test lanes which were constructed with frozen soils excavated from 2 borrow pits. Sieve and water (ice) analyses were carried out and thermocouples were installed in the test lanes. Meteorological data were recorded. Results indicate that (1) frozen borrow material cannot be loosened and disaggregated sufficiently and economically by explosives to satisfy the requirements of handling and placing without additional processing; (2) the most expedient method for loosening frozen gravel in the borrow pits was by rooters; (3) the available rooting equipment was inadequate for excavating frozen silty soils; (4) the most suitable method for hauling and placing fill material in the roadway was by trucks; (5) the most expedient method of loading trucks was by dipperstick shovel from stockpiles; (6) the sheepsfoot roller and the wobble-wheel roller were ineffective in compacting or disaggregating frozen gravel material; (7) the need for material such as logs, landing mats, brush, and the like, to support a fill was not required (provided the muskeg was in a frozen state); and (8) a 6-ft gravel fill on a frozen muskeg will keep the muskeg at a freezing temperature, or slightly above, for a shallow depth during thaw periods.

Bureau of Yards and Docks, Washington, D. C.
MAINTENANCE MANAGEMENT OF PUBLIC WORKS AND PUBLIC UTILITIES. Dec 59, 144p. NAVDOCKS P-321.
Order from LC mi$7.20, ph$22.80 PB 147 656

This publication has been prepared as an aid for naval and civilian personnel concerned with the maintenance management of public works and public utilities at shore activities of the Naval Establishment. Controlled Maintenance, as outlined in this publication, is the application of proven management and industrial engineering principles to the maintenance and operation of public works and public utilities. The significance of Controlled Maintenance is explained, as are the basic concepts, elements of control, and extent of control. Also included are procedures and other criteria to assist in the implementation of Controlled Maintenance.

Electrical and Electronic Engineering

Aero Service Corp. [Philadelphia, Pa.]
MAP DEVELOPMENT FOR ADVANCED RADAR SIMULATION TECHNIQUES, by Walther Barth. Rept. on Contract AF 33(600)31911. Feb 60, 83p. 36 refs. WADC Technical rept. 58-165.
Order from OTS $2.25 PB 161 795

Five basic considerations are treated separately as individual reports. The first describes and develops arithmetic progressions for densities, transmittances

and opacities, and calculates the densities sequences required, relating them to practical densities. An overlay is developed for use on the sensitometric curve, to obtain the progression of transmittances or opacities. In the second report the Densitometer is described and methods of use to eliminate errors are explained. The method of measuring densities on the photographic plate type map is described. The third report describes the method of development and fixing used for the photographic plate to achieve uniformity. The fourth report describes a method of obtaining a predetermined gray scale by paint mixing, in which is described an improved mixing sequence termed the Successive Mixing Method, which aids in eliminating errors and results in greater uniformity of the gray scales. The fifth report discusses the errors affecting the photographic reproduction and describes the principles for compensating variations in the reproduction and describes the principles for compensating variations in the reproduction. An emulsion is recommended which has the density range within the straight line portion of the sensitometric curve. (Author)

Aeronutronic, Newport Beach, Calif.
TELEMETRY SYSTEM STUDY. VOLUME I (of III). ANALYSIS AND DESIGN, by J. G. Hammond, W. F. Link and others. Final rept. v. 1, 6 Feb 57-30 Nov 59, on Contract DA 36-039-sc-73182. 18 Dec 59, 283p. [30] refs. Publication no. U-743.
Order from LC mi$11.10, ph$44.10 PB 147 919-1

A telemetry system study has been conducted to evaluate both experimentally and analytically the performance capability and potential of standard systems and to provide a design plan for an improved telemetry system. The results of the program are reported in three volumes. Volume I contains an analysis of each of the four basic systems: PCM-FM, PDM-FM, FM-FM, and PAM-FM. The analyses have been developed and verified experimentally to provide a means for determining the performance of each of the systems and to permit system parameters to be adjusted for optimum performance. The criteria for comparing the relative performance of the several systems are derived and the comparisons are presented. It is shown that PCM-FM and PAM-FM are superior to PDM-FM and FM-FM for the majority of anticipated applications. A conceptual design of a system which is recommended for development is described. Basically, the system employs a combination of PAM-FM and PCM-FM techniques in a configuration which enables the telemetry user to accommodate a wide variety of data economically and practically. (Author)

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Order from LC mi$6.90, ph$21.30 PB 147 919-2

This volume presents the results of the tests which were performed on the four systems to determine the optimum values for system parameters. The tests included measurements of errors introduced by the system under the influence of external noise and interference simulating field conditions. (Author) (See also PB 147 919-1)

Aeronutronic, Newport Beach, Calif.
TELEMETRY SYSTEM STUDY. VOLUME III (of III). TELEMETRY SYSTEMS TEST EQUIPMENTS. Final rept. v. 3, 6 Feb 57-30 Nov 59, on Contract DA 36-039-sc-73182. 18 Dec 59, 125p. Publication no. U-743.
Order from LC mi$6.30, ph$19.80 PB 147 919-3

This volume describes the test equipment and operational procedures which were especially developed to permit accurate evaluation of telemetry system performance. (Author) (See also PB 147 919-2)

Airborne Instruments Lab., Inc., Mineola, N. Y.
FABRICATION OF ENGINEERING MODEL OF RADAR SET AN/FPN-31(XW-1) (AIRPORT SURFACE DETECTION EQUIPMENT), by Joseph E. Woodward and Bruce A. Woodward. Final engineering rept. on Contract AF 30(602)296. Mar 57, 46p. 6 refs. Rept. no. 2388-1; RADC TR-57-87; AD-114 474.
Order from LC mi$3.30, ph$7.80 PB 146 375

Design details, layout, fabrication, and testing of the FPN-31(XW-1) radar set were completed. The radar set comprises 3 major units: (1) a transmitter-receiver group containing the radar transmitter, receiver, and associated circuits; (2) an indicator group containing the PPI display and associated circuits; and (3) an antenna group containing a radar antenna, a radome, and associated components. System tests demonstrated that the model system meets specifications. The antenna has an azimuth beamwidth of 0.25° and a vertical coverage that extends to 25° below the peak with no holes. Circular polarization was very effective against rain return. A satisfactory air-inflated radome is available to cover the antenna. The transmitter and receiver demonstrated satisfactory performance, and the stable and effective AFC circuit is trouble-free. Operation of the indicator was satisfactory and provided a stable display with good resolution and azimuth repeatability. There are no components in the radar that are in critical supply. Magnetrons for use in the transmitter are available from at least 2 sources and provide satisfactory electrical performance; more data are needed on the life performance of magnetron types QK511 and 6551 when operated at the short-pulse duration. The radome was satisfactory in electrical and mechanical performance, but more experience is required to determine the expected service life.

Airborne Instruments Lab., Deer Park, N. Y.
INVESTIGATION OF MULTIFEED ANTENNAS AND WIDE-ANGLE OPTICS, by C. A. Bergren, L. J. Kuskowski, and W. D. White. Rept. on Contract AF 30(602)1980. Mar 60, 40p. 7 refs. Rept. no. 7358-I-4; RADC-TN-60-92.
Order from LC mi$3.00, ph$6.30 PB 147 836

The Cassegrain antenna system has yielded a partial solution to the problem of designing a wide-angle multifeed antenna. Although design data has been obtained for the Cassegrain antenna, the problem of reducing side lobes due to aperture blocking still remains. Several methods that utilize the blocking aperture to reduce side lobes have been investigated. The Schwarzschild antenna system--another two-

refining and directional freezing of salt water. Crystallization-rate studies have established an upper limit for the growth rate of ice crystals from salt solutions. The technical feasibility of multiple-stage zone-freezing conversion of sea water has been demonstrated. Preliminary engineering evaluation of several multiple-stage, continuous freezing systems has indicated that at least one may be economically feasible.

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Order from LC mi$10.20, ph$36.30 PB 147 856

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Order from LC mi$11.10, ph$44.10 PB 147 919-1

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Order from LC mi$3.30, ph$7.80 PB 146 375

Design details, layout, fabrication, and testing of the FPN-31(XW-1) radar set were completed. The radar set comprises 3 major units: (1) a transmitter-receiver group containing the radar transmitter, receiver, and associated circuits; (2) an indicator group containing the PPI display and associated circuits; and (3) an antenna group containing a radar antenna, a radome, and associated components. System tests demonstrated that the model system meets specifications. The antenna has an azimuth beamwidth of 0.25° and a vertical coverage that extends to 25° below the peak with no holes. Circular polarization was very effective against rain return. A satisfactory air-inflated radome is available to cover the antenna. The transmitter and receiver demonstrated satisfactory performance, and the stable and effective AFC circuit is trouble-free. Operation of the indicator was satisfactory and provided a stable display with good resolution and azimuth repeatability. There are no components in the radar that are in critical supply. Magnetrons for use in the transmitter are available from at least 2 sources and provide satisfactory electrical performance; more data are needed on the life performance of magnetron types QK511 and 6551 when operated at the short-pulse duration. The radome was satisfactory in electrical and mechanical performance, but more experience is required to determine the expected service life.

Airborne Instruments Lab., Deer Park, N. Y.
INVESTIGATION OF MULTIFEED ANTENNAS AND WIDE-ANGLE OPTICS, by C. A. Bergren, L. J. Kuskowski, and W. D. White. Rept. on Contract AF 30(602)1980. Mar 60, 40p. 7 refs. Rept. no. 7358-1-4; RADC-TN-60-92.
Order from LC mi$3.00, ph$6.30 PB 147 836

The Cassegrain antenna system has yielded a partial solution to the problem of designing a wide-angle multifeed antenna. Although design data has been obtained for the Cassegrain antenna, the problem of reducing side lobes due to aperture blocking still remains. Several methods that utilize the blocking aperture to reduce side lobes have been investigated. The Schwarzschild antenna system--another two-

reflector system--is being investigated to determine its scan capabilities. The reflectors for this system are designed such that first order coma and spherical aberration are minimized over the necessary scan angles. Preliminary results have indicated that the Schwarzschild antenna system will yield scanning performance superior to that of the Cassegrain system. (Author)

American Inst. for Research, Pittsburgh, Pa.
PRINCIPLES AND PRELIMINARY RECOMMENDATIONS FOR A CORE SYSTEM OF NAVY RADAR OPERATOR TRAINING DEVICES, by Richard O. Peterson, Leon J. Lewandowski, and Angustus D. Daily. Rept. on Contract N61339-348. 2 Mar 60, 105p. 89 refs. Technical rept. NAVTRADEVCEN 348-1.
Order from LC mi$5.70, ph$16.80 PB 146 397

Investigation was made of the feasibility of developing a core of radar operator training devices of a general nature which could be used for training in a multiplicity of specific radar equipments and skills. Naval radar operator jobs were analyzed to determine the job contents which are common to many radar operator jobs. This resulted in a core of the skill and knowledge requirements which are basic to many radar operator jobs. From a rational analysis of the skill and knowledge requirements and of the equipment and training data collected, equipment design principles applicable to the design of radar operator training devices were derived. Preliminary recommendations for devices which would comprise a core training device system for radar operators were developed. (Author)

Armour Research Foundation, Chicago Ill.
PROCEEDINGS OF THE CONFERENCE [NO. 4] ON RADIO INTERFERENCE REDUCTION AND ELECTRONIC COMPATIBILITY HELD AT THE MUSEUM OF SCIENCE AND INDUSTRY, CHICAGO, ILLINOIS. OCTOBER 1-2, 1958. Oct 58, 664p. 133 refs.
Order from LC mi$11.10, ph$101.40 PB 148 073

Contents: The challenge of tomorrow's communications; an outlook into the future of the radio interference field and the part that the PGRFI will play in the future of the field of RF interference; radio gadgets; radio interference problems at AFMTC Cape Canaveral, Florida; comparison of PCM and PPM for radar command; the systems approach to missileborne telemetering interference; the measurement of interference effects on intelligibility; interference acceptance ratios in electronic communication equipments; computation of probability of interference due to adjacent channel cross-modulation, and intermodulation effects for randomly spaced equipments operating in the VHF and UHF bands; some observations concerning antenna and radiation patterns; target return losses due to blanking; variable gain interference reduction devices; external-transmitter interference in pulsed search systems; a formal representation of the interference between several pulse trains; design and development of a standard white noise generator and noise indicating instrument; receivers for interference measurements in the 20 to 4000 megacycle range; microwave field intensity meter; anechoic chambers for radio interference measurements above 50 megacycles; measurements of electromagnetic interference on high voltage (50 Kv) transmission lines; techniques for measuring three dimensional patterns; three dimensional radiation pattern graphical display technique; leakage of electromagnetic energy from coaxial cable structures; application of field theory to the solution of practical radiated radio interference problems; a free-space method for measuring coaxial cable shielding effectiveness; concepts of electromagnetic interference analysis and control; a method for controlling airplane wiring and equipment placement to eliminate AC magnetic field interference; spectrum signature; shortcomings of interference specifications; automatic power control; ferrites in radio interference filters; low pass filters using ferrites; radio interference control of semi-conductor circuitry; a non-linear effect in passive UHF transmission systems; analysis of interference generated in non-linear devices; a digital computer program for assigning a set of interference-free frequencies to a communications network; a digital computer technique for determination of permissible co-channel frequency assignment; application of digital computer model to the prediction of radio interference in a large signal complex; techniques for determining interference characteristics of communication equipment; processing of mutual interference charts for maximal lists of non-interfering frequencies. (See also PB 148 072)

Armour Research Foundation, Chicago, Ill.
PROCEEDINGS OF THE CONFERENCE [NO. 5] ON RADIO INTERFERENCE REDUCTION AND ELECTRONIC COMPATIBILITY HELD AT THE MUSEUM OF SCIENCE AND INDUSTRY, CHICAGO, ILLINOIS, OCTOBER 6-8, 1959. Oct 59, 697p. 118 refs.
Order from LC mi$11.10, ph$105.90 PB 148 074

Contents: Advanced technology and future problems in radio interference; spectrum utilization in a field army; the role of CISPR (International Special Committee on Radio Interference) in radio interference reduction and control; low noise devices as systems elements; susceptibility of pyrotechnic devices to electromagnetic energy; prediction factors influencing transmitter power spectrum; sensitivity of predicted interference to propagation model and spectrum availability; the construction of Mutual Interference Charts (MIC'S) and some statistical properties of the entries; processing of non-symmetrical mutual interference matrices; design of electromagnetic interference reduction; using computer simulation techniques; radio noise testing of the Lockheed Electra; interference implications of a commercial communications satellite system; measurements of spurious emission from an AM/EM tuner in accordance with Part 15 of the FCC Rules and Regulations; spurious responses of television receivers in the 300 to 1000 mc. region; investigation of corona noise in a three-phase transmission line; a thermistor bridge voltmeter for calibrating interference measuring instruments; application of the low noise traveling wave tube to interference instrumentation; a coaxial device for measuring the performance of shielding materials; a method of measuring high power transmitter cabinet and external wiring radiation; radio interference testing of large-scale computing systems-theory and practice; the effect of climatic environments on radio frequency interference; design of a wire communication system in a shielded passageway of the BMEWS radar system; planning interference-free communications-

electronics systems; procedure and problems inherent to interference testing of the B-58 aircraft; the systems approach in designing a specification for the control of radio interference in an airborne complex; some interesting aspects of interference and spurious signal measurements at the Army Transmitting Station Woodbridge, Virginia; radio interference detection system at Atlantic Missile Range (AMR); the gain of aperture antennas at spurious frequencies; Fresnel region patterns and gain corrections of large rectangular antennas; new techniques for evaluating the performance of shielded enclosures; contiguous wrapping of transmission line conductors with high-mu tape for large radio-interference attenuation; characteristics of microwave duplexer tubes under spurious radiation conditions; a method of evaluating the effectiveness of radio-frequency gasket materials; a transient suppressor for protection of transistorized equipment in 27 v D.C. aircraft electrical systems; relay noise suppression in airborne electronic systems; a method of assigning compatible frequencies to ground UHF radios in a transitional environment (Unclassified paper) (See also PB 148 073)

Army Ballistic Missile Agency, Redstone Arsenal, Ala.
CAPACITY DIODE PARAMETRIC PERFORMANCE AND CIRCUIT DESIGN BY A FINITE CURRENTS METHOD, by Alan J. Fisher. 19 Jan 59, 34p. Rept. no. DG-TR-1-59; AD-216 182.
Order from LC mi$3.00, ph$6.30 PB 146 270

If a finite number of sinusoidal currents rather than voltages are permitted to exist in a capacity diode parametric device, the performance will be more efficient and more easily calculated. A two-current analysis of frequency doubling (and halving) is presented which shows the relationships between efficiency and power and diode cutoff frequency. Input and output coupling circuits which approximate the two-current analysis are shown. The analytic results are used to predict the generation of watts of efficient microwave power by all solid state devices. Finally, the extension of the finite currents method to higher harmonics and parametric mixers, amplifiers and oscillators is discussed. (Author)

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
AN/DRW-11 (XE-1) RECEIVER SPECTRUM UTILIZATION, by Merwin A. Olson and Charles E. Hyman. 15 Apr 60, 55p. AFC rept. #DC 15-4-60 RdeC.
Order from LC mi$3.60, ph$9.30 PB 147 521

Results are presented of a laboratory investigation of an AN/DRW-11 FM (406 - 450 MCS) receiver to determine its spectrum utilization and interference susceptibility characteristics; this information is necessary to allow for efficient frequency allocation. Operating characteristics such as frequency stability, sensitivity, selectivity, spurious responses, spurious emissions, audio characteristics; interference characteristics, and antenna input VSWR were tested. Frequency stability was found to be within 0.002% and the 3 db overall selectivity was 342 KCS. In the frequency range from 150 KCs to 10 KMCS there were eleven spurious responses less than 60 db down; of these responses only one was below 2500 MCS (410 MCS at 54 db down). Five radiated emissions were found to be in excess of MIL-I-26600 limits for Class I equipment. (Author)

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
ASCOP TK-M7 TELEMETRY TRANSMITTER SPECTRUM UTILIZATION, by Charles R. Wise and Merwin A. Olson. 15 Apr 60, 49p. AFC Rept. TM-15-4-60-T.
Order from LC mi$3.30, ph$7.80 PB 147 742

Frequency stability, power output, modulation sensitivity, and deviation were tested with respect to supply voltage, operating time and environmental conditions; interference characteristics (antenna conducted and radiated spurious emissions) were also examined; all tests were empirical in nature. All spurious emissions (antenna conducted), except one at 202 MCS (54 db down) and four harmonics of the fundamental, were within the requirements of WSMR Regulation Nr. 600-5-59. Frequency stability was within the required 0.01% except for: supply voltage reductions of more than 15%, prolonged exposure to high altitudes, and certain conditions of acceleration in excess of 15 G's. This transmitter is compatible with the 0.5 MCS channelization, as per WSMR Regulation 600-5-59. (Author)

[Army] Signal [Research and] Engineering Lab., Fort Monmouth, N. J.
APPLICATION OF AUDIO TRANSFORMER DESIGN METHOD OUTLINED IN FINAL REPORT IN CONTRACT NO. W36-039-sc-38268. "TRANSFORMER DESIGN CRITERIA AND DATA", by Irving Remis. 28 May 52, 22p. Technical memo. no. M-1429.
Order from LC mi$2.70, ph$4.80 PB 148 544

It is the purpose of this report to present a sample design complete with curves and other pertinent information to act as a guide for engineers with little experience in transformer design.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
COMPLEMENTARY TRANSISTOR MODULATOR, by J. Grau and B. Humbel. 1 Oct 59, 35p. 2 refs. USASRDL technical rept. 2068; AD-230 739.
Order from LC mi$3.00, ph$6.30 PB 148 115

A recent preliminary investigation of modulator circuits using two complementary transistors revealed that this type of modulator offers some unique features not found in other types of modulators. These are: (1) no dc supply voltage necessary as the carrier furnishes the supply voltage for operation, (2) carrier suppression, (3) elimination of the use of a balance transformer, (4) accomodation of dc input and output signals, (5) offers a power gain as high as 3 db, as compared to other modulations which usually have an insertion loss, and (6) compactness in size (only two transistors and one transformer necessary) These advantages open a broad field of applications, e.g. its use in carrier frequency equipment, single sideband equipment, etc. Modulator circuits using 2 complementary transistors are investigated; condi-

tions to be fulfilled for working configurations are established; test results of 2 modulator configurations are given; and the theory of operation is explained. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
AN EXPERIMENTAL PULSE REPEATER FOR TRANSMISSION OF INVERTED BINARY PULSE SIGNALS OVER FIELD WIRE, by H. Wolf. 1 Oct 59, 36p. 7 refs. USASRDL technical rept. 2082; AD-232 489.
Order from LC mi$3.00, ph$6.30 PB 148 117

The problems connected with the transmission of a one megabit binary pulse signal over field wire WD-1/TT are discussed. The inverted binary pulse signal is introduced and the design of a repeater for inverted binary pulses is described. The results of cascading a series of these repeaters are shown. It is concluded that the lack of an inexpensive and reliable retiming circuit is a problem which requires further study. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MINIMIZATION OF CONNECTION ERRORS IN CRYSTAL IMPEDANCE METER LOAD CAPACITOR CALIBRATION, by Charles L. Shibla. 23 Mar 59, 38p. 2 refs. USASRDL Technical rept. 2017; AD-216 502.
Order from LC mi$3.00, ph$6.30 PB 146 266

Means of connecting crystal impedance meter load capacitors to capacity measuring equipment have been investigated. Stray capacities contributing to connection errors are identified and means of mutual cancellation are discussed. Construction details for connection devices and instructions for use are included. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PREFERRED RADIO FREQUENCY CABLES AND CONNECTORS FOR MILITARY APPLICATIONS, by Morton Pomerantz. 6 Jan 60, 11p. 3 refs. USASRDL technical rept. 2091; AD-231 568.
Order from LC mi$2.40, ph$3.30 PB 148 118

Tables are presented containing the latest applications and procurement information of radio frequency cables and connectors. A cross index between the 52 ohm and 50 ohm RF cables with their new nomenclatures are also given. The tables also include the latest connectors which were modified to make them compatible with the 50 ohm cables. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PROCEEDINGS OF THE SYMPOSIUM ON SOLID STATE MASERS, 12-13 JUNE 1958, HELD AT FORT MONMOUTH, NEW JERSEY. [1958] 105p. 28 refs. AD-217 741.
Order from LC mi$5.70, ph$16.80 PB 147 977

Contents:
Spin-spin interactions in potassium cobalti-chromicyanide
Some performance characteristics of solid-state masers
Relaxation measurements of Cr^{3+} in Al_2O_3
Recent developments in solid-state masers at Lincoln Laboratory
Some aspects of traveling-wave masers
Spontaneous emission into a single mode
Raman-type masers
Design of a maser amplifier for radioastronomy at 3 centimeters wavelength
Possible maser application of titanate host crystals
Proposal for a maser-amplifier system without non-reciprocal elements
Amplification and oscillation in two-level spin systems
Variation of crystal-field splitting by host-ion substitution in nickel double nitrates
Experiments with pulsed two- and three-level solid-state masers
Development of ruby maser at Willow Run Laboratories and future program
The necessary requirements for low-noise devices in radar and radiometry
Application of solid-state maser to fire control radar

Army Signal Research and Development Lab., Fort Monmouth, N. J.
SOLID TANTALUM CAPACITORS, by Albert Lunchick. 1 Oct 59, 17p. USASRDL technical rept. 2073.
Order from OTS $0.50 PB 161 821

The capabilities and limitations of the solid tantalum capacitor with respect to operating temperatures, electrical leakage, dissipation factor, stability, and life are summarized and illustrated. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE USE OF NETWORK TOPOLOGY WITH ACTIVE CIRCUITS, by Keats A. Pullen, Jr. Feb 60, 97p. 54 refs. Rept. no. 1096.
Order from LC mi$5.40, ph$15.30 PB 147 649

The application of the theory of linear graphs, or topology, to passive and active networks is reviewed, and some simplifications to the determination of equations for current and voltage gain are discussed. The calculation of the minimum number of network trees required to represent active networks is considered, and methods of simplifying the establishment of the required trees is examined. In addition, the active equations for the parametric amplifier are derived topologically. (Author)

Bulova Research and Development Labs., Inc., Woodside, N. Y.
AUTOMATIC MACHINE FOR SEALING OF QUARTZ CRYSTAL UNITS, by Robert J. Bibbero and R. Giglio Tos. Quarterly progress rept. no. 2, 25 Sep-24 Dec 57, on Contract DA 36-039-sc-72775. [1957] 25p.
Order from LC mi$2.70, ph$4.80 PB 137 443

An experimental run of HC-6/U cans and bases designed for projection weld sealing was ordered for evaluation in conjunction with commercial welding machines. Studies of machine layout and human task factors, together with automatic welding transport mechanisms, have been made which favor a rotary table mechanism. Vacuum pump-down calculations have been made and have led to a minimum pump size, for adequate chamber capacity, of 15 cfm with 0.1 micron ultimate vacuum. Present system capacity is estimated as 215 units per hour. (Author) (See also PB 137 444)

California U., Los Angeles.
ON THE PHILOSOPHY OF ADAPTIVE CONTROL FOR PROCESS ADAPTIVE SYSTEMS, by M. Margolis and C. T. Leondes. Rept. on Contract AF 49(638)438. Jan 60, 18p. 6 refs. AFOSR TN-59-1199; AD-233 499.
Order from LC mi$2.40, ph$3.30 PB 146 376

A very general approach is described to the design of process adaptive systems. A brief look is taken at the development of feedback control theory and practice. Then process adaptive control is discussed as a logical extension of the basic concepts of feedback theory. A particular mechanism for process adaptive control is suggested. This mechanism makes use of a learning model whose form is the same as the physical process and whose parameters are continually adjusted so that the model and process behave as much alike as possible. The parameters of the model are used to set the parameters of the controller for the overall control of the system. (Author) (See also PB 144 769)

Clevite Transistor Products, Waltham, Mass.
RESEARCH AND DEVELOPMENT OF GERMANIUM PNP JUNCTION SWITCHING TRANSISTORS, by Paul L. Meretsky. Progress rept. no. 5 (final), 10 May 58-9 Aug 59, on Contract DA 36-039-sc-75060. [1959] 74p. AD-232 673.
Order from LC mi$4.50, ph$12.30 PB 147 973

The following conclusions may be drawn from work accomplished: While the original specification was met on a developmental basis, some relaxations (saturation and thermal resistance) are required in order to make the device on a production basis. The thermal resistance will be somewhat compensated by a reduced low voltage Ico. At the same time certain specifications are tightened as in the case of fall time and current gain. A new suggested specification has been recommended. Additional specifications on breakdown measurements have been arrived at in the light of knowledge gained in the fifth quarter in which catastrophic failures in switching were assigned to device geometry as well as fabrication. A new packaging process was evolved during the Contract which has the capability of making hermetically sealed devices. Groups leak tested by the radioactive gas analysis method have an 81.8% expectancy to a leak rate of less than 7×10^{-12} cc/sec, and a 100% expectancy to less than 2.7×10^{-12} cc/sec. The devices were acceptable with respect to the environmental conditions set forth in MIL-STD-202 Method 106. Methods of introducing aluminum into the emitter have been reported and are thoroughly understood. (Author) (See also PB 146 167)

Colorado U., Boulder.
TRANSISTOR PHASE DETECTOR FOR PHASE-LOCK STABILIZATION OF A 30,00Mc/sec KLYSTRON, by Robert W. Zimmerer. Rept. on Contract Nonr-1147(05). [1959] 4p. AD-219 926.
Order from LC mi$1.80, 1h$1.80 PB 148 140

A novel high frequency phase detector was developed to operate over an input range of 12 to 18 mcs. A pair of Philco 2N588 transistors and a hearing aid battery were used to form the error signal which was applied to the repeller to an E. M. I. R. 9518 reflex klystron. The phase detector floats at -2000 volts and is connected to the reference signals through high frequency broad band ferrite transformers. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
INVESTIGATION OF NOISE GENERATION IN ELECTRICALLY TUNABLE MICROWAVE OSCILLATORS, by G. C. Dalman, P. R. McIsaac, and L. A. MacKenzie. Quarterly progress rept. no. 1, 23 June-23 Sep 59, on Contract DA 36-039-sc-84524. [1959] 40p. 7 refs. Research rept. EE 449; AD-229 345.
Order from LC mi$3.00, ph$6.30 PB 147 966

Research is concerned with gaining an understanding of the mechanism of the noise and spurious-output-signal generation in electrically tunable oscillators and with determining possible methods of improving the performance of these devices as local oscillators. A general expression for the signal-to-noise ratio of a backward-wave oscillator, operating as a local oscillator, is derived using linear travelling-wave tube theory. An approach to the large-signal theory of backward-wave oscillator operation is formulated. Methods of determining experimentally the large-signal properties of oscillators are being investigated. Some experimental results have been obtained and are being correlated with the theoretically expected results. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
INVESTIGATION OF NOISE GENERATION IN ELECTRICALLY TUNABLE MICROWAVE OSCILLATORS. Quarterly progress rept. no. 2, 23 Sep-23 Dec 59, on Contract DA 36-039-sc-84524. [1959] 52p. Research rept. EE-459; AD 234 840.
Order from LC mi$3.60, ph$9.30 PB 147 967

Measurements of the noise spectrum of a typical x-band backward-wave oscillator have been made and calculations of the signal-to-noise ratio begun. The normal mode analysis of transmission systems with current excitation is extended to cover the nonuniform current excitation of periodic circuits. The results are expressed in a form suitable for use with a nonlinear analysis of BWO's. A technique has been devised for determining experimentally the nonlinear characteristic associated with a self-excited oscillator. The method is essentially one of perturbation, which requires that small perturbing quantities be measured. To do this, a scheme for providing small changes in attenuation accurately has been developed. The general theory of perturbation is briefly outlined, and a specific case has been used for experimental

verification. The experimental data checks very well with theoretical predictions. (Author) (See also PB 147 966)

David Taylor Model Basin, Washington, D. C.
STRAIN-GAGE WATERPROOFING AND INSTRUMENTATION FOR FULL-SCALE SONAR DOME TESTS, by Mills Dean, III. Jan 59, 31p. 10 refs. Rept. 993.
Order from LC mi$3.00, ph$6.30 PB 138 273

Techniques used to install and waterproof a total of 168 strain gages are described. Also described is a unique method devised to accomodate the mass of connecting gage wires and to maintain the dummy gages in the same underwater environment as that of the active gages. Instrumentation circuits are given which were used for simultaneous recording of 61 channels of dynamic strain information on one sonar dome and 48 channels on the other.

Diamond Ordnance Fuze Labs., Washington, D. C.
FOUR-QUADRANT ANALOG VOLTAGE MULTIPLIER, by C. F. Ravilious. 16 May 60, 14p. 5 refs. TR-838.
Order from LC mi$2.40, ph$3.30 PB 146 812

A simple four-quadrant analog voltage multiplier is described. Four-quadrant multiplication is attained by means of a control winding, driven by one of the voltages to be multiplied, on the saturable reactor of a transistor-magnetic square-wave oscillator. The duty cycle of the oscillator is controlled by this input. A pair of transistor switches, operated from output windings on the oscillator core, apply the second voltage alternately in push-pull to two matched output resistors. The smoothed output taken across the two resistors in series is proportional to the product of the two input voltages. The operating range of the multiplier is ± 15 v output with a control winding input of ± 50 v and ± 25 v at the other input. Accuracy is within ± 2 percent of full scale. Power requirements are 12 ma at 12 v. (Author)

Electron Tube Research Lab., U. of Minnesota, Minneapolis.
STUDIES ON BASE NICKELS FOR OXIDE-COATED CATHODES, by W. G. Shepherd. Scientific rept. no. 7, 15 Oct 59-15 Jan 60, on Contract AF 19(604)3890. [1960] 82p. 3 refs. AFCRC-TN-60-194.
Order from LC mi$4.80, ph$13.80 PB 147 906

Problems associated with the preparation of Sr^{89}-tagged $(BaSr)CO_3$, prepared from $Sr(NO_3)_2$ powder irradiated in a high flux pile, are discussed. A technique is described for studying the long-pulse performance of oxide cathodes. Studies are reported of attempts to produce chemical activation by a controlled Ba atmosphere, in contrast to the normal chemical activation, in which an independent control of the alkaline earth metal vapor is not readily provided. Results are reported of the activation of oxide cathodes in the presence of active metal anodes. An experimental study of the deactivation of oxide cathodes by anode bombardment, and of subsequent reactivations is reported. Since all oxide cathodes are studied starting with a standard processing schedule, the effects of the processing schedule itself are reported. A technique for obtaining emission microscope patterns of an oxide cathode is described.

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
APPLICATION OF SILICON CONTROLLED RECTIFIERS TO A D-C SERVOMOTOR, by Clarence Cantor. Rept. on Contract Nonr-1841(53). Aug 59, 60p. 10 refs. Rept. 8060-R-1; AD-232 187.
Order from LC mi$3.60, ph$9.30 PB 147 686

Results are reported of designing, building, and testing a servo system which incorporates silicon controlled rectifiers as the power supply for a d-c servomotor. A half-wave, bi-directional circuit, supplied by single phase, 400 c, is selected as the basic circuit for the rectifiers and dc motor. Firing angle control of the silicon controlled rectifiers is accomplished by a simple, fast response, pulse firing scheme utilizing uni junction transistors. The input control signals are a 400 c positional error signal from a control transformer and a dc stablizing signal consisting of velocity feedback through a high pass filter. The locked rotor torque characteristics of the rectifier circuit, for both carrier modulated and dc control, are derived with the zero-signal firing angle as a parameter. Measured speed torque characteristics show essentially identical, linear characteristics for both types of control signals at low speeds and small values of signal. The rectifier circuit frequency response is measured and calculated. Both agree fairly well and indicate very little rectifier circuit phase lag at servo frequencies up to 50 cps. All of this represents a very fast, well damped, accurate servo system. (Author)

[Electronic Systems Lab.] Mass. Inst. of Tech., Cambridge.
HIGH-POWER PULSE GENERATION USING SEMICONDUCTORS AND MAGNETIC CORES, by Edward M. Lassiter. Rept. on Contract AF 33(616)5489. Jan 59, 42p. 11 refs. Technical memo. 7848-TM-2; AD-213 521.
Order from LC mi$3.30, ph$7.80 PB 148 040

A magnetic pulse generator using a controlled rectifier in the charging circuit is capable of generating high-power pulses and is suitable as a radar modulator. In the discharge network the saturable inductors operators operate as high-power switching devices and together with the capacitors reduce the duration of the current pulse from a long duration at the charging circuit to a short duration at the output. An experimental circuit demonstrates the theory. This circuit operates at a repetion rate of 5 kc and produces an average power output of 300 watts. The peak power and pulse width at the output are approximately 40 kw and 1.5 μsec respectively. The efficiency of the experimental circuit, not considering the bias circuit, is approximately 70 percent. (Author)

[Electronic Systems Lab.] Mass. Inst. of Tech., Cambridge.
A TRANSISTOR-MAGNETIC PULSE GENERATOR FOR RADAR-MODULATOR APPLICATIONS, by Arthur Krinitz. Rept. on Contract AF 33(616)5489. Sep 58, 97p. 7 refs. Rept. 7848-R-1; AD-210 247.
Order from LC mi$5.40, ph$15.30 PB 148 041

An experimental model of the pulse generator is described containing three Type H-2 transistors and one Type H-10, a two-section discharge network and a two-section pulse-forming network. The generator supplies a peak power of 24 kw to a Type 2J42 magnetron at a repetition frequency of 1.7 kc. The pulse duration is 1 μs and the average power delivered is 40 w. A jitter of less than 0.1 μs is achieved through the use of a low-ripple d-c power supply. An efficiency of 50% is achieved and it is believed that a considerable improvement in efficiency could be had by relatively simple modification of the circuit. It type to provide many times the power output of the experimental generator. (Author)

Electronics Research Labs., Columbia U., New York.
RESEARCH ON ULTRASONIC DELAY LINES, by W. Konig. Technical rept. T-1/152 for 1 Oct 58-30 June 59 on Contract AF 30(602)1971. 1 July 59, 91p. 22 refs. CU-2-59-AF-1971-ERL; RADC-TN-59-226; AD-219 634.
Order from LC mi$5.40, ph$15.30 PB 147 029

The general theory of elastic wave propagation is briefly presented. Reflection and refraction of plane elastic waves at plane interfaces are studied with special emphasis on the solid-air interface. Solutions to the wave equation for solid plates are presented and the specific solutions of interest in the design of delay lines are studied in detail. Design information is obtained for the vertical dimension of transducers to minimize the excitation of spurious modes in plates, thus reducing ripples in the passband of a delay line. Expressions permitting the calculation of delay variation with frequency are included and plotted for typical delay line parameters. Various kinds of quartz transducers are discussed. An equivalent circuit for a thickness vibrating piezo-electric transducer is presented and the implications of the circuit investigated. Expressions are obtained for midband loss and frequency response. The possibility of double-peaking in the frequency response is discussed, and the condition necessary for its occurrence determined. This includes results for typical delay line parameters. Various techniques of bonding are discussed and the results of one technique are compared to the performance predicted by theory. (Author)

Electronics Research Lab., U. of California, Berkeley.
STUDY OF CROSSED-FIELD AMPLIFIERS. Quarterly status rept. no. 4, 15 Oct 58-14 Jan 59, on Contract DA 36-039-sc-74981. [1959] 58p. 16 refs. AD-220 572.
Order from LC mi$3.60, ph$9.30 PB 148 106

Forward-wave amplifier: Investigations are presented concerning the possibility of noise growth in the gun region. Backward-wave amplifier: Investigation of the large-signal behavior of a beam type cascade backward-wave magnetron amplifier indicated that the beam position becomes a less critical factor in the RF performance as saturation is approached. It was further observed that at large signals the output power for 2-circuit operation reaches a maximum at a higher value of magnetic field than for small signals. Comparison of experiment and theory: Quantitative agreement between experiment and Sedin's large signal analysis for crossed-field devices was obtained for several aspects of backward-wave magnetron interaction. The large signal theory of Feinstein and Kino qualitatively agrees with observed experimental behavior for the power output-power input characteristic of the tube. New crossed-field tube design: The design was completed of a new experimental single-circuit M-type tube. Tube gain was calculated using Sedin's theory.

Electronics Research Lab., U. of California, Berkeley.
STUDY OF CROSSED-FIELD AMPLIFIERS, by T. Van Duzer, J. R. Whinnery, and J. R. Anderson. Quarterly status rept. no. 6 and 7, 15 Jan-14 July 59, on Contract DA 36-039-sc-74981. [1959] 62p. 18 refs. AD-230 792.
Order from LC mi$3.90, ph$10.80 PB 148 107

In noise studies, a retarding field diode has been designed for obtaining a measure of stream velocity distribution at several planes near the cathode. In large signal studies, the interdigital circuit velocity has been found and impedance is being obtained. Measurements were made on a single-anode model of the multianode velocity analyser designed for measurements on a crossed-field beam in the gun region. Preliminary analysis of the crossed-field potential minimum, shows that the critical parameters could be so modified by the magnetic field that instabilities would occur. A cathode which produces a transverse field across its surface to compensate the magnetic forces in the potential minimum has been conceived. In the large signal studies, the electron gun was found to produce a well-defined, smooth beam which could be focused to the collector with negligible beam spread for d-c operation. The dispersion curves for the first spatial harmonic of the inter-digital circuit have been checked under hot test conditions and the results agree well with previous cold test measurements. Both forward- and backward-wave interaction over a wide frequency band has been obtained. Exploratory measurements show a power gain of at least 17 db for backward-wave amplification at small signals. (Author)
(See also PB 148 106)

Electronics Research Lab., U. of California, Berkeley.
STUDY OF CROSSED-FIELD AMPLIFIERS, by J. R. Whinnery, C. K. Birdsall and others. Quarterly status rept. no. 8, 15 July-14 Oct 59, on Contract DA 36-039-sc-74981. [1959] 34p. 3 refs. AD-233 691.
Order from LC mi$3.00, ph$6.30 PB 148 108

A cathode which produces a transverse electric field across the surface in order to compensate the transverse magnetic forces in the region of the potential

minimum has been tested. The purpose of compensating the magnetic forces was to make the crossed-field potential minimum more like the ordinary type. The noise figure of the tube, operating as a N-type backward-wave amplifier, has been measured and is found to be of the same magnitude as for O-type traveling-wave tubes when attention was first directed toward their noise problem (25-35db). Also, signal-to-noise ratios were found to be very good (40 - 65 db). A range of d-c operating conditions has been determined over which a thin, rectilinear electron stream can be maintained. Some large-signal backward-wave amplifier experimental data have been obtained and are compared with Sedin's theory. Electronic efficiencies of 30% have been observed for backward-wave amplification, with the efficiency of conversion of available d-c beam energy to r-f wave energy as high as 70%. (Author) (See also PB 148 107)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
METHOD OF TESTING THE DIELECTRIC BREAKDOWN VOLTAGE AND DIELECTRIC STRENGTH OF MINIATURE SPECIMENS, by Andrew R. Blanck and Benjamin T. Holman. May 60, 10p. 4 refs. Technical notes no. 44.
Order from LC mi$1.80, ph$1.80 PB 145 926

Tubular shrouds were investigated as a means of preventing surface flashover in the testing of miniature test specimens for dielectric strength. The specimens used were cut from small-diameter polytetrafluoroethylene (TFE) rod. The technique is applicable whenever small specimens must be tested for breakdown voltage or dielectric strength and where flashover is found to occur. Tubular shrouds do not cause electric field distortion such as generally occurs with well-type specimens. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
HIGH-TEMPERATURE INSULATION FOR WIRE, by J. N. Harris and J. D. Walton, Jr. Rept. for Mar 59-Mar 60 on Electrical and Electronic Materials, Contract AF 33(616)3944. Mar 60, 40p. 2 refs. WADC Technical rept. 58-13, Pt. III.
Order from OTS $1.00 PB 161 788

Normal anodizing of commercial aluminum-clad copper wire did not result in complete anodization of the aluminum due to its thickness. Advantage was taken of the solvent action of sulfuric acid to remove a portion of the excess aluminum, however, complete anodization was not possible due to uneven removal of the aluminum causing exposure of the copper. Best results obtained were an anodized coating thickness of 0.8 to 1.0 mils and an unanodized aluminum layer 0.3 mil in thickness. The use of electrophoretic deposition of colloidal silica for sealing the pores of anodized coatings was not successful. Better results were obtained by providing colloidal silica sealing by gelling hydrolyzed ethyl silicate solutions on phosphoric acid anodized wire. This resulted in a wire insulation with an average dielectric constant of 2.89 and a dissipation factor of 1.87 per cent. The best insulation system was provided by sealing sulfuric acid--magnesium chloride anodized wire with a frit-resin coating. This wire was capable of operating at 800°F. (Author)

Hazeltine Electronics Corp., Little Neck, N. Y.
RADAR SET AN/TPS-25(XE-2) by R. A. Best and J. G. Simes. Final rept. for June 57-May 59 on Contract DA 36-039-sc-66411. [1959] 134p. Rept. 5115, includes rept. 9968-2; AD-228 080.
Order from LC mi$6.90, ph$21.30 PB 147 921

The Radar Set AN/TPS-25(XE-2) is a lightweight, highly-transportable battlefield-surveillance radar capable of detecting and locating a moving target or targets in the presence of ground clutter. The AN/TPS-25(XE-2), based on the non-coherent pulse doppler principle, can be used either inside or outside of its shelter. It is designed to search a given area for moving targets, and to aurally detect and locate them, especially at night or during periods of poor visibility. Equipment of this type is used for battle area surveillance by the latest Army ground service units; its accuracy and presentation are especially useful for artillery fire control. The acceptance tests were performed on two radar sets. They included all those environmental tests listed in the equipment specification. Changes determined by preliminary results of these tests were incorporated in all equipments and final test results indicated that the equipment met all of the acceptance test requirements. Additional tests, requested by the government representative were also described.

Hogan Labs., Inc., New York.
RESEARCH AND DEVELOPMENT OF AN OPTICAL TO ELECTRICAL SCANNING TRANSDUCER. Final technical rept. for 1 May 58-30 Apr 59 on Contract DA 44-009-eng-3485. 1 May 59, 79p. Rept. no. 1251-4; AD-218 992.
Order from LC mi$4.50, ph$12.30 PB 147 461

This report describes a high speed electro-mechanical scanning device to replace the manual tracing table in a Kelsh stereoplotter. The unit is capable of scanning the stereo model projected and formed by a Kelsh stereoplotter and will be suitable for use with automatic stereo mapping equipment.

Hughes Aircraft Labs., Culver City, Calif.
STUDY OF ATOMIC AND MOLECULAR RESONANCES FOR MICROWAVE GENERATION AND AMPLIFICATION, by G. Birnbaum, D. Devor and others. Final rept. for 15 Dec 57-15 Sep 59 on Contract DA 36-039-sc-74967. [1959] 57p. 29 refs.
Order from LC mi$3.60, ph$9.30 PB 147 426

The experimental performance of a ruby maser operating from 4° to 195°K is presented and discussed analytically. A 4-pound, liquid-nitrogen-cooled ruby maser amplifier was constructed with a 14-Mc gain-bandwidth product. The ordered operator theory of linear dissipative quantum circuits is extended to treat multi-port elements. Spin-lattice relaxation models are discussed. The feasibility of chemically tuning maser materials is demonstrated. Paramagnetic chars are assessed. The level splittings and transition probabilities for the ground state of rutile are given for various fields and orientations. (Author) (See also PB 147 425)

Hunt Corp., Carlisle, Pa.
DESIGN AND DEVELOPMENT OF IMPROVED METHODS OF MOUNTING AND ATTACHING SUPPORT WIRES TO LOW FREQUENCY RESONATORS, by R. E. Calaman. Final rept., 1 June 56-15 Apr 59, on Contract DA 36-039-sc-72791. [1959] 22p. AD-233 824.
Order from LC mi$2.70, ph$4.80 PB 147 976

Design and development efforts are summarized for mounting and attaching support wires to LF (below 500 kc) resonators. Studies indicated that satisfactory materials are limited for use in fabricating HF face-shear crystals for high-temperature (200°C) application. Adhesives and cements were unsatisfactory because of their instability and high damping characteristics. Lead attachments of quartz or glass filaments failed because of unmatched coefficients of expansion of the quartz plate, the filament, and the bonding glass solder. Plastic filaments were unsatisfactory for the same reasons, and because of distortion of their physical dimensions under heat and stress. Attachment of lead wires by cement caused damping and most cements could not be made electrically conductive. Evaporated films on the cements also failed. The use of foundation holes in their quartz gave greater strength but did not overcome the difficulties. Hard solders were used with good results but were not acceptable to the government. Nonbonded mountings were mechanically unsound. Pressure weld of metal leads to fired spots on the crystal faces by the thermo-weld technique provided the best bonds. Round configurations of DT cuts showed lower resistance than square units of similar construction and frequency. (See also PB 142 646)

Johns Hopkins U., Baltimore, Md.
THE TRANSIENT BEHAVIOR OF NONLINEAR SYSTEMS, by Francis H. Clauser. Rept. on Contract AF 49(638)496. Apr 60, 57p. 1 ref. AFOSR-TN-60-397.
Order from LC mi$3.60, ph$9.30 PB 147 520

It is shown that the classical perturbation procedure for treating nonlinear systems leads to solutions expressed as Fourier-like series with slowly varying coefficients. These slowly varying coefficients contain the information about the long term behavior of the system. Inconsistently, the classical perturbation procedure expresses these coefficients as power series, a mode of expression which has notoriously poor long term validity. An operational procedure is presented for treating oscillations having slowly variable amplitudes and frequencies.

Linfield Research Inst., McMinnville, Oreg.
THE APPLICATION OF FIELD EMISSION TO MILLIMETER-WAVE OSCILLATORS AND AMPLIFIERS, by F. M. Charbonnier, E. G. Brock and others. Final rept. 15 June 56-15 Aug 58, on Contract DA 36-039-sc-72377. [1958] 103p. 16 refs. AD-218 113.
Order from LC mi$5.70, ph$16.80 PB 147 987

Some distinctive properties of the field cathode and their implications in microwave devices are briefly discussed in the Introduction. The theoretical and experimental work performed on two field emission devices, a monotron oscillator and a frequency multiplier, is reported. In the latter case the experimental data obtained were used for a quantitative comparison with the theory. A satisfactory agreement was found, which confirms the high harmonic content of the field emission beam under suitable conditions, and suggests further work towards the development of high peak power field emission mixers and harmonic generators. The work on cathode and gun development is reported. Miniaturized high transmission field emission guns were developed under the present contract, which may be used in microwave and electron optical devices. A brief discussion is given of the high vacuum system and the microwave equipment built for the present contract, including test bench components at 70 kmc. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
PIEZORESISTIVITY IN SEMICONDUCTORS FOR TRANSDUCER APPLICATIONS, by L. E. Hollander, Jr., G. L. Vick and others. Technical rept. 1 June 59, 35p. 17 refs. LMSD-49736; AD-217 163.
Order from LC mi$3.00, ph$6.30 PB 147 675

Piezoresistivity, the result of strain on resistivity, offers a tool for analyzing the conduction mechanism in semiconductors and also offers potential transducer applications. A discussion of this effect and an analysis of the fourth rank piezoresistive tensor for 2 crystal symmetries are presented. The magnitude of the effect in semiconductors is tabulated, including 2 materials, TiO_2 and PbTe, which the authors have determined to be of considerable interest. The design of devices based on piezoresistivity is discussed and illustrated by working models. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
PRELIMINARY THEORETICAL AND EXPERIMENTAL STUDIES OF MICROWAVE MASER AMPLIFIERS, by J. Rowley and W. Taylor. Technical memo. 10 May 59, 32p. 7 refs. LMSD-49712.
Order from LC mi$3.00, ph$6.30 B 147 674

This report describes the initial phase, summarizing the experimental and theoretical studies, of an investigation of microwave amplification using stimulated electromagnetic radiation (MASER) between atomic energy levels of a paramagnetic material. Fundamental considerations for cavity and traveling-wave Maser amplifiers are discussed. Experimental data are reported on the microwave circuitry designed for the system. These data show good agreement with the design data. The data for the meanderline show good agreement with the theoretical predictions. From the data obtained, it appears that the microwave elements will satisfy the requirements for a working Maser. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
STATISTICAL DESIGN AND EVALUATION OF DEMODULATION SYSTEMS FOR ANGLE MODULATED SINUSOIDS, by J. J. Spilker, Jr. Technical rept. Apr 59, 83p. 21 refs. LMSD-48496; AD-216 592.
Order from LC mi$4.80, ph$13.80 PB 147 673

The optimum realizable demodulation system is derived for angle modulated sinusoids in the presence of additive noise. Optimum here refers to that estimate which maximizes the a posteriori probability of the message, given that a set of data was received, this message is most likely to have been transmitted. The optimum demodulation system is shown to have the same nonlinearities as a phase lock loop, but it has special linear filtering. A statistical comparison of the optimum system with a demodulation system using a discriminator shows the optimum system to provide significant improvement in the threshold signal-to-noise ratio. Another important set of results obtained in this paper is the derivation of the optimum realizable demodulation systems for signals where a modulated or sampled form of the message is used to angle modulate the carrier. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
THEORY OF FERRITE-COUPLED TRANSMISSION LINE NETWORKS, by Philip S. Carter, Jr. Technical note. 27 Feb 59, 28p. 9 refs. LMSD-48479; AD-215 979.
Order from LC mi$2.70, ph$4.80 PB 147 672

An analysis is presented of ferrite-coupled TEM-mode transmission lines. Both the reciprocal and nonreciprocal transmission properties of a two-line or two-mode system have been analyzed for the case where the axis of d-c magnetization is along the direction of transmission. The analysis was applied to the case of a transmission system which consists of two conductors plus a shield and it has been shown that under certain conditions the current will be coupled back and forth between the two conductors in a nonreciprocal fashion, i.e., gyrator action will be obtained. Formulas were derived from which the coupling coefficients due to the ferrite can be calculated for the case where the ferrite rod is located in the plane of symmetry between the two conductors. Finally, a proposed arrangement of ferrite coupled lines to form a transmission-line circulator is considered and its properties, i.e., matching requirements and isolation, are analyzed. (Author)

Mallory, P. R., and Co., Inc., Indianapolis, Ind.
SERVICE TEST MODELS OF POWER SUPPLY PP-1835 ( )/GRC AC POWER SUPPLY FOR STANDARDIZED SERIES OF FM RADIO SETS, by B. L. Borman. Final rept. 15 Apr 58-20 July 59, on Contract DA 36-039-sc-66435. [1959] 60p. AD-232 344.
Order from LC mi$3.60, ph$9.30 PB 148 104

The feasibility of producing AC power supplies for units of the AN/GRC-3 through AN/GRC-8 as well as AN/GRC-9Y in a PP-327F/GRC-9Y case was demonstrated. The power supply can operate Set 1(RT-66, 67, or 68/GRC); Set 2 (RT-70/GRC); Audio Amplifier (AM-65/GRC), or the Auxiliary Receiver (R-108, 109, or 110/GRC) singly or in possible unit combinations. Operation of the power supply without load is not detrimental. The operation of one or several units from a single supply required considerable voltage regulation to compensate for varying voltage drops resulting from variation in output currents. This is considerably different from previous supplies like the PP-327A which operated only into constant loads. By utilizing the latest power rectification and voltage control methods, a considerable reduction in internal dissipation of the supply was achieved. The silicon rectifiers and magnetic amplifiers used in this supply are not subject to aging and will operate at a higher temperature compared to the selenium rectifiers and series pass regulator tubes used in previous power supplies of this type. The 5 service test models for this contract satisfactorily passed all tests. (Author)

Massachusetts Inst. of Tech., Cambridge.
TRANSISTORIZED TWO-SEGMENT COMMUTATOR FOR A DIRECT-CURRENT MACHINE, by D. M. P. Eisenlohr. Rept. on Contract AF 33(616)3984. Feb 60, 61p. 31 refs. WADC Technical rept. 59-683.
Order from OTS $1.75 PB 161 790

This report covers the development of a fully electronic two-segment commutator, which was then experimentally used to demonstrate generator and motor operation of a d-c machine with a single winding armature. A short review is given of the brushless machines already existing and their similarities to synchronous machines. Their limitations are pointed out and a type of static bilateral inverter (commutator) is suggested, which would avoid these limitations. The main part of the report describes the development of a two-segment commutator using transistors for the commutator switches as well as for the control circuitry. The complete circuit consists of a position signal generator, mounted on the shaft of the machine, where the Hall effect is used for obtaining a signal indicative of rotor position without the use of mechanical contacts. This signal is converted into pulses by transistorized Schmitt triggers. These trigger pulses drive transistor control flip-flops, whose function is to turn on and off the power transistors responsible for commutating the armature. This inverter was shown to operate analogously to a mechanical two-segment commutator and some tests of its operation are reported. (Author) (See also PB 161 721)

Melabs, Inc., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts. Quarterly progress rept. no. 6 (Scientific rept. no. 6) 10 Sep-9 Dec 59, on Contract AF 19(604)4071. 9 Jan 60, 34p. 2 refs. AFCRC-TN-60-140; AD-233 578.
Order from LC mi$3.00, ph$6.30 PB 146 323

A theoretical analysis of the ungrounded comb structure was extended. Methods of controlling the slowing factor were investigated and it was determined that considerable control could be exercised by changing the placement of the ruby slab. A theoretical analysis of a cross-relaxation effect which is particularly helpful at these frequencies was carried out. This is a multiple transition type effect and as such is very sensitive to paramagnetic ion concentration. (Author)

Microwave Associates, Inc., Burlington, Mass.
ENGINEERING REFINEMENT PROGRAM FOR S BAND TR TUBE EST-25( ), by Emanuel L. Horn. Final rept. 21 Apr 58-30 Oct 59, on Contract DA 36-039-sc-75039. [1959] 98p. AD-233 745.
Order from LC mi$5.40, ph$15.30 PB 147 969

The technique for fabricating the encapsulated windows appears to be applicable for production since a rate of six units per hour can be obtained with one set of equipment. The preliminary environmental tests seem to indicate that the window is rugged and can withstand severe mechanical and temperature shock. Additional environmental tests on the encapsulated window also failed to produce window failure. The windows were subjected to a non-uniform temperature shock test which should simulate the effect of a gas discharge on the window properties. The use of the improved ignitor assembly in a TR tube should result in a stable ignitor performance. (Author)

Microwave Associates, Inc., Burlington, Mass.
HIGH POWER C-BAND BEACON MAGNETRON RESEARCH AND DEVELOPMENT PROGRAM, by W. V. Hattery. Quarterly progress rept. no. 1, 1 July-30 Sep 59, on Contract DA 36-039-sc-78934. [1959] 29p. AD-230 919.
Order from LC mi$2.70, ph$4.80 PB 147 985

Research concerns the development of an adjustable frequency high power C-band magnetron. The magnetron shall be tunable through the range 5625 to 5675 Mc/s with a peak power output of 40 Kw. It shall operate with a 10 Kv maximum anode pulse with a ten microsecond duration. The delivery of three final design tubes and associated manufacturing drawings is required as partial fulfillment of the contract. A statement of the technical requirements and a description of the electrical and mechanical designs employed to meet these requirements are given. A cross section view of the proposed magnetron and an outline drawing, showing the general configuration of the proposed MA220 magnetron, are presented. Results of preliminary tests are given. The more difficult of the anticipated problems and the plans for their solution are discussed.

Microwave Associates, Inc., Burlington, Mass.
HIGH POWER C-BAND BEACON MAGNETRON RESEARCH AND DEVELOPMENT PROGRAM, by D. Hobbs. Quarterly progress rept. no. 2, 1 Oct-31 Dec 59, on Contract DA 36-039-sc-78934. [1959] 33p.
Order from LC mi$3.00, ph$6.30 PB 147 986

Results of tests performed on various subassemblies of the tube are described and various measured parameters compared with calculated values. A discussion of the results obtained on the operation of the first two tubes is given. Further discussion is given on work done to solve cathode problems due to the long-pulse operation requirement. (Author) (See also PB 147 985)

Microwave Associates, Inc., Burlington, Mass.
HIGH REPETITION RATE BROADBAND DUPLEXER, by Emanuel L. Horn. Quarterly progress rept. no. 4, 15 May-15 Aug 59, on Contract DA 36-039-sc-78165. [1959] 38p.
Order from LC mi$3.00, ph$6.30 PB 147 982

Measurements of arc loss and recovery time as a function of argon gas pressure were continued using an encapsulated input window containing various densities of quartz wool. The data shows that at practical operating pressures with peak incident power of 6 kw and 16 μs pulse width, an encapsulated window with no quartz wool has a minimum recovery time of 40 μs and a corresponding arc loss of 3.3%. Windows with medium density and heavy density quartz wool have minimum recovery times of 20 μs and 8 μs respectively and corresponding arc losses of 3.7% and 5.5%. Experimental windows with dumbell shaped irises and argon gas fills yielded minimum recovery times of 65 μs and 80 μs with corresponding arc losses of 2.35% and 5.5%. The modulator for the X-700 klystron has been received and installed. (Author) (See also PB 146 494)

Microwave Engineering Labs., Palo Alto, Calif.
INVESTIGATION OF MICROWAVE NON-LINEAR EFFECTS UTILIZING FERROMAGNETIC MATERIALS, by Roy W. Roberts. Quarterly progress rept. no. 11, 1 Nov 59-31 Jan 60, on Contract DA 36-039-sc-73278. [1960] 48p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 147 994

An expression is developed showing the volume dependence of the generated second harmonic power. This expression has been verified qualitatively. In general, best conversion is obtained from large samples with a high moment and narrow linewidth. It is relatively independent of sample shape provided no dimension is longer than a free space wavelength. An analysis of dielectric rod resonances has been applied to low-field ferrite rod resonances in an attempt to gain more quantitative information regarding the ferrite amplifier signal modes. A study of the theory has led to the concept of a new type of ferromagnetic amplifier. Considerable success has been achieved in growing large single crystals. In one run a crystal weighing nine-grams and measuring 2.3 cm in length was obtained. (Author) (See also PB 146 491)

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH, by M. Chodorow. Scientific rept. no. 19, 1 Oct-31 Dec 59, on Contract AF 19(604)1930. Feb 60, 30p. M. L. rept. no. 694; AFCRC TN-60-180.
Order from LC mi$2.70, ph$4.80 PB 148 028

Microwave Tube Studies: Analysis of the behavior of velocity modulated electron beams in long gaps has been extended to the calculation of the beam loading admittance. A project has been initiated to obtain highly convergent space-charge limited guns for certain crossed-field devices. Plasma Physics Studies: Numerical solutions have been computed for the determinantal equation for the interaction of a modulated electron beam with a plasma medium in an infinite magnetic field. A re-examination of the theory of traveling-wave type parametric amplification in a plasma column has given insight on the marginal performance of the tubes used. Experiments attempting to excite low-velocity plasma sound waves are described. A new electrode configuration for imposing the rf field on the plasma confirmed earlier conclusions that the confinement phenomena is not a radiation pressure effect but more likely a sheath effect. A new project is concerned with analysis of

nonlinear effects by Hamiltonian methods and the investigation of a possible experiment to verify the concept of Landau damping. Further knowledge has been gained about the production of cesium plasmas.
Ferrite Studies: The objective of a new project is to investigate nonlinear resonance phenomena in small ferrite ellipsoids. Theory is being compared with experiments on small ferrite samples to gain insight into the essential factors necessary for efficient frequency multiplication using ferrites. (See also PB 145 968)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
LINEAR PASSIVE NETWORKS INVESTIGATION, by D. C. Youla and H. J. Carlin. Final rept. on Contract AF 30(602)1709. 15 Dec 59, 12p. Final rept. R-793-59; PIB-721; RADC-TR-59-253; AD-233 009.
Order from LC mi$2.40, ph$3.30 PB 146 124

This report is a presentation of the research in network techniques for lumped, distributed, active, and time-varying systems that has been carried out under this contract. The report contains the results on the physical realizability and general representation of linear, passive n-ports. Methods suitable for the broadband equalization of distributed parameter one-ports and lumped two-ports have been developed. The conclusions drawn from a study of the analytic properties of distributed-lumped networks are reported. The results of a theoretical and experimental program concerned with networks containing parametric elements are included. In general this program has extended many of the concepts of low frequency network theory to the solution of theoretical and practical design problems at microwave frequencies. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
QUARTERLY PROGRESS REPORT 15 APRIL 1957 THROUGH 14 JULY 1957 TO JOINT SERVICES TECHNICAL ADVISORY COMMITTEE, by Ernst Weber. Rept. on Contract AF 18(600)1505. Sep 57, 106p. 48 refs. Rept. R-452.8-57.
Order from LC mi$5.70, ph$16.80 PB 137 569

The research effort at the Microwave Research Institute is motivated by a desire to fulfill an academic responsibility by providing a means for both faculty and graduate student body to participate in a significant and fundamental research program responsive to technological and national interests. Accordingly the program covers a broad spectrum ranging from basic theoretical programs in physics, mathematics, and engineering to experimental programs involving basic measurements and the development of devices and materials. Although the specific structure of this program is continually being refined, it appears desirable to summarize from time to time the individual programs of the various groups and sections that constitute the Microwave Research Institute.

Motorola, Inc., Riverside, Calif.
PERSONNEL NAVIGATION SYSTEM STUDY, by Hugh J. Galbraith and Leslie D. Snyder. Final rept. for 15 Apr 58-15 Apr 59 on Contract DA 36-039-sc-75037. May 59, 497p. 787 refs. Rept. no. RLF-3838-1; AD-227 998.
Order from LC mi$11.10, ph$75.60 PB 146 981

A detailed design proposal for a lightweight manpack personnel navigation equipment is presented. The Appendixes support the proposed equipment design and constitute a final report on all phases of the theoretical and experimental investigations of applicable motional sensors, directional references and navigation techniques. The equipment embodies an ultrasonic Doppler velocity sensor, a magnetic directional reference and an operational-digital navigation computer and indicator. The unique features of the proposed design include a novel frequency tracking scheme, an all-electronic method of reading out magnetic heading and pulse-train digital computing techniques. The feasibility of magnetic velocity determination and algebraic-inertial navigation techniques were also investigated. The experimental effort included the fabrication and testing of ultrasonic Doppler transducers, simulators, and associated circuitry, magnetic heading reference circuitry, and magnetic field measuring devices. The human factors aspect of a personnel navigator were investigated and an experiment was conducted to obtain measurements of linear and angular accelerations that may be expected of a man carrying the navigation equipment. (Author)

National Bureau of Standards, Boulder, Colo.
VARIABLE CAPACITOR CALIBRATION WITH AN INDUCTIVE VOLTAGE DIVIDER BRIDGE, by Thomas L. Zapf. May 60, 9p. 4 refs. Technical note no. 57.
Order from OTS $0.50 PB 161 558

The use of an inductive voltage divider bridge for the calibration of three-terminal and two-terminal variable air capacitors is discussed. (Author)

Naval Research Lab., Washington, D. C.
REDUCTION OF THE HYDROGEN OVERVOLTAGE OF NICKEL ELECTRODES WITH PALLADIUM, by J. C. White and S. Schuldiner. Final rept. 6 May 60, 8p. 2 refs. NRL rept. 5454.
Order from LC mi$1.80, ph$1.80 PB 144 637

The hydrogen overvoltage of nickel electrodes in 21% KOH solutions can be lowered by the addition of palladium to the electrodes. This can be done either by plating Pd black on the surface or by alloying nickel with a small amount of palladium. In the latter case it was shown that under anodic and cathodic cycling, palladium concentrated on the surface of the electrode. The possible use of these modified nickel electrodes in the electrolytic oxygen generator developed at NRL is suggested. (Author)

Office of Scientific Research and Development. Div. 6.
SEA-WATER BATTERIES, by W. H. Martin (Bell Telephone Labs., Inc.). Final rept. on Contract OEMsr-1069. 30 Nov 45, declassified 1 Feb 60. 535p. Section no. 6.1-sr-1069-2128; OSRD no. 6420; AD-128 639.
Order from LC mi$11.10, ph$81.90 PB 146 264

Part One outlines basic research and the general principles of electrochemical and mechanical design of sea-water batteries. Part Two describes specific designs of sea-water batteries, their performance

characteristics, and the testing program. Part Three covers battery building and related activities such as the development of tools, facilities and methods for battery production, materials procurement, and engineering of the transition to manufacture. Nine appendices are a selection of technical papers that deal with electrochemical and hydraulic considerations. Also included are a list of other pertinent memoranda and letters, and a bibliography of technical memoranda, specifications, and patent applications. The sea-water batteries developed under this project, employ silver chloride as the active cathode material and magnesium alloy as the anode. Sea water is admitted to the battery by breaking the seals at the time the battery is put in use.

Physical Science Lab., New Mexico State U., University Park.
400 Mc/Sec CUTOFF NOTCH ANTENNA AEROBEE HI, by Dennis G. Henry. Scientific rept. no. 4, on Contract AF 19(604)2188. 2 Mar 60, 21p. AFCRC-TN-60-295.
Order from LC mi$2.70, ph$4.80 PB 147 898

This report gives the characteristics of the 400 Mc range Command Control Notch Antenna for the AEROBEE HI. This antenna is to be modified from the 54.5 Mc notch antenna. A detailed study of the radiation pattern was conducted to see what effect the modification had. A bandwidth check was also made. The physical dimensions of the modified antenna are given and compared to the original 54.5 Mc notch. These changes are shown in the included photographs. (Author)

Physical Science Lab., New Mexico State U., University Park.
SPLIT MISSILE ANTENNA; 400 Mc COMMAND CONTROL NOTCH ANTENNA; THE THREE ELEMENT SLOT ARRAY AND BENT-DIPOLE NOSE PROBE; QUADRALOOP ANTENNA AT S-BAND; TELEMETRY AND COMMAND CONTROL ANTENNAS; RADIO FREQUENCY BREAKDOWN MEASUREMENTS ON QUADRALOOP ANTENNAS. Final rept. on Contract AF 19(604)2188. 28 Apr 60, 10p. 6 refs. AFCRC-TR[60]261.
Order from LC mi$1.80, ph$1.80 PB 147 899

Radio Corp. of America, Lancaster, Pa.
ELECTRON TUBE MATERIALS, GASES, AND GETTERS, by J. C. Turnbull and G. P. Kirkpatrick. Quarterly progress rept. no. 4, 15 July-15 Oct 59, on Contract DA 36-039-sc-78226. 15 Nov 59, 66p. 7 refs. AD-232 384.
Order from LC mi$3.90, ph$10.80 PB 147 991

Outgassing data were obtained on Ni, cold-rolled steel, Ni-plated steel, gas-carbonized Ni-coated steel, Al-clad steel, Mo, and Kovar by the use of RF induction heating (AD-227 616). The metal sample was a strip 0.005 in. thick, formed into a cylinder 1 in. in diameter by 3/8 in. high. The cylinder was mounted on a tungsten lead stem and had a chromel-alumel thermocouple welded to the inside. The sample was sealed inside a hard glass bulb, exhausted, and baked at 400°C for 1 hour. The gas evolution obtained on heating the sample by RF induction was measured with a mass spectrometer. Quantities of the gas components (H, CO + N, CO_2 and O) for Ni, Mo, Ni-plated steel, and Kovar were similar in magnitude. H ranged from 0.5 to 2 1-μ/g, CO + N from 10 to 30 1-μ/g, and CO_2 from 2 to 9 1-μ/g. Al-clad steel showed higher levels of H, with other gases in the same range. Cold-rolled steel showed similar levels of H and CO_2, with much higher levels of CO + N. Carbonized Ni-coated steel showed high levels of all gases, with a small evolution of O at the higher temperatures. Lower-temperature (400°C) outgassing experiments for 40 hr were performed on Ni, cold-rolled steel, Al-clad steel, gas-carbonized Ni-coated steel, Ta, Cu, and mica. Little relationship was found by comparing gases evolved on heating in 20-min steps to 1000°C with gases determined by vacuum fusion analysis. The predominant gas on outgassing at 400°C was H. (See also PB 145 802)

Ramo-Wooldridge, Div., Canoga Park, Calif.
STUDY OF FAULT LOCATION AND PREDICTION TECHNIQUES LEADING TO PLANS FOR AUTOMATIC AND DYNAMIC TESTING OF MILITARY GROUND EQUIPMENT, PARTS I AND II. Final rept. on Contract AF 30(602)1997. 15 Feb 60, 192p. 3 refs. C62-9U37; RADC-TR-59-248A. AD-233 011.
Order from LC mi$8.70, ph$30.30 PB 146 109

The study has been oriented to resolving the problems of automatic monitoring and testing of the equipments of a P-site; a primary objective has been to arrive at plans for a test-system which would be applicable not only to a P-site but to a variety of operational and maintenance installations, both present and prospective, the only important condition being that the equipments or systems to be tested are basically electrical or electronic in nature. Part I. Theory, Methods, and Design Principles. Part II. Test-System Plans.

RCA Defense Electronic Products, Camden, N. J.
MARKER BEACON RECEIVER R737( )/ARN, by F. E. Randolph. Final engineering rept. 15 July 56-31 Jan 57, on Contract DA 36-039-sc-73083. [1957] 90p. AD-221 459.
Order from LC mi$4.80, ph$13.80 PB 147 978

The design is presented of a completely transistorized 75mc fixed frequency marker beacon receiver of unusually small dimensions, light weight, low power drain and rugged construction for use in Army aircraft. The radio receiver R-737( )/ARN employs a double coversion superheterodyne circuit for the reception of aircraft beacon signals. The circuits are fully transistorized utilizing subminiature components mounted on a printed circuit board. (Author)

Rixon Electronics, Inc., Silver Spring, Md.
SYNTHESIS OF A TYPE OF PHASE CORRECTOR FOR MAGNETIC TAPE RECORDERS, by Richard A. Wainwright. Technical rept. no. 1 on Contract DA 49-186-502-ORD-832. Apr 60, 100p. 27 refs.
Order from LC mi$5.40, ph$15.30 PB 147 637

This paper covers several closely related areas concerning approximately linear phase, complex wave handling systems, with particular emphasis on phase linearization of magnetic tape recorders. The first

subject concerns the phase and amplitude requirements of a system required to handle complex waveforms in order to have an output waveform that for the most part resembles the signal applied to the input terminals. The second section covers complex waveform makeup, their Fourier expressions where convenient, spectrum plots of certain types of complex waveforms, and shows pictorially the effects of amplitude and phase distortions of a few common waveforms, viz., square waves, and triangular type waveforms. The third section covers the general theory of All-Pass Networks from the point of view of the poles and zeros of the transfer function, and includes a discussion of mismatch effects. Section four describes the system used to verify the phase correcting scheme described in section three. Section five gives a rather general coverage of tape noises and includes a curve which shows the approximate spectrum of tape noise vs. tape-to-head spacing. The conclusion lists several applications of the networks described that are not included in the main body of the report.

Rome Air Development Center, Griffiss AFB, N. Y.
DESIGN OF A RADAR COVERAGE INDICATOR FOR RADAR QUALITY-CONTROL FUNCTIONS, by Edward F. LaForge and Edmund J. Kennedy. Apr 60, 19p. RADC-TR-60-10.
Order from LC mi$2.40, ph$3.30 PB 147 770

A radar coverage indicator has been designed, and a model developed, to satisfy the requirements of the Air Defense Command and the Tactical Air Command for a suitable radar quality-control device. This report describes the model, and includes a brief description of the function of the radar coverage indicator, with emphasis on those aspects of the display considered significant from the operator's viewpoint. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
EVALUATION OF SAL-81 KLYSTRON, by Dirk T. Bussey. Apr 60, 24p. RADC-TR-60-39.
Order from LC mi$2.70, ph$4.80 PB 147 663

The SAL-81 is a three-cavity electrostatically focused amplifier klystron that was designed for pulsed operation in L-band at power levels up to 20 kilowatts peak. This report describes the measurements that were made and the tests performed to establish the operating parameters of this tube under conditions useful in pulse radar design. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
MULTIPLE ANGLE DIVERSITY DESIGN CONSIDERATIONS, by W. R. Richard and M. H. Bickelhaupt. Apr 60, 39p. 21 refs. RADC-TN-60-22.
Order from LC mi$3.00, ph$6.30 PB 147 753

Tropospheric scatter communication will become a very important means of communication in the foreseeable future. In order to obtain longer ranges, tropospheric scatter systems have been designed for use at lower and lower frequencies. At the present time our longest range tropospheric scatter equipments operate in the region of 400 megacycles; but there are regions in the world where this frequency band cannot be made available. Accordingly, a new principle, multiple-angle diversity, has been applied, which allows somewhat greater ranges or more reliability at higher frequencies - even into the microwave region. This paper discusses the multiple-angle diversity scatter system and its design considerations. Particular attention is given to the beam patterns employed and to accordant modifications of antenna and antenna-feeder requirements. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
THE NATURE AND BEHAVIOR OF REDUNDANCY NETWORKS AND FUNCTIONS, by Fred Moskowitz. May 60, 196p. 33 refs. RADC TR-60-4.
Order from LC mi$8.70, ph$30.30 PB 148 022

This report presents various properties and characteristics of probabilistic redundancy networks and functions which can be used to represent reliability relationships in complex equipment containing redundant elements; large scale systems containing a multiplicity of alternative subsystems or telecommunication nets containing possibilities of alternative routing. By making the simplifying assumptions that all elements of a system have independent failure statistics and that the reliability of an element remains unchanged when it is incorporated into a system, a simple algebra can be used by means of which the analysis of such redundancy networks becomes possible. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
RADAR DATA TRANSFER SYSTEM AN/TRQ-10(XW-1)/GR, by G. K. Bennison and M. M. McCormick. Apr 60, 116p. RADC TR-60-38.
Order from LC mi$6.00, ph$18.30 PB 147 760

This system operates in the 7135- to 7985-mc frequency range and relays radar search and surveillance data by a narrow microwave beam, virtually eliminating interception by an enemy. The equipment is compact, easily transported by land or air, and readily sited. It consists of a transmitting unit and a receiving unit which are rack-mounted in portable electrical equipment shelters. The system range (15 to 30 miles under line-of-sight conditions) can be extended by the use of repeater stations and is a great improvement over the 10,000-foot limitation of cable-link systems. Azimuth data, three video signals range marks and trigger pulses are combined and transmitted on four f-m microwave carriers. The system was field tested using an r-f path established between Griffiss AFB and Verona, N. Y. Receiver sensitivity, transmitter power output, cross-talk measurement, azimuth tracking accuracy, power regulation, comparison of local and remote plan position indicator (PPI) presentations, and antenna radiation pattern, system delay, and VSWR measurements were among the tests performed. This new microwave system constitutes an effective and very reliable link for transmitting tactical radar data to distant points. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
TROPOSPHERIC SCATTER RADIO SETS AN/FRC-39(V) AND AN/FRC-56(V), by Lewis A. Javarone.. Dec 59, 25p. RADC TR-59-8; AD-232 052.
Order from LC mi$2.70, ph$4.80 PB 146 271

Radio sets AN/FRC-39(V) and AN/FRC-56(V), standard military sets developed for tropospheric scatter, are described. Test results are appended. (Author)

Sperry Gyroscope Co., Great Neck, N. Y.
DEVELOPMENT OF A LOW-FREQUENCY TRAVELING-WAVE-TUBE CHAIN. Final progress rept. 1 Dec 56-28 Feb 59, on Contract DA 36-039-sc-73116. Oct 59, 159p. 13 refs. Sperry rept. no. NA-8230-8157.
Order from LC mi$7.50, ph$24.30 PB 147 971

Ten STP-106 prototypes were constructed. A demountable tube was assembled, containing the helix interaction structure, to develop a satisfactory low-noise gun. The construction of this tube provided for the expeditious interchange of electron guns and adjustment of beam entrance point. An optimum configuration of mechanical and electrical parameters provided the required low-noise figure. The STP-107 traveling-wave tube is a modification of the STP-172. Particular attention was directed toward attenuator design and construction to reduce gain fine structure. In addition, construction techniques for the envelope, r-f connection, electron gun assembly, and helix support assembly were studied. These studies, which reduced leakage and mounting problems, yielded a rugged tube meeting specifications.

Sperry Gyroscope Co., Great Neck, N. Y.
INVESTIGATION OF MICROWAVE WINDOW FAILURE MECHANISMS AND THEIR ELIMINATION, by T. Sege, D. Churchill, and others. Quarterly progress rept. no. 1, 1 June-1 Sep 59, on Contract DA 36-039-sc-78314. Oct 59, 65p. 22 refs. Sperry Rept. no. NA-8240-8182-1; AD-232 923
Order from LC mi$3.90, ph$10.80 PB 147 972

A survey of industrial and academic organizations has shown that window failure is caused by arc-over, thermal breakdown, seal failure, and dielectric puncture and cracking. The mechanisms of radiation damage, intrinsic breakdown, and thermal breakdown apparently change the structure of window materials. Sample materials are undergoing analyses to correlate crystalline structure with failure mechanism. Arc-over in both transverse and slanted surfaces is being studied using field-strength techniques. High-order mode resonances and surface losses are being investigated. (Author)

Stanford Electronics Labs., Stanford U., Calif.
ASSOCIATION BETWEEN AURORAE AND VLF HISS OBSERVED AT BYRD STATION, ANTARCTICA, by L. H. Martin, R. A. Helliwell, and K. R. Marks. Technical rept. no. 1 on National Science Foundation Grant 9511. 29 Apr 60, 13p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 147 749

Observations through 1959 at Byrd Station, Antarctica (70.5°S Geomagnetic), show that a close association exists between aurorae and certain VLF hiss. The hiss usually occurs in a broad band with a center frequency of about 8 kc/s. The intensity and bandwidth vary with ionospheric absorption and may also vary with the intensity of the aurorae. Under conditions of extreme ionospheric absorption the intensity of the hiss drops to undetectable levels even in the presence of intense and active aurorae. There are some indications that the center frequency of this auroral hiss band may be related to the type of aurora; in particular, a center frequency of 9.6 kc/s appears to be associated with red aurora. The average field intensity of the auroral hiss lies between 1 mv/m and 3 mv/m.

Stanford Electronics Labs., Stanford U., Calif.
CAVITY AND TRAVELING-WAVE MASERS USING RUBY AT S-BAND, by W. S. C. Chang, J. Cromack, and A. E. Siegman. Rept. on Contract DA 36-039-sc-73178. 28 July 59, 25p. 6 refs. Technical rept. no. 155-2.
Order from LC mi$2.70, ph$4.80 PB 146 276

Several three-level solid-state masers using ruby have been operated at frequencies near 3000 Mc/s, using a high-efficiency cavity having TEM modes in a rectangular geometry, or a meander-line slow-traveling-wave circuit with low group velocity over the signal pass band. Various possible maser operating points in the energy-level spectrum of ruby have been studied with both structures. At good operating points, i.e. points where the observed inversion at the signal frequency is large when the pump is turned on, large gain-bandwidth products are obtained in the cavity maser and large gains/unit length in the traveling-wave maser. Although the cavity gain-bandwidth products obtained are two orders of magnitude larger than were obtained in early maser work, and are sufficiently large for some practical applications, the traveling-wave maser appears to have much more promise due to its inherently broader bandwidth, stability and built-in nonreciprocity. (Author)

Stanford Electronics Labs., Stanford U., Calif.
ELECTRON DEVICES RESEARCH. Consolidated quarterly status rept. no. 11, 1 July-30 Sep 59 on Contracts DA 36-039-sc-73178, AF 33(616)6207, AF 19(604)5480, Nonr-225(40) and Nonr-225(24). [1959] 70p. 5 refs. AD-229 956.
Order from LC mi$3.90, ph$10.80 PB 147 014

Stanford Electronics Labs., Stanford U., Calif.
TRAVELING-WAVE TECHNIQUES FOR MICROWAVE RESONANCE MEASUREMENTS, by A. E. Siegman. Rept. on Contract DA 36-039-sc-73178. 12 Oct 59, 11p. 5 refs. Technical rept. no. 155-3.
Order from LC mi$2.40, ph$3.30 PB 146 277

Recent developments in traveling-wave solid-state masers point up the utility of slow-wave circuits in comparison with cavities for magnetic resonance measurements. Among other advantages, slow-wave circuits are ideally suited for broadband or multifrequency measurements without loss of sensitivity; they readily produce circularly-polarized fields over large volumes; measurements of χ' and χ'', which involve measurements of resonant frequency and Q in a cavity, reduce to generally simpler measurements of attenuation and phase shift. Because slow-wave circuits are less widely known than cavities, this paper proposes to discuss some of their characteristics which are especially relevant to magnetic resonance measurements and to point out ways in which slow-wave circuits can be used to advantage. (Author)

Syracuse U. Research Inst., N. Y.
FERRITE POSTS IN RECTANGULAR WAVEGUIDE, by Harry Gruenberg and Arthur Cohen. Technical rept. on Contract AF 30(602)1627. 1 June 59, 51p. 17 refs. SURI rept. no. EE475-596-TR-1; RADC-TR-59-91; AD-217 679.
Order from LC mi$3.60, ph$9.30 PB 147 030

Measurements were made of the scattering matrix of a cylindrical ferrite post in a rectangular waveguide and the results are compared with an approximate theory. The theoretical formulas are used to compute the constants of the ferrite, such as dielectric constant, saturation magnetization, and loss factor, from the experimental results on thin posts. These computed values are then used to predict the scattering matrix for posts of larger diameters to see how far the theory can be extrapolated. (Author)

Technical Research Group, Syosset, N. Y.
YAGI ANTENNA STUDY, by Alan F. Kay. Scientific rept. no. 1 on Contract AF 19(604)3476. 6 Jan 60, 53p. 12 refs. TRG-121-SR-1; AFCRC-TN-60-364.
Order from LC mi$3.60, ph$9.30 PB 148 012

An experimental study of the near fields of yagis was undertaken. Quantities measured were the surface wave phase velocity, longitudinal and transverse field decay; excitation efficiency, tolerance effects, ohmic losses, and behavior near the source. Particular emphasis is given to long maximum gain yagis (up to 300λ in length) and how the above quantities enter to limit the gain. A partially empirical theory is developed from the extensive measured data which gives a simple picture of the fields around a yagi suitable for computing far field patterns without the errors of the Hansen-Woodyard theory. This theory would be applicable to other parasitic linear, endfire antennas. (Author)

Tung-Sol Electric, Inc., Bloomfield, N. J.
UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION, by B. G. Firth. Quarterly rept. no. 2, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-78081. [1959] 23p. AD-217 861.
Order from LC mi$2.70, ph$4.80 PB 147 988

Five active phases of the project are discussed. (1) Completion of the magnetic analysis of electron energy distribution from the MgO self-sustained emission cathode shows a peak at 13.5 volts and 90% of electrons less than 65 volts. The curve is believed to give an energy distribution accurate to a few volts. (2) Preliminary cathode ray guns have been operated with beam currents of 0.3-0.5 ma with control grid at 300-400 volts and collector at 1500 volts. (3) Mesh dynodes for the secondary emission preamplifier have been made with an effective delta of 3. (4) A new Type DT-812C audio output amplifier tube is being designed to be more effective than the present DT-812B. It is hoped to exceed the 600 micromhos Gm of the latter. (5) Cathode research and development is in progress to (a) determine the illusive factors periodically affecting quality, (b) establish necessary controls for them, (c) improve the cathode, and (d) work out if possible an effective preprocessing method to do away with any necessity for admitting air on exhaust. The sodium activated cathode is found to start 3 to 6 times faster than the regular MgO cathode with a "daylight" lamp shining on it. (Author)

Westinghouse Electric Corp. [Lester, Pa.]
PHOTOEMITTER PREPARATION BY EMPIRICAL AND MICROBALANCE TECHNIQUES, by Eugene Heath. Rept. for 1 June 58-30 Nov 59 on Research on the Quantum Nature of Light, Contract AF 33(616)5729. Feb 60, 50p. 2 refs. WADD Technical rept. 60-5.
Order from OTS $1.25 PB 161 782

A design for a vacuum system to be used with a microbalance in the study of photosurfaces has been successfully evolved and tested. The chief problem of such a system appears to be the large volume. By reducing the volume to a minimum and by suitable baffling and restrictions, the effect of the large volume has been minimized. A photosurface of the antimony-cesium type has been successfuily formed within this system. An empirical study of photosurfaces has led to a modified multi-alkali type photosurface with a maximum overall sensitivity of 140 microamperes per lumen, a peak response shifted to approximately 6000 Å and appreciable response beyond 8000 Å. A tentative processing schedule for forming this photosurface is given. (Author)

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 1, 1 Jan-31 Mar 56, on Contract DA 36-039-sc-71158. 30 Apr 56, 12p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 147 922

Apparatus to obtain antenna gain and pattern measurements is required for the study. The first period was devoted to the design and construction of the apparatus for making these measurements. Several surface wave antennas have also been constructed.

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 2, 1 Apr-30 June 56, on Contract DA 36-039-sc-71158. 31 July 56, 24p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 147 923

The construction of the apparatus necessary for taking horizontal radiation patterns of surface wave antennas has been completed. The turntable to support and rotate the antennas is driven from the receiver location by power synchros. Microwave absorber screens behind the antenna serve to minimize room reflections. Some preliminary pattern measurements have been made on two types of surface wave antennas. The two types of antennas are the surface wave cone antenna and the surface wave dipole antenna. The results obtained for these antennas, operating at the design frequency of 9360 mc/s, appear to show promise. (Author) (See also PB 147 922)

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 3, 1 July-30 Sep 56, on Contract DA 36-039-sc-71158. 31 Oct 56, 17p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 147 924

A number of improvements were made in the antenna measuring apparatus as well as in the antenna structure itself. These improvements resulted in more reliable antenna measurements. A suitable termination for the surface wave turnstile antenna has been found, thus removing the uncertainty of the presence of a reflected wave. The preliminary horizontal and vertical pattern measurements made thus far, along with approximate gain measurements indicate, that a fairly large number of elements must be used in the turnstile arrangement if reasonable values of gain are desired. An approximate gain of 9 db was obtained for 44 elements. The optimum design has not yet been determined but a method for measuring the phase velocity along the antenna structure has been found and should aid materially in obtaining design criteria. (Author) (See also PB 147 923)

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 4, 1 Oct-31 Dec 56, on Contract DA 36-039-sc-71158. 31 Jan 57, 17p. 8 refs.
AD-130 601.
Order from LC mi$2.40, ph$3.30 PB 147 925

Detailed measurements were made on a surface-wave turnstile antenna to obtain data for optimizing antenna design. These measurements are the reduction in phase velocity along the antenna structure versus both the length and the cross-sectional area of the elements, and the attenuation along the structure versus the number of elements. Results indicated that a reduction in phase velocity along the antenna structure of more than 3% is necessary for reasonable efficiency. This 3% reduction requires 44 elements (11 wavelengths) to achieve a 9-db gain; about 66% of the input power is lost in the termination. The larger the reduction in phase velocity along the antenna, the greater is the radiating efficiency. An increase in the reduction of phase velocity is possible by choosing the proper length and diameter of elements and by increasing the number of elements per wavelength. The analytical solution of the surface wave turnstile antenna shows promise. (See also PB 147 924)

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 5, 1 Jan-31 Mar 57, on Contract DA 36-039-sc-71158. 30 Apr 57, 25p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 147 926

Measurements are presented of the gain, beam width, reduction in phase velocity, pattern, and attenuation of a turnstile type of surface wave antenna. It appears that sufficient data on this antenna has now been obtained to make possible an optimum design. (Author) (See also PB 147 925)

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 6, 1 Apr-30 June 57, on Contract DA 36-039-sc-71158. 31 July 57, 70p. 20 refs.
AD-139 776.
Order from LC mi$3.90, ph$10.80 PB 147 927

An analysis was made of the surface wave turnstile antenna. The analysis does not permit a complete antenna design since the attenuation of the wave along the structure cannot be predicted with reasonable accuracy. The calculations are based on the assumption that a line loaded with radial elements behaves like a surface wave line. Phase velocity reduction calculations are limited to cases in which the element diameter does not exceed the length. Gain and phase velocity reduction calculations agree well with the measured values. Measurements indicate that the highest gains are obtained for a small reduction in phase velocity of the surface wave along the antenna structure. When the required reduction is determined for an antenna design, the element size can be obtained by measurements or calculations. The surface wave turnstile antenna is mechanically simple to construct. The radiating elements are automatically phased by their position along the antenna structure. The antenna bandwidth is about 8% of the center frequency and is comparable to other arrays which it might replace. (See also PB 147 926)

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 7, 1 July-30 Sep 57. on Contract DA 36-039-sc-71158. 31 Oct 57, 21p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 147 928

Measurements were begun on a dielectric disc surface wave antenna. The measurements made were of a preliminary nature in an attempt to discover the factors which are important in determining the gain and pattern shape of this antenna. Two reflector type surface wave antennas were also tried. Both antennas operate on the same principle, but one has horizontal and the other vertical polarization. Patterns of these antennas have been obtained. (Author) (See also PB 147 927)

Wisconsin, U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Quarterly progress rept. no. 8, 1 Oct-31 Dec 57, on Contract DA 36-039-sc-71158. 31 Jan 58, 50p. 13 refs.
Order from LC mi$3.30, ph$7.80 PB 147 929

A surface wave dielectric disc antenna was studied analytically and experimentally. Pattern and gain measurements agreed with predicted values when good surface wave launching efficiency was obtained. Gains of 7.5 db were obtained for reasonable size antenna structures. (Author) (See also PB 147 928)

Wisconsin U., Madison.
SURFACE WAVE AND ANTENNA ENGINEERING RESEARCH STUDY, by Elmer H. Scheibe. Final rept. for 1 Jan 56-31 Mar 58 on Contract DA 36-039-sc-71158. 30 Apr 58, 93p. 26 refs. AD-158 454.
Order from LC mi$5.40, ph$15.30 PB 147 930

The engineering research study was concentrated on 4 types of surface wave (SW) antennas: the SW turnstile antenna, the SW dielectric disk antenna (SWDDA), the SW cone, and SW reflector antennas. The SW turnstile antenna was unidirectional in the horizontal plane and capable of high gain. An approximate analysis was successful in predicting the gain and reduction in phase velocity along the structure. The SWDDA has a unidirectional pattern in the horizontal plane and has moderate gain. An analysis of an ideal SWDDA was successful in guiding the design and experimental measurements. Theoretically, high gain is possible, but because of low SW launching efficiency the maximum gain achieved was 7.5 db for a disk diameter of 24 in. at 9360 mc. The thinner the dielectric, the higher the gain. The cone antenna has a circular horizontal pattern, vertical polarization, and very low gain. The conversion of the SW field to a radiation field was not very efficient. The reflector antennas had considerable less directivity than expected. In actual tests, the antennas showed low gain and poor directivity. A proper combination appeared possible of the horizontal and vertical polarization types of reflector antennas to give circular or elliptical polarization. The SW turnstile antenna was the most successful of all the antennas studied. (Author) (See also PB 147 929)

Ordnance, Missiles, and Satellite Vehicles

AER, Inc. [Pasadena, Calif.]
GROUND INTERFERENCE EFFECTS ON BODIES MOVING THROUGH A COMPRESSIBLE FLUID AND THEIR APPLICATIONS TO SHORT SLED DESIGNS, by T. Y. Wu. Rept. on Contract N123-60530s-4595A. 1 July 58, 111p. 19 refs. NOTS 2118; NAVORD rept. 6420; AD 206 530.
Order from LC mi$6.00, ph$18.30 PB 147 595

Ground interference effects on the pressure distribution and lift, drag, and moment coefficients for various simple 2- and 3-dimensional bodies used in high-speed rocket-test sleds are theoretically determined for the subsonic and supersonic speed flow-regimes. The families of 2-dimensional bodies considered are: (a) single wedges, flat afterbody; (b) double-wedge sections; (c) biconvex sections; (d) thin wings, circulation present; and (e) circular cylinders. Included in the analysis for 3-dimensional bodies in subsonic flow are: (a) slender, pointed, cone-cylinders; (b) slender, pointed ogive-cylinders; (c) double ogives; and (d) finite-span lifting wings. Detached shock wave flows on 2-dimensional bodies (horizontal wedge with a flat afterbody, and upper-sided wedge with a bump on the lower surface) were also considered. This latter analysis indicates that, under certain conditions, pressures of the order of 14 atmospheres may be exerted on the underside of a rocket test sled. Various design plots are also included. (Author)

Aerial Reconnaissance Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
APPLICATION OF TRILATERATION TECHNIQUE TO DETERMINE POSITION OF SATELLITE OR MISSILE IN SPACE, by Lee R. Avery. May 58, 11p. WADC-TN-58-141; AD-155 572.
Order from OTS $0.50 PB 151 136

The trilateration technique described herein provides an extremely accurate method for obtaining a three-dimensional location in space of satellites and other man-made vehicles. It is shown herein that a root mean square accuracy of ±160 feet in space position is obtainable. The timing circuits in the suggested method of measuring require fractional-microsecond accuracy. The achievement of these timing accuracies at widely separated points could impose requirements which would be too severe; however, a time-sharing adaptation of the proposed method could reduce the stringency of this requirement. If the accrual of scientific data requires greater positional accuracy than the present state-of-the-art allows, the satellite-positioning technique described herein is proposed. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
A BEST ESTIMATE OF TRAJECTORY USING REDUCED DATA FROM VARIOUS INSTRUMENTS AT A SINGLE POINT IN TIME, by Harold L. Dibble and Charles L. Carroll, Jr. May 60, 41p. RCA Quality Analysis Technical rept. no. 10; AFMTC-TR-60-12.
Order from LC mi$3.30, ph$7.80 PB 148 061

The mathematical theory of a single point-in-time method of computing a "Best Estimate of Trajectory" utilizing reduced x, y, z data from two or more instruments is developed using the minimum variance criterion. A technique which has proven adequate for estimation of systematic errors and obtaining an estimate of the best position and best velocity data from several instrumentation systems is discussed. Related topics such as editing of input data, reduction to common tracking point and accuracy of the method are also included. (Author)

Allied Research Associates, Inc., Boston, Mass.
LAUNCHING OF AIRBORNE MISSILES UNDERWATER. PART III. NOTE ON LATERAL HYDRODYNAMIC FORCES DUE TO THE FREE SURFACE, by Theodore R. Goodman. Rept. on Contract Nonr-2343(00). 1 Aug 59, 10p. 1 ref. Document no. ARA-653; AD-219 758.
Order from LC mi$1.80, ph$1.80 PB 147 711

When an airborne missile is propelled from a submerged submarine it must pass from the air environment of the submarine into the water environment of the sea. Subsequently, it must pass from the sea to the atmosphere. Both as it enters and as it leaves the sea it passes through a free surface. The hydrodynamic coefficients and the buoyancy are constant when the missile is fully submerged, but are time-dependent when the missile is in the neighborhood of the free surface. It is the objective of this note to discuss when free surface effects are significant and to derive the variation in the hydrodynamic coefficients during that time. (See also PB 144 117)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE USE OF WIND-MEASURING SET AN/GMQ-17() TO MEASURE THE ROCKET WIND FOR THE HONEST JOHN ROCKET, by Walter Conover. 1 Apr 59, 12p. 3 refs. USASRDL Technical rept. 2024.
Order from LC mi$2.40, ph$3.30 PB 146 293

A theoretical technique is described for using Wind-Measuring Set AN/GMQ-17() (the shooting-sphere anemometer) to measure a weighted low-level wind for the Honest John rocket. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A MULTIPURPOSE OPTICAL TRACKING AND RECORDING INSTRUMENT, by S. M. Lipton. May 53, 20p. 1 ref. Memo. rept. no. 688; AD-18 420.
Order from LC mi$2.40, ph$3.30 PB 148 645

A new tracking telescope type of optical recording instrument was developed for missile programs. The instrument consists of a telescopic main optical system, a motion picture camera, auxiliary guiding telescopes, a mount which moves the telescopes and camera in azimuth and elevation, and auxiliary electrical and electronic equipment. The mount must be capable of 360° azimuth rotation and slightly more than 90° elevation rotation. The instrument may be used as a cinetheodolite of moderate precision since the design and construction of the basic mount provide sufficient accuracy.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ORBITAL DATA HANDLING AND PRESENTATION, by R. E. A. Putnam. Rept. no. 3 on ARPA Satellite Fence Series. June 59, 12p. BRL Technical note no. 1265.
Order from LC mi$2.40, ph$3.30 PB 146 116

The problem of detecting dark (passive) satellites, utilizing doppler techniques, is accompanied by a need for early satellite identification. The latter requirement necessitates an expeditious handling and classification of orbital data, and a presentation of results in ways that facilitate positive and immediate identification of "strange" satellites. This report is the result of a preliminary study of prospective data handling and presentation procedures. Its purpose is to present the relative merits and limitations of various alternatives proposed, to indicate the particular methods worthy of serious consideration and further study, and to outline the time factors and development costs likely to be involved in procuring prototype equipment. Discussion is limited to a general, rather than to a specific treatment of the subject. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE USE OF PLASTIC SABOTS FOR FREE FLIGHT TESTING, by L. C. MacAllister. May 54, 27p. 4 refs. Memo. rept. no. 782.
Order from LC mi$2.70, ph$4.80 PB 147 839

A description of the use of sabots to adapt winged and/or finned projectiles for gun-launching in free flight range testing is given. Examples of adaptations for 20mm, 37mm, 57mm, 90mm and 155mm guns are described. (Author)

Bliley Electric Co., Erie, Pa.
PRECISION CRYSTAL UNITS FOR SATELLITE USE, by J. M. Wolfskill and R. T. Schlaudecker. Quarterly progress rept. no. 2, 1 Oct-31 Dec 59, on Contract DA 36-039-sc-84556. [1959] 28p.
Order from LC mi$2.70, ph$4.80 PB 147 975

Development of designs for Phase I experimental units. 5th, 7th, 9th overtone units at 100 Mc Double "V" ribbon channel mounting arrangement. Comparison of gold plated and aluminum plated crystals. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus.
WELDED FABRICATION OF STEEL SOLID-PROPELLANT ROCKET-MOTOR CASES, by M. D. Randall, R. E. Monroe, and P. J. Rieppel. 31 May 60, 29p. 28 refs. DMIC memo. 56.
Order from OTS $0.50 PB 161 206

The purpose of this report is to present information in summary form that deals exclusively with solid-propellant rocket-motor cases, and to make recommendations for the welding of these cases. The materials, joint designs, welding processes, welding conditions, and inspection techniques used to fabricate solid-propellant rocket-motor cases will be discussed. This report is limited to: (1) Unclassified information, (2) Information available at the Defense Metals Information Center prior to February 29, 1960, (3) Full-size production or prototype motor cases. As a result of these limitations, some omissions resulting from the unavailability of specific data are probable.

Diamond Ordnance Fuze Labs., Washington, D. C.
180-HOUR AIRBORNE TIMER, by David S. Bettwy, Rai R. Mamoer, and John Furlani. 4 Mar 60, 22p. 1 ref. Technical rept. TR-767.
Order from LC mi$2.70, ph$4.80 PB 147 784

A lightweight program timer was developed for use in the Army lunar probe missiles. The features of this timer include (1) at least 99-percent accuracy for 180-hr operation; (2) programming of switching functions for two independent circuits; (3) operation under 1000-rpm spin; (4) operation after 100-g launching acceleration; and (5) lightweight (0.41 lb). The minimum accuracy of 99 percent was achieved in laboratory tests at room temperatures. Flight tests in a gravity-free environment would be necessary to determine if the timer can operate properly in space. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
AN OPTICAL CAVITY TRIGGERING SCREEN, by Reinhard R. Ulrich. 20 Dec 59, 16p. 2 refs. TR-654.
Order from LC mi$2.40, ph$3.30 PB 146 341

An optical triggering screen suitable for establishing a precise time and position reference to a point on the trajectory of a projectile in flight has been designed and proved effective. By applying an adaptation of the quasi-parallel light principle, a narrow optical detection region of a uniform width of only 1/8 in. was achieved. The detector is a photomultiplier which looks into a light trap cavity. The output pulse produced by the reflection of light off a projectile as it passes through the detection region may serve to trigger a counter, an oscilloscope or another device. The positional reference can be achieved to an accuracy better than ± 0.05 in. regardless of the velocity of the projectile. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PRELIMINARY STUDY OF A BALLISTIC RANGING SYSTEM, by O. Dellasanta and D. L. Hamilton. 19 May 60, 24p. TR-840.
Order from LC mi$2.70, ph$4.80 PB 147 163

A preliminary investigation has been made of a ballistic ranging system using a small caliber rifle and associated optical and electronic equipment. Range finding is accomplished by utilizing bullet ballistics; that is, for a given target range a bullet will require a specific time to reach the target. The bullet flight time is determined by magnetically sensing the bullet as it leaves the gun and optically detecting a flash produced by a spotting charge within the bullet as it strikes the target. Tests indicate that the system should give an accuracy of ± 1 yd at a range of 600 yd and that the spotting charge flash can be detected at distances well over a mile. For many range finding applications the system would be limited only by the operator's ability to hit a target. (Author)

General Electric Co. [Schenectady, N. Y.]
ANALYSIS OF "BOILER" LOX TANK PRESSURIZATION MEANS FOR THE HA-3B, by W. W. Fischer. 10 Apr 53, declassified. 10p. Proj. Hermes Heat Trans. memo. no. 73A.
Order from LC mi$1.80, ph$1.80 PB 147 480

The additional data are the results of thermodynamic calculations. They are presented as a series of tables. Time is utilized as the parameter common to all these tables. The pressurizing gaseous O_2 leaves the vent line and enters the oxidizer tank at the boiler outlet temperature of 290°F.

General Electric Co. [Schenectady, N. Y.]
ANALYSIS OF "BOILERLESS" LOX TANK PRESSURIZATION MEANS FOR THE HA-3B, by Henry J. Sneck and W. W. Fischer. 18 Feb 53, declassified. 20p. Proj. Hermes Heat Trans. memo. no. 72.
Order from LC mi$2.40, ph$3.30 PB 147 478

The calculated thermodynamic data are presented as a series of curves. Included, also, is an approximate comparison of total weight of the systems.

General Electric Co. [Schenectady, N. Y.]
ANALYSIS OF HA-3B OXIDIZER TANK PRESSURIZATION UTILIZING A 0.6 #/sec., 150°F. BOILER OUTPUT, by W. W. Fischer and Nancy D. Fitzroy. 7 Aug 53, declassified. 30p. Proj. Hermes Heat Trans. memo. no. 73B.
Order from LC mi$2.70, ph$4.80 PB 147 481

Object of research was to present the results of a detailed thermodynamic analysis of the Hermes A-3B oxidizer tank pressurization system. Analysis includes prelaunch and powered flight phases of the trajectory. The effects of condensation on the oxidizer tank walls and in the vent line are included as well as the effect of cooling of the pressurizing gas as it flows through the lox vent line from the boiler to the oxidizer tank. Conduction along the oxidizer tank wall and to the forward head, and transient temperature distributions in the tank walls and in the forward head are also included.

General Electric Co. [Schenectady, N. Y.]
COOLING OF HYDRAULIC FIN SERVO MECHANISM, by David J. Masson. 28 Jan 53, 3p. Proj. Hermes Heat Trans. memo. 68A.
Order from LC mi$1.80, ph$1.80 PB 147 473

General Electric Co. [Schenectady, N. Y.]
COOLING OF HYDRAULIC FIN SERVO MECHANISM FOR A-3B, by David J. Masson. 7 Apr 53, declassified. 3p. Proj. Hermes Heat Trans. memo. no. 68C.
Order from LC mi$1.80, ph$1.80 PB 147 474

General Electric Co. [Schenectady, N. Y.]
ESTIMATE OF ELECTRONIC EQUIPMENT SERVICE DURING TESTING FOR HA-3A MISSILES, by Glen E. McIntosh. 12 Jan 53, 2p. Proj. Hermes Heat Transfer memo. no. 70.
Order from LC mi$1.80, ph$1.80 PB 147 476

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE VARIATIONS IN THE ODOMETER COMPARTMENT DURING FLIGHT HA-3A ROUNDS #5-#8, by W. D. Breingan and W. W. Fischer. 31 Oct 52, declassified. 3p. 3 refs. Proj. Hermes Heat Transfer memo. no. 62.
Order from LC mi$1.80, ph$1.80 PB 147 466

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE VARIATIONS IN THE ODOMETER COMPARTMENT DURING FLIGHT HA-3A ROUND #9 ONWARD, by W. D. Breingan and W. W. Fischer. 3 Nov 52, declassified, 5p. 4 refs. Proj. Hermes Heat Trans. memo. no. 63.
Order from LC mi$1.80, ph$1.80 PB 147 467

General Electric Co. [Schenectady, N. Y.]
FORCE AND MOMENT CHARACTERISTICS OF A-3B JET VANE, by R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 29 Dec 53, declassified 28 May 58, 18p. Proj. Hermes A-3B Aerodynamic data memo. no. 18C.
Order from LC mi$2.40, ph$3.30 PB 146 186

This memorandum supersedes A-3B Aerodynamic Data Memoranda 18, 18A and 18B. It presents the latest estimates of all important jet-vane force and moment characteristics. These characteristics include lift, drag, chordwise center of pressure, spanwise center of pressure, base force and couple produced by base forces. In addition the approximate effect of jet-vane erosion upon lift and drag is presented.

General Electric Co.[Schenectady, N. Y.]
INSULATION OF DESTRUCTOR AND PRIMACORD LEADS FOR EMERGENCY FLIGHT INTERRUPTION DEVICE, RV-A-10, by David J. Masson. 19 Nov 52, declassified. 3p. Proj. Hermes Heat Transfer memo. no. 65.
Order from LC mi$1.80, ph$1.80 PB 147 469

General Electric Co. [Schenectady, N. Y.]
PRELIMINARY ESTIMATION OF TRANSIENT TEMPERATURES IN TAIL COMPARTMENT DURING PRE-LAUNCH TESTING, HA-3B, by Helen G. Bass. 27 Jan 53, declassified. 5p. Proj. Hermes Heat Transfer memo. no. 69.
Order from LC mi$1.80, ph$1.80 PB 147 475

General Electric Co. [Schenectady, N. Y.]
TEMPERATURE TESTS OF BEACON RESISTOR BOX, by Robert W. Ottaway and Glen E. McIntosh. 16 Dec 52, 2p. Proj. Hermes Heat Transfer memo. no. 67.
Order from LC mi$1.80, ph$1.80 PB 147 471

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EQUATIONS OF MOTION OF A TUMBLING RE-ENTRY BODY, by E. F. Dobies. Rept. on Contract DA 04-495-ORD-18. 22 Nov 57, 15p. Progress rept. no. 20-339; AD-159 890.
Order from LC mi$2.40, ph$3.30 PB 148 384

A set of equations are presented which may be used to describe the re-entry trajectory of a coasting tumbling rocket. The equations of motion are kept as general as possible, with the exception that the azimuth coordinate is linearized, and coriolis and magnus forces are neglected. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
MINIMUM TRANSFER TIME FOR A POWER-LIMITED ROCKET, by George Leitmann (U. of California). Technical memo. 14 Aug 59, 38p. 41 refs. LMSD-49769; AD-225 924.
Order from LC mi$3.00, ph$6.30 PB 147 680

The problem considered is that of determining the acceleration program leading to minimum transfer time for a power-limited rocket moving between prescribed positions and velocities in a constant gravitational field. It is found that flight must take place at maximum power and that the acceleration components are linear functions of time. The case of rectilinear transfer between positions of rest is treated in detail, and the results are compared with those previously obtained for a constant acceleration transfer. (Author)

Marine Corps Development Center, Quantico, Va.
4.2 INCH MORTAR KIT FOR LVTP6; TEST OF, by A. J. Honeycutt. 2 Dec 57, 16p. MCEB Proj. no. ET-1211; AD-149 141.
Order from LC mi$2.40, ph$3.30 PB 148 253

During the initial firing tests, the following deficiencies occurred: loss of torque in the beam and platform bolts, enlarged traverse lock ring holes, and failures in the block clamp assembly. The deficiencies necessitated temporary suspension of the service test and return of the carrier and the test kit to the contractor for modifications to correct the deficiencies. Subsequent to the modifications being made, engineer tests conducted at Yuma Test Station, Arizona, encountered the same deficiencies that existed during the service test. (Author)

Naval Ordnance Test Station, China Lake, Calif.
PERIODIC SURFACES AND SATELLITE ORBITS, by Stephen P. Diliberto. 1 May 59, 99p. 4 refs. NOTS TP-2153; NAVORD rept. 6445; AD-220 842.
Order from LC mi$5.40, ph$15.30 PB 148 042

A mathematical study of conservative dynamical systems is presented. For the types of systems under consideration the problem studied is that of determining integrals in addition to the energy integral - or equivalently of reducing the order of the equations. A new technique for determining a suitable coordinate system is developed. When applied to the problem of satellite orbits it is shown that certain earlier conclusions are true, but for a wider class of orbits than previously considered. (Author)

Naval Research Lab., Washington, D. C.
THE ACOUSTICAL SPECTRUM AS A TOOL FOR INVESTIGATING THE IMPACT SENSITIVITY OF EXPLOSIVES, by R. C. Bowers and J. B. Romans. Final rept. 9 May 60, 10p. 12 refs. NRL rept. 5466.
Order from LC mi$1.80, ph$1.80 PB 145 242

It has been found possible to use the acoustical spectrum as a tool to distinguish quantitatively between detonation and failure of certain explosive compositions in an impact-sensitivity test machine. The greater resolution obtained by this method is particularly useful when partial decomposition results in low-order explosions that make detection by presently used methods most difficult. Because of the superior resolving power of the method employed, RDX explosive compositions will appear to be more sensitive than when determined by conventional methods. The apparatus consisted primarily of a microphone, an oscilloscope, a sweep-timing mechanism, a sound-conducting tube, and a camera for permanently

recording the sound spectra. Successful use of the apparatus in a study of the mechanisms involved in the the desensitization of RDX explosive compositions revealed that it was possible to make measurements of the time delay between impact and explosion, to record instantaneous sound pressures, and also to estimate the propagation rate of decomposition of the explosive. Study of these properties in greater detail and an investigation of the ultrasonic spectrum would be possible by modifying the apparatus. (Author)

Naval Research Lab., Washington, D. C.
MINITRACK DATA FOR THE ARTIFICIAL EARTH SATELLITES 1958 ALPHA AND 1958 BETA FROM 7 MAY 1958 TO 20 MAY 1958, by W. M. Hocking. Project Vanguard rept. no. 32, Minitract rept. no. 5. 22 Sep 58, 47p. NRL rept. 5198.
Order from LC mi$3.30, ph$7.80 PB 146 092

The information necessary to permit satellite orbit computations from raw Minitrack data is given, and the Minitrack data on the satellites 1958 Alpha and 1958 Beta for the period 7 through 20 May 1958 are presented in appendixes. It is intended that the use of these data will encourage and facilitate the development of new computation techniques. The basic Minitrack measurement and the data message itself are described, and a discussion is made of the handling and preparation of the data message for the Vanguard IBM 704 computer.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
THE DESIGN OF INFRARED EQUIPMENT FOR SATELLITE DETECTION, by Carl F. Borchert. Scientific rept. no. 1 on Contract AF 19(604)4547. Sep 59, 67p. 3 refs. Technical rept. 379; AFCRC-TN-60-255.
Order from LC mi$3.90, ph$10.80 PB 147 907

The problem of observing satellite vehicles with an infrared detector is discussed with emphasis on the design of an optimum ground based detection system. Near infrared radiation due to the passage of a satellite is assumed. Theoretical considerations for obtaining the maximum signal-to-noise ratio from the detecting element are presented with a preliminary comparison of several methods of attack. Consideration is also given to optical systems with large collector diameters and large fields of view. Some preliminary experiments are described. (Author)

Rock Island Arsenal Lab., Ill.
CHARACTERISTICS OF VCI MATERIALS WHEN APPLIED AS PACKAGING MEDIA, by Linden H. Wagner. 6 Apr 60, 18p. Rept. no. 60-1051.
Order from LC mi$2.40, ph$3.30 PB 147 431

This report covers results observed during final examination of Cal. .30 M1 Carbines and component parts after three years in open exposure (tarpaulin covered). These carbines had been packaged in four different volatile corrosion inhibitor materials meeting the requirements of Military Specification MIL-P-3420. There was no evidence of rust on the metallic surfaces of the carbines, slings, magazines, and the oilers. The VCI materials afforded adequate protection during the exposure periods. Each weapon was in a "ready to issue" condition. (Author)

Rock Island Arsenal Lab., Ill.
INVESTIGATION OF HYDROPNEUMATIC RECOIL MECHANISM PACKING SPRING LOADS, by L. R. Raisbeck. 14 Apr 60, 33p. 6 refs. Rept. no. 60-1149.
Order from LC mi$3.00, ph$6.30 PB 147 730

Conventional packings for the 75 MM Pack, 105 MM, 155 MM and 8 Inch Howitzer Hydropneumatic Recoil Mechanism floating pistons were tested in a laboratory fixture to determine the relationship between axial packing load and radial packing pressure at sub-zero, normal, and elevated temperature. Tests were conducted with leather-silver-rubber and Teflon-aluminum-rubber packings. Both types of packings were tested in a 105 MM Howitzer Hydropneumatic Recoil Mechanism to determine the relationship between Belleville spring load and their sealing effectiveness at sub-zero, normal and elevated temperatures under dynamic conditions.

Underwater Explosives Research Lab., Woods Hole Oceanographic Institution, Mass.
PHOTOGRAPHY OF UNDERWATER EXPLOSIONS, II. SUPPLEMENT: PHOTOGRAPHIC STUDIES OF SMALL CHARGES OF BLASTING GELATIN, by J. C. Decius and Elijah Swift, Jr. 15 Sep 47, 13p. 5 refs. NAVORD rept. 416.
Order from LC mi$2.40, ph$3.30 PB 148 667

Both single picture and motion picture techniques have been employed in these experiments. The equipment has been described in previous reports, the only important modifications being the omission of the flash-charge illumination in the case of the single photographs and the use of the motion picture rig at a greater depth than any previously attained. This latter depth was about 900 ft.

Virginia Agricultural Experiment Station, Blacksburg.
MULTIVARIATE SEQUENTIAL PROCEDURES FOR TESTING MEANS, by J. E. Jackson and R. A. Bradley. Technical rept. no. 10 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Aug 59, 136p. 51 refs. AD-225 594.
Order from LC mi$6.90, ph$21.30 PB 148 193

Multivariate sequential inspection schemes are derived for the characteristic averages both for the case where the population variance-covariance matrix is known or assumed to be known, and where it must be estimated from the sample. When the covariance matrix is known, a sequential X^2-test is developed; when the covariance matrix is estimated from the sample, a sequential T^2-test is developed. A review is given of the pertinent literature concerning sequential analysis, the X^2- and T^2-distributions, and some hypergeometric functions. The sequential X^2- and T^2-tests are derived and the related mathematical proofs dealing with the existence and termination of these procedures are given. Some general discussions are given of topics associated with applications of the methods, i.e., the expected sample size required for the procedures, the extension of these procedures to some other multivariate situations, and the problem of relating tolerances to the specifications of the procedures. (Author)

Watertown Arsenal Labs., Mass.
CORRELATION OF TOUGHNESS BETWEEN H-PLATE AND CHARPY IMPACT TESTS, by W. P. Hatch, Jr. Sep 59, 32p. 4 refs. WAL TR 112/96; AD-225 832.
Order from OTS $1.00 PB 151 850

This report covers a post-ballistic metallurgical examination of a series of H-plates made from high and low harndess armor plate of different chemistries. Examination included chemical analyses, macro and microexamination, hardness surveys, and Charpy V notch transition tests of the armors both welded and unwelded. A correlation between transition data and ballistic performance of the H-plates is indicated. (Author)

Sanitation and Safety Engineering

American Machine and Foundry Co., Alexandria, Va.
DEVELOPMENT OF A UNIT FOR RECOVERY OF WATER AND DISPOSAL OR STORAGE OF SOLIDS FROM HUMAN WASTES. PART I. THE STUDY PHASE, by J. D. Zeff and R. A. Bambenek. Rept. on Contract AF 33(616)5783. Nov 59, 55p. 19 refs. WADC Technical rept. 58-562(I).
Order from OTS $1.50 PB 161 809

This report summarizes the results of a laboratory evaluation utilizing known techniques of water purification. Urine and feces were introduced as raw material, and the recovered water was analyzed for solid content, presence of bacteria, color turbidity, pH, and odor. Results of the water analyses indicate that techniques employing a change of phase are best for recovering water from human wastes. A design evaluation of the most successful laboratory techniques was then undertaken. The design considerations indicate that a vacuum distillation system is advantageous on a weight basis, providing the duration of flight is longer than three days and the number of crew is not more than two men. Compression distillation was found to be advantageous if the number of crew was larger than two and the duration of flight longer than seven days. It was found that vacuum distillation can utilize the excess heat of the cabin as energy, whereas the compression distillation energy requirement is ten watts of electrical energy per man per day. (Author)

Electric Boat Div., General Dynamics Corp., Groton, Conn.
SELECTION OF AN ALGA FOR A PHOTOSYNTHETIC GAS EXCHANGER, by R. J. Benoit, F. Trainor, and A. Bialecki. Rept., Phase I, 16 Mar-15 July 59, on Equipment for Life Support in Aerospace, Contract AF 33(616)6344. Feb 60, 36p. 16 refs. WADD Technical rept. 60-163.
Order from OTS $1.00 PB 161 806

A detailed survey of the plant kingdom and an examination of the requirements for an effective photosynthetic gas exchanger for closed-cycle ecological systems reveal that the unicellular nonmotile (coccoid) algae stand out above all other plant forms for use in an apparatus employing a suspension of cells in a liquid growth medium. The possibility of the effective use of a system in which plants are grown on moist surfaces is explored. Of the few strains or species of coccoid algae that are well studied, a thermophilic strain of Chlorella seems to have the best combination of desirable characteristics for the closed cycle application. Nevertheless, an intense industrial-scale screening program for the discovery of even better strains of algae is suggested. (Author)

Northwestern Technological Inst., Evanston, Ill.
A NEW METHOD OF WASTE DISPOSAL FOR ISOLATED SITES IN THE ARCTIC. II, by John A. Logan. Rept. for 30 Sep-31 Dec 58 on Contract AF 41(657)207. May 59, 10p. Technical note AAL TN-59-6; AD-230 844.
Order from LC mi$1.80, ph$1.80 PB 146 118

Burner tests were conducted to determine requirements for a prototype oil carriage waste disposal unit. A metering system incorporating a positive displacement pump with a variable speed control was designed to replace the pressurized orifice metering system. The new system was operated for 6 hr with the sludge-oil slurry. The sludge-paper-oil slurry was burned for 5 hr at concentrations from 2 to 25% waste. The rotary cup tended to clog within about 15 min when concentrations approaching 20% were used. Fibrous waste components which accumulated behind the impeller and in the cup were easily removed. The fibrous accumulation appeared only with high concentrations, but the runs were of short duration. At low concentrations (10% or less) the oil appeared to scavenge the cup completely. Six hours running at these low concentrations seemed to indicate that clogging did not occur. Combustion appeared to be no problem with ground garbage.

Rome Air Development Center, Griffiss AFB, N. Y.
SPRAY-IN-PLACE SHELTERS, by Anthony F. Gurdo, Joseph M. Schramp and others. Mar 60, 33p. RADC-TN-60-40.
Order from OTS $1.00 PB 161 780

This report covers in-the-house efforts to develop a field fabrication kit for erecting personnel and/or storage shelters on site in-the-field. It describes fabrication techniques, equipments, and materials used and the structural design analysis used as a criteria for a specific configuration fabricated. (Author)

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Army Engineer Research and Development Labs., Fort Belvoir, Va.
EXPERIMENTAL PACKAGING FOR PROJECT MASS, by T. R. Eiler. 26 Jan 60, 37p. Rept. 1617-TR.
Order from LC mi$3.00, ph$6.30 PB 147 845

The following conclusions are applicable to the packaging of CE small repair parts for supply to troops in Europe by a MASS type of operation: (a) compared to present overseas packaging practice, only minimum preservation is required for MASS operations; (b) significant economy and simplification of packaging

An optical triggering screen suitable for establishing a precise time and position reference to a point on the trajectory of a projectile in flight has been designed and proved effective. By applying an adaptation of the quasi-parallel light principle, a narrow optical detection region of a uniform width of only 1/8 in. was achieved. The detector is a photomultiplier which looks into a light trap cavity. The output pulse produced by the reflection of light off a projectile as it passes through the detection region may serve to trigger a counter, an oscilloscope or another device. The positional reference can be achieved to an accuracy better than ± 0.05 in., regardless of the velocity of the projectile. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PRELIMINARY STUDY OF A BALLISTIC RANGING SYSTEM, by O. Dellasanta and D. L. Hamilton. 19 May 60, 24p. TR-540.
Order from LC mi$2.70, ph$4.80 PB 147 163

A preliminary investigation has been made of a ballistic ranging system using a small caliber rifle and associated optical and electronic equipment. Range finding is accomplished by utilizing bullet ballistics; that is, for a given target range a bullet will require a specific time to reach the target. The bullet flight time is determined by magnetically sensing the bullet as it leaves the gun and optically detecting a flash produced by a spotting charge within the bullet as it strikes the target. Tests indicate that the system should give an accuracy of ± 1 yd at a range of 600 yd and that the spotting charge flash can be detected at distances well over a mile. For many range finding applications the system would be limited only by the operator's ability to hit a target. (Author)

General Electric Co. [Schenectady, N. Y.]
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Order from LC mi$1.80, ph$1.80 PB 147 480

The additional data are the results of thermodynamic calculations. They are presented as a series of tables. Time is utilized as the parameter common to all these tables. The pressurizing gaseous O_2 leaves the vent line and enters the oxidizer tank at the boiler outlet temperature of 290°F.

General Electric Co. [Schenectady, N. Y.]
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General Electric Co. [Schenectady, N. Y.]
ANALYSIS OF HA-3B OXIDIZER TANK PRESSURIZATION UTILIZING A 0.6 #/sec., 1500F BOILER OUTPUT, by W. W. Fischer and Nancy D. Fitzroy. 7 Aug 53, declassified. 30p. Proj. Hermes Heat Trans. memo. no. 73B.
Order from LC mi$2.70, ph$4.80 PB 147 481

Object of research was to present the results of a detailed thermodynamic analysis of the Hermes A-3B oxidizer tank pressurization system. Analysis includes prelaunch and powered flight phases of the trajectory. The effects of condensation on the oxidizer tank walls and in the vent line are included as well as the effect of cooling of the pressurizing gas as it flows through the ion vent line from the boiler to the oxidizer tank. Conduction along the oxidizer tank wall and to the forward head, and transient temperature distributions in the tank walls and in the forward head are also included.

General Electric Co. [Schenectady, N. Y.]
COOLING OF HYDRAULIC FIN SERVO MECHANISM, by David J. Masson. 28 Jan 53, 3p. Proj. Hermes Heat Trans. memo. 68A.
Order from LC mi$1.80, ph$1.80 PB 147 473

General Electric Co. [Schenectady, N. Y.]
COOLING OF HYDRAULIC FIN SERVO MECHANISM FOR A-3B, by David J. Masson. 7 Apr 53, declassified. 3p. Proj. Hermes Heat Trans. memo. no. 68C.
Order from LC mi$1.80, ph$1.80 PB 147 474

General Electric Co. [Schenectady, N. Y.]
ESTIMATE OF ELECTRONIC EQUIPMENT SERVICE DURING TESTING FOR HA-3A MISSILES, by Glen E. McIntosh. 12 Jan 53, 2p. Proj. Hermes Heat Transfer memo. no. 70.
Order from LC mi$1.80, ph$1.80 PB 147 476

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE VARIATIONS IN THE ODOMETER COMPARTMENT DURING FLIGHT HA-3A ROUNDS #5-#8, by W. D. Breingan and W. W. Fischer. 31 Oct 52, declassified. 3p. 3 refs. Proj. Hermes Heat Transfer memo. no. 62.
Order from LC mi$1.80, ph$1.80 PB 147 466

General Electric Co. [Schenectady, N. Y.]
ESTIMATION OF TEMPERATURE VARIATIONS IN THE ODOMETER COMPARTMENT DURING FLIGHT HA-3A ROUND #9 ONWARD, by W. D. Breingan and W. W. Fischer. 3 Nov 52, declassified, 5p. 4 refs. Proj. Hermes Heat Trans. memo. no. 63.
Order from LC mi$1.80, ph$1.80 PB 147 467

General Electric Co. [Schenectady, N. Y.]
FORCE AND MOMENT CHARACTERISTICS OF A-3B JET VANE, by R. E. Geiger. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 29 Dec 53, declassified 28 May 58, 18p. Proj. Hermes A-3B Aerodynamic data memo. no. 18C.
Order from LC mi$2.40, ph$3.30 PB 146 186

This memorandum supersedes A-3B Aerodynamic Data Memoranda 18, 18A and 18B. It presents the latest estimates of all important jet-vane force and moment characteristics. These characteristics include lift, drag, chordwise center of pressure, spanwise center of pressure, base force and couple produced by base forces. In addition the approximate effect of jet-vane erosion upon lift and drag is presented.

General Electric Co. [Schenectady, N. Y.]
INSULATION OF DESTRUCTOR AND PRIMACORD LEADS FOR EMERGENCY FLIGHT INTERRUPTION DEVICE, RV-A-10, by David J. Masson. 19 Nov 52, declassified. 3p. Proj. Hermes Heat Transfer memo no. 65.
Order from LC mi$1.80, ph$1.80 PB 147 469

General Electric Co. [Schenectady, N. Y.]
PRELIMINARY ESTIMATION OF TRANSIENT TEMPERATURES IN TAIL COMPARTMENT DURING PRE-LAUNCH TESTING, HA-3B, by Helen G. Bass. 27 Jan 53, declassified. 5p. Proj. Hermes Heat Transfer memo. no. 69.
Order from LC mi$1.80, ph$1.80 PB 147 475

General Electric Co. [Schenectady, N. Y.]
TEMPERATURE TESTS OF BEACON RESISTOR BOX, by Robert W. Ottaway and Glen E. McIntosh. 16 Dec 52, 2p. Proj. Hermes Heat Transfer memo. no. 67.
Order from LC mi$1.80, ph$1.80 PB 147 471

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EQUATIONS OF MOTION OF A TUMBLING RE-ENTRY BODY, by E. F. Dobies. Rept. on Contract DA 04-495-ORD-18. 22 Nov 57, 15p. Progress rept. no. 20-339; AD-159 890.
Order from LC mi$2.40, ph$3.30 PB 148 384

A set of equations are presented which may be used to describe the re-entry trajectory of a coasting tumbling rocket. The equations of motion are kept as general as possible, with the exception that the azimuth coordinate is linearized, and coriolis and magnus forces are neglected. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
MINIMUM TRANSFER TIME FOR A POWER-LIMITED ROCKET, by George Leitmann (U. of California). Technical memo. 14 Aug 59, 38p. 41 refs. LMSD-49769; AD-225 924.
Order from LC mi$3.00, ph$6.30 PB 147 680

The problem considered is that of determining the acceleration program leading to minimum transfer time for a power-limited rocket moving between prescribed positions and velocities in a constant gravitational field. It is found that flight must take place at maximum power and that the acceleration components are linear functions of time. The case of rectilinear transfer between positions of rest is treated in detail, and the results are compared with those previously obtained for a constant acceleration transfer. (Author)

Marine Corps Development Center, Quantico, Va.
4.2 INCH MORTAR KIT FOR LVTP6, TEST OF, by A. J. Honeycutt. 2 Dec 57, 16p. MCEB Proj. no. ET-1211, AD-149 141.
Order from LC mi$2.40, ph$3.30 PB 148 253

During the initial firing tests, the following deficiencies occurred: loss of torque in the beam and platform bolts, enlarged traverse lock ring holes, and failures in the block clamp assembly. The deficiencies necessitated temporary suspension of the service test and return of the carrier and the test kit to the contractor for modifications to correct the deficiencies. Subsequent to the modifications being made, engineer tests conducted at Yuma Test Station, Arizona, encountered the same deficiencies that existed during the service test. (Author)

Naval Ordnance Test Station, China Lake, Calif.
PERIODIC SURFACES AND SATELLITE ORBITS, by Stephen P. Diliberto. 1 May 59, 99p. 4 refs. NOTS TP-2153; NAVORD rept. 6445; AD-220 842.
Order from LC mi$5.40, ph$15.30 PB 148 042

A mathematical study of conservative dynamical systems is presented. For the types of systems under consideration the problem studied is that of determining integrals in addition to the energy integral - or equivalently of reducing the order of the equations. A new technique for determining a suitable coordinate system is developed. When applied to the problem of satellite orbits it is shown that certain earlier conclusions are true, but for a wider class of orbits than previously considered. (Author)

Naval Research Lab., Washington, D. C.
THE ACOUSTICAL SPECTRUM AS A TOOL FOR INVESTIGATING THE IMPACT SENSITIVITY OF EXPLOSIVES, by R. C. Bowers and J. B. Romans. Final rept. 9 May 60, 10p. 12 refs. NRL rept. 5466.
Order from LC mi$1.80, ph$1.80 PB 145 242

It has been found possible to use the acoustical spectrum as a tool to distinguish quantitatively between detonation and failure of certain explosive compositions in an impact-sensitivity test machine. The greater resolution obtained by this method is particularly useful when partial decomposition results in low-order explosions that make detection by presently used methods most difficult. Because of the superior resolving power of the method employed, RDX explosive compositions will appear to be more sensitive than when determined by conventional methods. The apparatus consisted primarily of a microphone, an oscilloscope, a sweep-timing mechanism, a sound-conducting tube, and a camera for permanently

recording the sound spectra. Successful use of the apparatus in a study of the mechanisms involved in the the desensitization of RDX explosive compositions revealed that it was possible to make measurements of the time delay between impact and explosion, to record instantaneous sound pressures, and also to estimate the propagation rate of decomposition of the explosive. Study of these properties in greater detail and an investigation of the ultrasonic spectrum would be possible by modifying the apparatus. (Author)

Naval Research Lab., Washington, D. C.
MINITRACK DATA FOR THE ARTIFICIAL EARTH SATELLITES 1958 ALPHA AND 1958 BETA FROM 7 MAY 1958 TO 20 MAY 1958, by W. M. Hocking. Project Vanguard rept. no. 32, Minitract rept. no. 5. 22 Sep 58, 47p. NRL rept. 5198.
Order from LC mi$3.30, ph$7.80 PB 146 092

The information necessary to permit satellite orbit computations from raw Minitrack data is given, and the Minitrack data on the satellites 1958 Alpha and 1958 Beta for the period 7 through 20 May 1958 are presented in appendixes. It is intended that the use of these data will encourage and facilitate the development of new computation techniques. The basic Minitrack measurement and the data message itself are described, and a discussion is made of the handling and preparation of the data message for the Vanguard IBM 704 computer.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
THE DESIGN OF INFRARED EQUIPMENT FOR SATELLITE DETECTION, by Carl F. Borchert. Scientific rept. no. 1 on Contract AF 19(604)4547. Sep 59, 67p. 3 refs. Technical rept. 379; AFCRC-TN-60-255.
Order from LC mi$3.90, ph$10.80 PB 147 907

The problem of observing satellite vehicles with an infrared detector is discussed with emphasis on the design of an optimum ground based detection system. Near infrared radiation due to the passage of a satellite is assumed. Theoretical considerations for obtaining the maximum signal-to-noise ratio from the detecting element are presented with a preliminary comparison of several methods of attack. Consideration is also given to optical systems with large collector diameters and large fields of view. Some preliminary experiments are described. (Author)

Rock Island Arsenal Lab., Ill.
CHARACTERISTICS OF VCI MATERIALS WHEN APPLIED AS PACKAGING MEDIA, by Linden H. Wagner. 6 Apr 60, 18p. Rept. no. 60-1051.
Order from LC mi$2.40, ph$3.30 PB 147 431

This report covers results observed during final examination of Cal. .30 M1 Carbines and component parts after three years in open exposure (tarpaulin covered). These carbines had been packaged in four different volatile corrosion inhibitor materials meeting the requirements of Military Specification MIL-P-3420. There was no evidence of rust on the metallic surfaces of the carbines, slings, magazines, and the oilers. The VCI materials afforded adequate protection during the exposure periods. Each weapon was in a "ready to issue" condition. (Author)

Rock Island Arsenal Lab., Ill.
INVESTIGATION OF HYDROPNEUMATIC RECOIL MECHANISM PACKING SPRING LOADS, by L. R. Raisbeck. 14 Apr 60, 33p. 6 refs. Rept. no. 60-1149.
Order from LC mi$3.00, ph$6.30 PB 147 730

Conventional packings for the 75 MM Pack, 105 MM, 155 MM and 8 Inch Howitzer Hydropneumatic Recoil Mechanism floating pistons were tested in a laboratory fixture to determine the relationship between axial packing load and radial packing pressure at subzero, normal, and elevated temperature. Tests were conducted with leather-silver-rubber and Teflon-aluminum-rubber packings. Both types of packings were tested in a 105 MM Howitzer Hydropneumatic Recoil Mechanism to determine the relationship between Belleville spring load and their sealing effectiveness at sub-zero, normal and elevated temperatures under dynamic conditions.

Underwater Explosives Research Lab., Woods Hole Oceanographic Institution, Mass.
PHOTOGRAPHY OF UNDERWATER EXPLOSIONS, II. SUPPLEMENT: PHOTOGRAPHIC STUDIES OF SMALL CHARGES OF BLASTING GELATIN, by J. C. Decius and Elijah Swift, Jr. 15 Sep 47, 13p. 5 refs. NAVORD rept. 416.
Order from LC mi$2.40, ph$3.30 PB 148 667

Both single picture and motion picture techniques have been employed in these experiments. The equipment has been described in previous reports, the only important modifications being the omission of the flash-charge illumination in the case of the single photographs and the use of the motion picture rig at a greater depth than any previously attained. This latter depth was about 900 ft.

Virginia Agricultural Experiment Station, Blacksburg.
MULTIVARIATE SEQUENTIAL PROCEDURES FOR TESTING MEANS, by J. E. Jackson and R. A. Bradley. Technical rept. no. 10 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Aug 59, 136p. 51 refs. AD-225 594.
Order from LC mi$6.90, ph$21.30 PB 148 193

Multivariate sequential inspection schemes are derived for the characteristic averages both for the case where the population variance-covariance matrix is known or assumed to be known, and where it must be estimated from the sample. When the covariance matrix is known, a sequential X^2-test is developed; when the covariance matrix is estimated from the sample, a sequential T^2-test is developed. A review is given of the pertinent literature concerning sequential analysis, the X^2- and T^2-distributions, and some hypergeometric functions. The sequential X^2- and T^2-tests are derived and the related mathematical proofs dealing with the existence and termination of these procedures are given. Some general discussions are given of topics associated with applications of the methods, i.e., the expected sample size required for the procedures, the extension of these procedures to some other multivariate situations, and the problem of relating tolerances to the specifications of the procedures. (Author)

Watertown Arsenal Labs., Mass.
CORRELATION OF TOUGHNESS BETWEEN H-PLATE AND CHARPY IMPACT TESTS, by W. P. Hatch, Jr. Sep 59, 32p. 4 refs. WAL TR 112/96; AD-225 832.
Order from OTS $1.00 PB 151 850

This report covers a post-ballistic metallurgical examination of a series of H-plates made from high and low harndess armor plate of different chemistries. Examination included chemical analyses, macro and microexamination, hardness surveys, and Charpy V notch transition tests of the armors both welded and unwelded. A correlation between transition data and ballistic performance of the H-plates is indicated. (Author)

Sanitation and Safety Engineering

American Machine and Foundry Co., Alexandria, Va.
DEVELOPMENT OF A UNIT FOR RECOVERY OF WATER AND DISPOSAL OR STORAGE OF SOLIDS FROM HUMAN WASTES. PART I. THE STUDY PHASE, by J. D. Zeff and R. A. Bambenek. Rept. on Contract AF 33(616)5783. Nov 59, 55p. 19 refs. WADC Technical rept. 58-562(I).
Order from OTS $1.50 PB 161 809

This report summarizes the results of a laboratory evaluation utilizing known techniques of water purification. Urine and feces were introduced as raw material, and the recovered water was analyzed for solid content, presence of bacteria, color turbidity, pH, and odor. Results of the water analyses indicate that techniques employing a change of phase are best for recovering water from human wastes. A design evaluation of the most successful laboratory techniques was then undertaken. The design considerations indicate that a vacuum distillation system is advantageous on a weight basis, providing the duration of flight is longer than three days and the number of crew is not more than two men. Compression distillation was found to be advantageous if the number of crew was larger than two and the duration of flight longer than seven days. It was found that vacuum distillation can utilize the excess heat of the cabin as energy, whereas the compression distillation energy requirement is ten watts of electrical energy per man per day. (Author)

Electric Boat Div., General Dynamics Corp., Groton, Conn.
SELECTION OF AN ALGA FOR A PHOTOSYNTHETIC GAS EXCHANGER, by R. J. Benoit, F. Trainor, and A. Bialecki. Rept., Phase I, 16 Mar 15 July 59, on Equipment for Life Support in Aerospace, Contract AF 33(616)6344. Feb 60, 36p. 16 refs. WADD Technical rept. 60-163.
Order from OTS $1.00 PB 161 806

A detailed survey of the plant kingdom and an examination of the requirements for an effective photosynthetic gas exchanger for closed-cycle ecological systems reveal that the unicellular nonmotile (coccoid) algae stand out above all other plant forms for use in an apparatus employing a suspension of cells in a liquid growth medium. The possibility of the effective use of a system in which plants are grown on moist surfaces is explored. Of the few strains or species of coccoid algae that are well studied, a thermophilic strain of Chlorella seems to have the best combination of desirable characteristics for the closed cycle application. Nevertheless, an intense industrial-scale screening program for the discovery of even better strains of algae is suggested. (Author)

Northwestern Technological Inst., Evanston, Ill.
A NEW METHOD OF WASTE DISPOSAL FOR ISOLATED SITES IN THE ARCTIC. II, by John A. Logan. Rept. for 30 Sep-31 Dec 58 on Contract AF 41(657)207. May 59, 10p. Technical note AAL TN-59-6; AD-230 844.
Order from LC mi$1.80, ph$1.80 PB 146 118

Burner tests were conducted to determine requirements for a prototype oil carriage waste disposal unit. A metering system incorporating a positive displacement pump with a variable speed control was designed to replace the pressurized orifice metering system. The new system was operated for 6 hr with the sludge-oil slurry. The sludge-paper-oil slurry was burned for 5 hr at concentrations from 2 to 25% waste. The rotary cup tended to clog within about 15 min when concentrations approaching 20% were used. Fibrous waste components which accumulated behind the impeller and in the cup were easily removed. The fibrous accumulation appeared only with high concentrations, but the runs were of short duration. At low concentrations (10% or less) the oil appeared to scavenge the cup completely. Six hours running at these low concentrations seemed to indicate that clogging did not occur. Combustion appeared to be no problem with ground garbage.

Rome Air Development Center, Griffiss AFB, N. Y.
SPRAY-IN-PLACE SHELTERS, by Anthony F. Gurdo, Joseph M. Schramp and others. Mar 60, 33p. RADC-TN-60-40.
Order from OTS $1.00 PB 161 780

This report covers in-the-house efforts to develop a field fabrication kit for erecting personnel and/or storage shelters on site in-the-field. It describes fabrication techniques, equipments, and materials used and the structural design analysis used as a criteria for a specific configuration fabricated. (Author)

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Army Engineer Research and Development Labs., Fort Belvoir, Va.
EXPERIMENTAL PACKAGING FOR PROJECT MASS, by T. R. Eiler. 26 Jan 60, 37p. Rept. 1617-TR.
Order from LC mi$3.00, ph$6.30 PB 147 845

The following conclusions are applicable to the packaging of CE small repair parts for supply to troops in Europe by a MASS type of operation: (a) compared to present overseas packaging practice, only minimum preservation is required for MASS operations; (b) significant economy and simplification of packaging

result from reduced preservation and packing; (c) all methods tested are compatible with current depot packaging facilities and procedures; (d) eight of the 46 preservative methods tested will provide adequate preservation for most parts; (e) mode of shipment was not a determining factor in the performance of the methods of preservation; (f) the absolute minimum preservation required was not determined because of the negligible failure rate of all tested preservation methods; (g) shipping containers of water-resistant fiberboard are adequate for most shipments; (h) wood boxes can be replaced as containers for most consolidated loads up to 600 pounds by triple-wall fiberboard boxes; and (i) shipping containers in excess of 15-cubic-foot capacity are seldom required. (Author)

Food

Arctic Aeromedical Lab., Ladd AFB, Alaska.
EFFECT OF REPEATED FREEZING AND THAWING ON "C" RATIONS, by Jack D. Douglas. May 59, 7p. Technical note AAL-TN-59-7; AD-230 845.
Order from LC mi$1.80, ph$1.80 PB 146 117

A pilot study was undertaken to determine the extent of damage to C ration cans incurred during the process of freezing and thawing. Results indicated that the freezing of C ration components does not produce mechanical damage to the cans in which these components packed. Freezing does produce a physical breakdown in the components which results in a ration of lowered palatability. It was felt that freezing per se of C rations did not create a hazard to health. The physical changes produced when coupled with improper handling of the rations could facilitate bacterial action.

Naval Supply Research and Development Facility, Bayonne, N. J.
EFFECT OF COOKING AND BAKING PROCESSES ON THE STERILIZATION OF FOOD CONTAMINATED WITH BACTERIAL SPORES, by Richard R. Barton. Final rept. on Shipboard Subsistence, Proj. NT002024(CR53-89). 10 Aug 53, 43p.
Order from LC mi$3.30, ph$7.80 PB 148 038

The object of the work is to determine the ability of standard cooking procedures to sterilize foods contaminated with spores of the non-toxic bacteriological warfare simulant, Bacillus globigii. Modifications of standard cooking procedures will be developed for those foods which cannot be sterilized with standard procedures.

Vanderbilt U. School of Medicine, Nashville, Tenn.
LONG-TERM DOG FEEDING EXPERIMENT ON IRRADIATED CHICKEN, BEEF, AND JAM, by Frank R. Blood, William J. Darby and others. Progress rept. no. 1, 1 Feb 57-17 Mar 58, on Contract DA 49-007-MD-779. [1958] 14p. 3 refs.
Order from LC mi$2.40, ph$3.30 PB 148 056

Forty AKC registered beagle puppies were obtained from the Harris Hill Kennels, Elmira, New York. Seven male and seven female puppies were received 7 November 1957 and thirteen males and thirteen female puppies 13 November 1957. After a period of acclimation, the dogs were randomly divided into nine groups with two females and two males in each group; four animals were held for replacement. Feeding consists of a diet containing 35% solids of chicken, beef, or jam irradiated at 2.79×10^6 rads (X-irradiation), 5.58×10^6 rads (2 X-irradiation), and non-irradiated (control) incorporated with Purina laboratory meal. The feeding is in its twelfth week and no effects due to toxicity of the irradiated foods have been noted. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Arnold Engineering Development Center [Tullahoma, Tenn.]
THE DYNAMIC PERFORMANCE OF EFT-B CLIMATIC PRESSURE CONTROL SYSTEMS, by W. K. McGregor, Jr. and L. F. Burns, Jr. Rept. on ARO, Inc., Contract 40(600)700 S/A 13(59-1). Nov 58, 55p. 2 refs. AEDC TR-58-11; AD-204 622.
Order from LC mi$3.60, ph$9.30 PB 146 114

The transient performance of the climatic pressure control systems of the Engine Test Facility, Basic Plant, has been analytically and experimentally defined and found to be in close agreement. The closed loop frequency response at any operating point of the air side pressure system exhibits an amplitude ratio down 3 db at 2.5 rad/sec and the exhaust pressure system down 3 db at 4 rad/sec. The maximum rates of change of pressures available for trajectory testing are dependent upon engine weight flow and can be calculated. Agreement of the calculation with experimental values is demonstrated, and an expedient method is devised to predict these rates. Typical maximum rates for a 200 lb/sec engine are exhaust pressure rate +1.5 and -2.1 psi/sec and air side pressure rate +0.5 and -0.4 psi/sec. Either inlet or exhaust pressure systems are capable of recovering to within two percent of setpoint in less than 10 sec in the case of instantaneous simulated engine flow changes up to 140 lb/sec. For small changes which do not cause the valves to travel to their extreme positions, the recovery time is about 2 sec. Typical engine accelerations introduce transient deviations as high as 2 percent while deviations for instantaneous disturbances may be as high as 20 percent. (Author)

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
HEAT TRANSFER EFFICIENCY OF AUTOMOTIVE ENGINE COOLANTS, by Halkey K. Ross. 17 Mar 60, 26p. 8 refs. Rept. no. CCL-90.
Order from OTS $0.75 PB 161 476

This report investigates the heat transfer properties and thermal capacities of several selected liquid mixtures and explores the possibilities of improving the presently used engine coolants with reference to cooling efficiency. A special calorimeter was constructed and specific heats of glycol-water mixtures, methanol-water mixtures, and methyl ethyl ketone-water mixtures were determined. An apparatus based on the method described by Hutchinson was built and thermal conductivities of these selected mixtures were determined. There is no promising indication that any worthwhile improvement can be made over presently used coolants with respect to heat transfer efficiency, and no mixture approaches the efficiency of water in the range of operating temperatures in the present internal combustion engines. It is recommended that improvements in heat dissipating efficiency of internal combustion engines be sought in radiator and heat exchanger designs. It may be necessary to make radical departures from the present design of radiators, both in detail and overall configuration and location in the vehicle. The greatest benefit would be realized if a substantial improvement in the thermal efficiency of the engine itself could be realized. (Author)

National Research Labs., Ottawa (Canada).
TURBOJET THRUST AUGMENTATION: FLIGHT TEST RESULTS FROM A REHEAT SYSTEM EMPLOYING FUEL INJECTION UPSTREAM OF A TWO-STAGE TURBINE, by E. P. Cockshutt, D. F. Daw and others. Jan 60, 59p. 12 refs. Aeronautical rept. LR-272.
Order from LC mi$3.60, ph$9.30 PB 147 735

The system was fitted to an Orenda 14 engine installed in a Sabre 6 aircraft. The reheat system was stable over the range of conditions explored, and operated satisfactorily at the ceiling of the aircraft with a tail-pipe static pressure of 3.85 p.s.i.a. A net thrust boost of 32 percent was obtained at a flight Mach number of 0.82. Combustion efficiency decreased slowly from 86 percent at sea level static to 79 percent at 50,000 feet. With the fixed oversize reheat nozzle, consistent relights were obtained up to 45,000 feet (corresponding to an altitude of 52,000 feet with a variable area nozzle in the closed position). Above 45,000 feet, results were erratic. No serious mechanical or performance troubles attributable to pre-turbine injection of the reheat fuel were experienced. (Author)

Princeton U., N. J.
GAS DYNAMIC PROCESSES INVOLVING SUSPENDED SOLIDS, by S. L. Soo. Rept. on Project Squid, Contract Nonr-1858(25). Aug 59, 43p. 9 refs. Technical rept. PR-99-P; AD-227 904.
Order from LC mi$3.30, ph$7.80 PB 147 704

Basic gas dynamic equations involving suspended solid particles were formulated. Considerations include momentum and heat transfer between the gaseous phase and the solid phase. Significance of these contributions was illustrated with the case of expansion through a de Laval nozzle. Duct flow and normal shock problems were also discussed. Extent of earlier methods of approximation were pointed out. (Author)

Reaction Motors Div., Thiokol Chemical Corp., Denville, N. J.
HEAVY PARTICLE PROPULSION RESEARCH, by Raymond E. Weich, Jr. Rept. for 1 July-31 Dec 59 on Contract AF 49(638)657. [1960] 67p. 4 refs. Rept. RMD-1155-S2; AFOSR-TR-60-48.
Order from LC mi$3.90, ph$10.80 PB 147 519

Earlier work was primarily concerned with the generation of charged heavy particles from the liquid state. Various particle generator cells were tried, all of which performed the dual operation of charge and spray. The experimental work was limited to the generation of charged heavy particles from the solid state. The general problems of particle charging mechanisms and the effect of charge-to-mass ratio distribution upon power-plant performance were theoretically investigated. Based upon theoretical conclusions, an experimental steady flow unit was constructed. The approximate characteristics of the research unit are: mass flow rate $\doteq$ 1 milligram/sec, thrust $\doteq$ 50 to 150 dynes (voltage sensitive), performance $\doteq$ 100 sec (voltage sensitive), and a propellant of iron powder (300 Angstrom mean diameter).

Manufacturing Equipment and Processes

Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC WELDING OF STRUCTURAL ALUMINUM ALLOYS. Bi-monthly rept. no. 6, 21 Nov 57-20 Jan 58, on Contract NOas-57-480-c. Feb 58, 3p. AD-161 341.
Order from LC mi$1.80, ph$1.80 PB 148 457

Fatigue test specimens of monometal 5- x 9-3/4-in. panels of 0.050-in. 2024-T3 and 7075-T6 Al alloy are being prepared with 2 rows of staggered welds in the 2-1/4-in. overlap.

Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC WELDING SURVEY REPORT AND ULTRASONIC WELDING EQUIPMENT MANUAL, by W. C. Potthoff and H. L. McKaig. Rept. for 1 Dec 57-1 Dec 58 on Contract NOas 58-108-c. May 59, 26p. Research rept. no. 59-106.
Order from LC mi$2.70, ph$4.80 PB 147 625

Alfred U., N. Y.
RESISTANCE HOT PRESSING. Technical rept. on Contract Nonr-2407(00). Aug 59, 30p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 147 689

Resistance hot pressing of multi-component systems of metals, intermetallics and oxides has been developed as a very successful method of producing dense materials. Two types of resistance furnaces have been utilized: one is a water-cooled, metal-enclosed assembly for very rapid pressing in graphite resistance dies; the other uses graphite resistance dies, insulated with ceramic products, and will form much larger specimens. In many aspects, resistance hot pressing offers definite advantages over sintering methods and induction hot pressing. (Author)

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF HIGH TEMPERATURE DIE MATERIALS (HOT DIE MATERIALS) by H. R. Nichols W. H. Graft and others. Final technical engineering rept. for 15 Oct 57-15 June 59 on Contract AF 33(600)35914. Oct 59, 133p. 29 refs. AMC Technical rept. 59-7-579; AD-232 717.
Order from OTS $2.50 PB 161 779

Precision, thin-walled, high-strength steel forgings for high performance aircraft and missiles can be quickly and economically forged in hot dies of Inconel 713-C using a potassium iodide-graphite lubricant-parting agent. The nickel-base casting alloy, (Inconel 713-C) proved superior to a cobalt-base alloy (HE 1049) and four other basic alloy families in oxidation resistance, hot strength stability on aging, hot wear resistance, and compressive deformation strength at temperatures as high as 1600°F. The four other alloy families were ferritic, Fe-Co-W; austenitic, Fe-Cr-W-Ni; austenitic with vanadium, columbium or tungsten carbide; and a superlattice aluminum-bearing austenite. A lubricant-parting agent, powdered potassium iodide and graphite in a ratio of 1:2, increased forging reduction and permitted metal flow at the die-work interface at die temperatures up to 1600°F. Approximately 200 test forgings of one-half of an H-beam section were produced which had a projected area of 25 square inches, including flash. Marked increases in die filling took place as the die temperature increased from 300°F to 1600°F. (Author)

Armour Research Foundation, Chicago, Ill.
METHODS AND CONTROLS FOR PRODUCING CASTABLE DIES FOR FORGING STEEL AND TITANIUM ALLOYS, by Andrew H. Murphy, Harry P. Nichols, and Paul R. Gouwens. Final technical engineering rept. for 10 June 57-10 Mar 59 on Contract AF 33(600)35530. Apr 59, 104p. 49 refs. AMC Technical rept. 59-7-578; AD-227 751.
Order from OTS $2.50 PB 161 778

High performance aircraft forgings of high-strength steels, with long, thin sections, can now be produced with a minimum of costly and time consuming machining. Forging dies capable of operating at 1600°F can be cast with cavities which require no machining. Casting molds made of special graphite mixtures provide excellent surface finish, close dimensional tolerance, finer cast grain size and good internal soundness of the high temperature resistant forging dies. These cast dies can be maintained at operating temperatures up to 1600°F and at pressures up to 80,000 psi. Die filling ability increased as the die temperatures increased, with the most favorable results occurring in the 1200°F to 1600°F temperature range. (Author)

Army Chemical Corps Engineering Command, Army Chemical Center, Md.
ANNUAL STANDARDIZATION SYMPOSIUM [NO. 1] 24 and 25 MARCH 1958, ARMY CHEMICAL CENTER, MARYLAND. [1958] 118p. 3 refs.
Order from LC mi$6.00, ph$18.30 PB 137 561

Contents:
The Chemical Corps contribution to the Department of Defense Standardization Program
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Avco Corp., Wilmington, Mass.
BERYLLIUM JOINING; RAD SPONSORED PROGRAM, by J. B. Cohen. Rept. for July 58-Oct 59 on Contract AF 33(616)5913. Apr 60, 45p. 23 refs. WADC Technical rept. 59-695, Pt. I.
Order from OTS $1.25 PB 161 830

New brazing techniques are described for joining beryllium to itself. A Be-20 a/o Ag brazing alloy developed under this program is shown to yield joint strengths at room temperature of 60 percent (30,000 psi) of that of the base metal. In the temperature range of 700 to 1450°F, the joint strength is 80 percent that of the base metal. Twenty-four hour exposures at these temperatures did not affect the room temperature strength. Similar strengths are achieved by brazing with pure silver, if a continuous interface of silver in the joint is absent. This is readily accomplished by heat treatment because of the rapid intergranular penetration of silver into beryllium. The resulting thick joint is not deleterious, since it is shown that a two phase silver beryllium alloy with a silver network is ductile. As in the above case, long time exposure (24 hrs) at temperatures above 1300°F did not affect the room temperature joint strength. Spreading of liquid silver on beryllium is not appreciable, probably because of its rapid intergranular penetration. (Author)

Avco Corp., Wilmington, Mass.
BERYLLIUM JOINING; WADC SPONSORED PROGRAM, by E. M. Passmore. Rept. for June 58-Oct 59 on Metallic Materials, Contract AF 33(616)5913. Apr 60, 127p. 25 refs. WADC Technical rept. 59-695, Pt. II.
Order from OTS $2.75 PB 161 831

Joining of beryllium plates and rods by braze welding, fusion welding, and pressure welding was investigated, with the objective of developing improved methods for applications at both room and elevated temperatures. From the work described in this report, it can be concluded that braze welding with silver filler metal and pressure welding without filler offer the most promise as useful joining techniques for beryllium. (Author) (See also PB 161 830)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PROBLEMS WITH RESTRAINT IN HEAVY WELDMENTS, by Glenn E. Faulkner. 29 Apr 60, 10p. DMIC memo. 54.
Order from OTS $0.50 PB 161 204

One of the important phases of research to evaluate thick titanium plate for use in deep-diving submarines is the evaluation of welded joints in thick titanium-alloy plates. As part of the weld-evaluation program, procedures will be developed for welding 2-inch-thick plates. These plates will be 30 inches long. Restraint in weldments of this size is high. Restraint in welding is the restriction of expansion and contraction during the heating and cooling cycles of welding operations.

Denver Research Inst., Colo.
SURVEY OF THE BROACHING PROCESS, by Bruce Hanna and Charles E. Eppinger. Final technical engineering rept. for Mar-Dec 59 on Contract AF 33(600)39008. Jan 60, 126p. 205 refs. AMC Technical rept. 60-7-645.
Order from OTS $2.75 PB 161 776

An extensive survey of the broaching process was performed to determine current status, problem areas, current efforts at resolution of problems, and needed developments. In addition to a survey of broaching literature, fifty-one organizations were contacted for information. The effect of broach gullets on cutting action and certain characteristic economic considerations were treated analytically. Broaching has been developed into a highly efficient method of metal removal with inherent accuracy and efficiency. Difficult-to-machine high temperature alloys have created broaching problems of which short tool life is the most serious. Current efforts toward resolution are limited in extent. Improved tool materials, broach design information, and comprehensive broach life data are needed. (Author)

[Hermes Electronics Co.] Cambridge, Mass.
FUNDAMENTAL MODE FILTER CRYSTALS, by F. Earle Clark. Quarterly progress rept. no. 3, 21 Nov 57-21 Feb 58, on Contract DA 36-039-sc-73234. 20 June 58, 19p. H. E. Proj. no. F-297.
Order from LC mi$2.40, ph$3.30 PB 147 984

Final development of a spurious mode identification and mapping device is described. Data on both circular and triangular AT plates gathered with the mode mapping device as well as with conventional techniques is presented. Physically identical crystals show individual characteristics to an unexpected degree. Conclusions based on the data are presented including some ideas on the behavior of triangular crystals. Triangular crystals have more freedom from spurious modes than equivalent circular crystals. Reduction of electrode size on both circular and triangular crystals removes some of the drive from spurious modes. (Author) (See also PB 140 600)

Naval Ordnance Test Station, China Lake, Calif.
THE EXPLOSIVE WORKING OF METALS, by John Pearson. 4 Feb 60, 54p. 47 refs. NOTS TP 2421; NAVORD rept. 7035.
Order from OTS $1.50 PB 161 828

Many metal working operations such as the forming, sizing, shaping, cutting, compacting, and welding of parts can now be performed by the energy released from either a detonating or deflagrating explosive. Several of these basic types of operations are currently in use on a production basis, the others are still in the applied research area of investigation. Both open and closed systems are employed with "standoff" and "contact" charges used to develop working pressures ranging from a few thousand to several million psi. Fundamental aspects of pressures, forces, and velocities pertinent to explosive metal working operations are discussed. Material behavior patterns are briefly considered. Several of the above operations are described in some detail. (Author)

Naval Ordnance Lab., White Oak, Md.
X-RAY STANDARDS FOR SHIELDED ARC WELDS IN ALUMINUM, PARTS I AND II, by R. E. Hightower. 28 Apr 53, 2 vols. NAVORD OD-7574.
Order from OTS $30.00 PB 161 833

Part 1: The standards are primarily designed to be applicable to the inspection of mine cases and similar structures fabricated from Aluminum 2S and 3S sheet. Part 2 contains only radiographs in photographic negative form.

Naval [Weapons Plant] Washington, D. C.
LITERATURE SURVEY ON COPPER BASE ALLOY CASTINGS FOR GAS AND HYDROSTATIC PRESSURE APPLICATIONS, by Vincent DePierre and Shingo Inouye. 15 May 59, 40p. 85 refs. NAVORD rept. 6484; NGF T-30-58; AD 219 362.
Order from OTS $1.00 PB 161 777

As the initial part of a task assignment to prepare a specification covering "Copper Base Alloy Castings (For Gas and Hydrostatic Pressure Applications)," a survey of the literature was made on copper base alloy pressure castings. A bibliography was prepared. Defects responsible for leakage in pressure castings, alloys generally used in bronze pressure castings and major factors (melt quality, composition, pouring temperature, mold variables, casting section thickness, and machining) influencing the pressure tightness of these alloys are reviewed. (Author)

Transport, Traction and Hoist Facilities

George Washington U., Washington, D. C.
THE CONCEPTS OF NOTIONAL SHIP AND NOTIONAL VALUE IN LOGISTIC CAPABILITY STUDIES INVOLVING MERCHANT SHIPS, by Ralph B. Hunt and Erling F. Rosholdt. Rept. on Logistics Research Project, Contract Nonr-761(05). 21 Aug 59, 12p. Serial T-103/59; AD-225 901.
Order from LC mi$2.40, ph$3.30 PB 148 156

A primary logistic planning operation is described for determining how many ships are required to transport a given quantity of cargo (dry, liquid, or human) from one point to another according to a particular lift requirement schedule. For studies involving ships, the concepts of a notional ship and of a

notional value of an actual ship are considered. The procedures for determining the number of notional ships for a given lift requirement schedule were previously described (AD-217 232). It is necessary to convert the number of notional ships required over each route to the number of actual ships required. The total actual ship requirements are obtained by applying the concept of the notional value of an actual ship which is a function of the distance (route) over which the ship operates. This factor may be handled 2 ways: (1) to determine the notional value of each actual ship for every route for which the number of notional ships needed were determined, and (2) to decide on a standard reference distance (notional distance) and convert the notional ship requirements, as calculated for the different routes, to the notional ship equivalent at the notional distance selected. An example is worked out using these concepts.

Universal Molded Products Corp., Bristol, Va.
ENGINEERING INVESTIGATION OF RUBBER OR PLASTIC MATERIAL FOR TRUCK COMPONENTS, by LeRoy R. Boggs. Final rept. on Contract DA 20-089-ORD-37127. 20 June 56, 16p. AD-202 133.
Order from LC mi$2.40, ph$3.30 PB 147 593

An engineering investigation was conducted of rubber, reinforced rubber, plastics, reinforced plastics or other materials as superior substitute for metal in the construction of various body parts for the 3/4 ton, 4 x 4 truck. Specified evaluation criteria were as follows: (a) resistance to atmosphere exposure, (b) resistance to fungi, (c) resistance to impact, (d) resistance to flame, (e) lightweight, (f) ease of field repair, (g) production efficiency, and (h) ease of initiating new production. Fiberglass reinforced polyester plastic was the best substitute for metal as a material for typical body components of tactical vehicles such as the M-37 truck. To best utilize the desirable properties of this material, the fundamental design of the application should be made around these properties. For example, if original design of a body component takes into account the low elastic modulus, the fabrication liberties of form, shape and local integral reinforcement and the other unusual properties of this material, then a much more efficient design will result than if a mere material substitution is made in a design originally intended for an entirely different material such as steel. Under such favorable design conditions, there are many applications in which this material would be clearly superior to steel or any other known material. Production of truck body components of this material is feasible in a wide range of quantities. Techniques used in this project represent moderate quantity methods but higher production rates appear equally feasible. (Author)

MATERIALS

[Army Engineer] Waterways Experiment Station, Vicksburg, Miss.
PLASTIC-GLASS FIBER REINFORCEMENT FOR REINFORCED AND PRESTRESSED CONCRETE, by Bryant Mather and R. V. Tye. Summary of information available to 1 July 55. Nov 55, 62p. 78 refs. Technical Memo. no. 6-421, rept. 1.
Order from LC mi$3.90, ph$10.80 PB 148 085

Information on use of glass and reinforcement in concrete is summarized and evaluated. Solid strip glass was studied in Europe in the 1930's but probably is not currently practical. Since 1951 promising studies have been made of glass fiber reinforced plastic rods as prestressing. Glass with relatively low modulus of elasticity, high tensile strength, and low specific gravity should be superior to steel if these properties can be employed conveniently, safely, and consistently. (Author)

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PLASTIC-GLASS FIBER REINFORCEMENT FOR REINFORCED AND PRESTRESSED CONCRETE, by Leonard Pepper and Bryant Mather. Summary of Information Available 1 July 55-to 1 Jan 59. Nov 59, 23p. 19 refs. Technical memo. no. 6-421, rept. 2.
Order from LC mi$2.70, ph$4.80 PB 148 086

Reports of work in Germany and Russia involving fiber glass and information obtained from domestic and foreign agencies, companies, and scientific organizations concerning use of fiber-glass reinforcing and prestressing elements for concrete are summarized. This information suggests the present availability of fiber glass possessing the mechanical characteristics necessary for a prestressing element. However, fiber glass cannot be used for this purpose without adequate protection from surface attack by the environment, and the available fiberglass-reinforced plastic systems do not possess the mechanical characteristics necessary for a prestressing element. Additional experimental work along lines that can now be described should provide the necessary background for specification of fiberglass-reinforced plastic units as an alternate to steel in prestressed-concrete construction. (Author)
(See also PB 148 085)

Arnold Engineering Development Center [Tullahoma, Tenn.]
AERODYNAMIC HEATING TESTS AT MACH NUMBER 5 OF NYLON PARACHUTE MATERIAL PROTECTED WITH VARIOUS SUBLIMING COMPOUNDS, by R. L. Palko. Rept. on ARO, Inc., Contract AF 40(600)700 S/A 13(59-1). May 59, 27p. 2 refs. AEDC-TN-59-41; AD-214 595.
Order from LC mi$2.70, ph$4.80 PB 146 113

Samples of nylon parachute ribbons treated with various subliming compounds were tested at Mach number 5, a simulated pressure altitude of 100,000 feet, and a stagnation temperature of approximately 730°F. The melting rates of the ribbons were observed with the aid of high-speed photography, and time histories of the ribbon temperatures were recorded. The apparatus used and typical results are described. (Author)

Office of Technical Services, Washington, D. C.
MATERIALS TESTING (1950-1960). May 60, 16p. 248 refs. OTS Selective Bibliography SB-411.
Order from OTS $0.10 OTS SB-411

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports are arranged in categories as follows: nondestructive testing; ultrasonic testing; autoradiographic and radiographic testing; and materials testing, general.

Ceramics and Refractories

Armour Research Foundation, Chicago, Ill.
INVESTIGATION OF GRAPHITE BODIES, by Samuel W. Bradstreet, Leon M. Atlas and others. Rept. for 1 Oct 58-1 Nov 59 on Ceramic and Cermet Materials, Contract AF 33(616)6143. Apr 60, 116p. WADC Technical rept. 59-706.
Order from OTS $2.50 PB 161 802

In investigating the influence of composition and processing variables on certain properties of small, molded multicrystalline graphite, non-impregnated specimens have been made at densities above 1.8 gm/cc to exhibit flexural strengths in excess of 350(psi at 20°C and 8000 psi at 2250°C. Concomitant studies have involved techniques of differential thermal analysis and dilatometry in binder investigation, a novel method of measuring tensile strength in brittle ring specimens, measurement of strengths and moduli to temperatures above 2850°C, and additions of a thermal carbon to coke flour as an inter-packing aggregate. The value of furfuryl alcohol polymer as a binder is confirmed. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
AN INVESTIGATION OF THE THEORETICAL AND PRACTICAL ASPECTS OF THE THERMAL EXPANSION OF CERAMIC MATERIALS. VOLUME ONE. LITERATURE SURVEY, by Raymond H. Stutzman, John R. Salvaggi and Henry P. Kirchner. Summary rept. for 1 July 58-31 Aug 59 on Contract NOrd-18419. 31 Aug 59, 162p. 954 refs. Rept. no. PI-1273-M-4; AD-220 685.
Order from OTS $3.00 PB 161 826

A literature survey was conducted on the reversible thermal expansion of crystalline ceramics, rocks and minerals, glasses, cermets, intermetallic compounds salts, cements, glazes, enamels and ceramics combined with other types of materials. Approximately 1200 references were collected of which 954 are assembled in a bibliography. 523 of the articles and reports were reviewed in detail and the results of thermal expansion measurements are published in tabular form (Author)

General Electric Research Lab., Schenectady, N. Y.
LOW-TEMPERATURE BRITTLENESS OF REFRACTORY METALS, by H. W. Schadler and J. R. Low, Jr. Annual summary rept. for 15 June 58-31 July 59 on Contract Nonr-2614(00). Aug 59, 43p. 34 refs. AD-226 968.
Order from LC mi$3.30, ph$7.80 PB 147 720

Dislocation etch pits in tungsten: A study was made of the dislocation etch-pitting technique of Wolff (Acta Met., 6:559, 1958). The study showed that this technique reveals dislocation reproducibly, and that no decoration of the dislocations is required. An etch-pitting technique was developed that employes a stainless steel sheet cathode, and an NaOH electrolyte with the specimen as anode. Electron beam melting: Equipment was constructed for the zone purification of refractory metals; it was used to melt W, Ta, Fe, and Ni. Measurements of electrical resistivity and mechanical properties of W single crystals indicated that purification is accomplished both by vacuum distilling and by zone refining. Deformation behavior of zone-melted W single crystals: Tungsten single crystals grown by electron bombardment floating zone refining were strained 2% in tension and bending at 298°, 77°, and 20°K to determine the modes and crystallography of the plastic deformation. The temperature dependence of the yield strength of W single crystals: The temperature dependence of the yield of W was measured using single crystals of zone-refined W of a variety of orientations. To eliminate the crystal orientation as a variable, the tensile yield strength was converted to a resolved shear stress on slip systems of the type (011) [111]. The average values of the resolved shear stress were a linear function of reciprocal absolute temperature as the theory of Fisher (Trans. Am Soc Metals, 47:451, 1955) predicts.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS, by J. D. Walton and C. R. Mason, Quarterly rept. no. 11, 1 Feb-31 Apr 58, on Contract NOrd-15701. [1958] 35p.
Order from LC mi$3.00, ph$6.30 PB 148 455

Zirconium-carbide- and titanium-carbide-forming thermite reactions were studied with regard to throttling materials (alumina versus kaolin, EPK), binders (core oil versus a saturated solution of aluminum hydroxide), carbon source for carbide-forming (graphite versus lampblack), and various shrouding techniques during ignition. Nozzles fabricated using the thermite reaction between fused silica and aluminum, with fused silica as the throttling material, were too weakly bonded to withstand the physical shock of the start cycle on the small rocket test stand. Nozzles fabricated using the zirconium-carbide-forming thermite reaction with EPK as the throttling material melted rapidly when tested on the small rocket motor. Erratic results were found to be caused by discrepancies in fabricating techniques.

Illinois U., Urbana.
NONDESTRUCTIVE TESTS FOR CERAMIC, CERMET AND GRAPHITE MATERIALS, by Julian H. Lauchner. Dwight G. Bennett, and George L. Morgan. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5687. Nov 59, 61p. 41 refs. WADC Technical rept. 59-412.
Order from OTS $1.75 PB 161 815

A feasibility study of several nondestructive tests as methods for predicting performance characteristics of ceramic, cermet and graphite materials was carried out. Radiographic identification of internal flaws, penetrant identification of external flaws, density measurements, and residual stress analyses were

employed in nondestructive evaluation. In the absence of viscous or plastic flow, external flaws were found to markedly affect material strength, whereas internal flaws were, in some cases, found to be of secondary importance. Residual stress developments in composite bodies were analyzed. Thermal expansion, elastic moduli, shape factors and heat treatments were employed. Such residual stress was observed to be a first order factor in predicting performance characteristics. Static strengths of alumina bodies correlated well with particle sizes as determined by X-ray back reflection. (Author)

Linde Co., Indianapolis, Ind.
RESEARCH INVESTIGATION TO DETERMINE THE OPTIMUM CONDITIONS FOR GROWING SINGLE CRYSTALS OF SELECTED BORIDES, SILICIDES AND CARBIDES, by A. D. Kiffer. Rept. for Mar 59-Feb 60 on Ceramic and Cermet Materials, Contract AF 33(616)6326. Apr 60, 31p. 8 refs. WADD Technical rept. 60-52.
Order from OTS $1.00 PB 161 792

This work was undertaken to produce selected crystals in the refractory hard metals class for mechanical and other property determinations. A Verneuil-type process using an arc heat source and argon shield gas was employed. Single crystal boules of titanium diboride and tungsten disilicide, 1/4-inch diameter and up to 4-1/2-inches long, were made. Most of them cracked upon cooling. The largest single crystal pieces recovered were 1/4-inch diameter and over 1/2-inch long. Dimolybdenum carbide boules had large sections of a "single crystal" Mo_2C matrix containing about 10% by volume of another phase distributed uniformly through it. No Mo_2C single crystal pieces free from this phase were made. In very limited work with ditungsten pentaboride only polycrystalline boules were produced. A major problem was encountered in getting powders suitable for Verneuil-type crystal growth. Best results were obtained from compounds prepared by fusing together commercially available pure elements and crushing the lumps into a suitable particle size fraction. Process improvements and purer powders are required to produce better quality TiB_2 and WSi_2 crystals. More experimental information is required on the molybdenum-carbon and the tungsten-boron systems. (Author)

Fuels, Lubricants, and Hydraulic Fluids

Army Chemical Warfare Labs., Army Chemical Center, Md.
AMMONIUM NITRATE FUEL BLOCKS, by Edward P. Cole. Rept. for Mar 54-Mar 55. Feb 60, 26p. Special Pub. 1-10; AD-234 129.
Order from LC mi$2.70, ph$4.80 PB 147 626

The object of the work described in this report was to determine whether the physical variables inherent in the procedure for loading AN-M7 smoke-pot fuel blocks had any noticeable effect on the observed tendency of the blocks to swell during storage. No relationship was found between consolidation pressure, ram dwell time, or the presence of a cellulose-nitrate disk seal, and the tendency of fuel blocks to swell. There was a correlation between slight swelling and (1) the addition of 2% water to the fuel mixtures prior to consolidation and (2) consolidation of the fuel mixture in one increment instead of two. It was also found that the starter mixture showed signs of swelling, that blocks having a concave top surface swelled, and that "fast" (MIL-STD-545) fuel mixtures showed considerably greater swelling than pure ammonium nitrate blocks. All the miniature fuel blocks used in the experiments swelled after storage. No change in the physical variables inherent in the loading procedure of fuel blocks is capable of completely eliminating the tendency of ammonium nitrate fuel blocks to swell. (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
THE APPARENT ORDER OF HETEROGENEOUS SPRAY REACTIONS, by F. A. Williams. [Technical] rept. no. 27 on Contract DA 04-495-ORD-446. Sep 58, 7p. 5 refs. AD-203 812.
Order from LC mi$1.80, ph$1.80 PB 138 160

The order and rate of a heterogeneous reaction involving liquid or solid particles in a gaseous medium are sometimes measured in devices which produce a steady flow of the heterogeneous mixture. It is proposed to show that the apparent order of the reaction (with respect to the material composing the particles) obtained in this manner is primarily a function of the particle size distribution and is largely independent of the single-particle reaction order.

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by W. C. Schumb and C. N. Satterfield. Quarterly periodic status rept. on Contract Nonr-1841(11). 30 June 59, 14p. AD-220 223.
Order from LC mi$2.40, ph$3.30 PB 146 281

Stability studies: A study of the decomposition rates of dilute solutions of H_2O_2 was begun in an attempt to establish the true shape of the decomposition rate vs concentration curve; principal consideration was given to the 5 to 30% concentration range. Although a moderate variance in results occurred, a gradual increase in decomposition rate was indicated as the H_2O_2 concentration decreased. H_2O_2 decomposition flame at subatmospheric pressures: The best cleanliness, mechanical flexibility, and temperature controllability of the boiler flask was obtained with a 6-ft, 108-w heating tape. There were no marked improvements in preventing ignitions of the solution in the boiler, nor in the behavior of the boiler flask system. A ground, jointed Y-connection was added to the side arm of the boiler flasks to decrease the pressure fluctuations in the boiler. Porous-walled reactor studies: Carbon dioxide was more effective than N as an injectant into the H_2O_2 decomposition system. The surface rate constant for H_2O_2 decomposition ranged from 1.6 to 2.2×10^{-4} g mol/sq cm(min) (atm) when CO_2 and N, respectively, were used as carrier gases with no injections. Decomposition of H_2O_2 vapor on catalytic surfaces: Two sets of runs were made to determine the combinations of temperature, velocity, and H_2O_2 concentration under which mass transfer is not controlling on an active catalyst surface (silver). At 50°C the ratio of experimental rate to that for the mass transfer which was controlled averaged 0.46; at 40°C the average was 0.27. One-fourth of the H_2O_2 entering the tube decomposed. (See also PB 139 967)

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
STORAGE STABILITY OF FLUIDS AND LUBRICANTS. PART II. ROOM TEMPERATURE STORAGE OF AIRCRAFT GREASES, by John B. Christian. Rept. for June 55-June 57 on Transmission Technology. Apr 60, 20p. 5 refs. WADC Technical rept. 58-287, Pt. II.
Order from OTS $0.50 PB 161 808

Eleven greases qualified under Military Specifications MIL-G-3278, MIL-L-3545, MIL-L-4343, MIL-G-7421, and MIL-L-7711, and supplied by various manufacturers were placed in storage at room temperature for two years. The greases were examined periodically to determine if storage had affected any of their properties. At the termination of two years of storage, it was discovered large changes in consistency had occurred in three out of four Specification MIL-L-7711 greases. The properties of these greases were no longer within specification limitations. All other greases maintained minimum requirements. (Author)

Naval Boiler and Turbine Lab. [Philadelphia, Pa.]
EVALUATION OF "COSAG" FUELS, by H. E. Meyer. Evaluation rept. 20 Feb 58, 40p. NBTL Test P-305; AD-205 997.
Order from LC mi$3.00, ph$6.30 PB 146 292

Twenty-two distillate type fuels were subjected to laboratory examination; three of these fuels to full scale boiler tests. The laboratory results showed that all fuels were adversely affected by sea water contamination; some indications of incompatibility also were encountered. Meter and pump failures and sprayer plate erosion represent the principal difficulties requiring design studies before the adoption of such fuels for naval use. A specification for ash-free fuels suitable for under boiler service was formulated

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON LUBRICANTS AND HYDRAULIC FLUIDS, by S. L. Cosgrove. Rept. on Contract AF 33(616)5171. 30 Apr 58, 80p. 50 refs. REIC rept. no. 4; AD-154 432.
Order from LC mi$4.50, ph$12.30 PB 147 102

This report presents the state of the art of the effect of nuclear radiation on aircraft lubricants and hydraulic fluids from 1955 through 1957. A brief review of the mechanism by which organic materials degrade chemically under the influence of nuclear radiation is followed by a discussion of the radiation stability of current aircraft lubricants and hydraulic fluids. In general, military-specification aircraft lubricants and hydraulic fluids show inadequate radiation stability for projected ANP purposes. The incorporation of antirads into these materials does not provide the necessary additional stability. Aromatic compounds, specifically alkyl biphenyls, and substituted aromatic ethers, show the most promise as radiation-resistant base stocks. In most cases their performance properties have yet to be fully evaluated, especially under in-source, or dynamic irradiation, conditions. Lubricants are categorized by function; radiation-resistant lubricant and hydraulic-fluid development programs are reviewed by chemical species rather than by the contracting agency responsible for their development. The appendixes contain selected tabular data showing the effects of radiation on both conventional materials and those developed for projected ANP use. (Author)

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON LUBRICANTS AND HYDRAULIC FLUIDS (FIRST ADDENDUM) by S. L. Cosgrove. Rept. on Contract AF 33(616)5171. 31 Mar 59, 51p. 42 refs. REIC rept. no. 4 (Addendum); AD-210 760.
Order from LC mi$3.60, ph$9.30 PB 147 102-S-1

This report reviews publications, reports and other communications received during 1958. Those basic radiation studies on organic compounds of significance to lubricant and hydraulic fluid development are reviewed, and their significance is discussed. Radiation-resistant gas-turbine-lubricant development during the past year has centered around the expanded study of polyphenyl ethers and alkylated aromatic ethers. Meta-linked polyphenyl ethers (uninhibited) show promise for use in the 0 to 700 F range and at exposures up to 1×10^{11} ergs g^{-1}(C). Alkylated aromatic ethers (containing antioxidants) are somewhat less radiation stable, but show a useful temperature range of approximately -35 to 600 F. Alkylated diphenyl ethers and diaryl alkanes show the most promise for use in conventional hydraulic systems under irradiation conditions. In hydraulic systems which would tolerate high pour points (about 5F) and marginal high-temperature viscosity, unsubstituted polyphenyl ethers could be used to advantage. The combination of radiation-stable fluids and modified soap (terephthalamates) or nonsoap thickeners has resulted in greases of adequate radiation stability for anticipated ANP needs. Likewise, commercially available dry-film lubricants show adequate radiation stability for anticipated ANP applications. (Author) (See also PB 147 102)

Rock Island Arsenal Lab., Ill.
A STUDY OF THE LUBRICITY OF A SULFURIZED COATING, by G. P. Murphy and F. S. Meade. 26 Apr 60, 10p. 2 refs. Rept. no. 60-1308.
Order from LC mi$1.80, ph$1.80 PB 147 731

Test specimens were sulfurized by a commercial firm. The lubricity of the coating was evaluated both dry and with a mineral oil. The coating was also evaluated as a pretreatment for resin bonded dry lubricants. When the sulfurized specimens were evaluated dry for wear resistance and antiseizure, it was determined that the sulfurized coating offered no improvement in wear resistance and only slight improvement in antiseizure when compared with plain steel specimens. However,

as a pretreatment for both oil and resin bonded dry lubricants, the sulfurized coating was superior to both plain steel and zinc phosphated (MIL-C-16232, Type Z) steel with regard to wear resistance. The antiseizure characteristics of the sulfurized coating was superior to the plain steel and equivalent to zinc phosphated steel. (Author)

Plastics

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
TRAINING COURSE AND INSTRUCTIONS FOR FOAMING-IN-PLACE AND THERMAL-FORMING REPAIR OF FOAMED STRUCTURES, by H. R. Moore and R. A. Coen. 8 Feb 55, 23p. 10 refs. Rept. no. NADC-EL-54151; AD-126 873.
Order from LC mi$2.70, ph$4.80 PB 138 073

This report was prepared to describe a training course and the necessary instructions on foaming-in-place and thermal-forming techniques for repairing the two main classifications of damage encountered by foamed structures, namely: (1) Damage to core accompanied by rupture of one or both skins. (2) Delamination of core from skin, not requiring replacement of skin or core by patching.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
EFFECT OF AN EMBOSSED PATTERN ON THE RIGIDITY OF PLASTICS, by Paul A. Signet. 15 Oct 58, 10p. Rept. no. 6126-3; AD-211 690.
Order from LC mi$1.80, ph$1.80 PB 146 279

This report covers an investigation of the effect of vacuum forming sheets of polyvinyl chloride in accordance with a pattern reported to have no axes of weaknesses. An aluminum mold was used to vacuum form the sheets. Specimens were cut and tested in bending at angles of 30, 60, 90, 120, and 150 degrees to an arbitrarily chosen axis. Combinations of two sheets were tested to determine if an increase in rigidity could be obtained. These included bonding together of two sheets with no special attempt at alignment, and bonding together of two sheets with an alignment of the pattern. It is concluded that the effect of embossing the sheet with the pattern resulted in a sheet with no axis of weakness and a great increase in rigidity.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EPOXY RESINS FOR USE ON CIVIL WORKS PROJECTS, by Leonard Pepper. Summary of data available as of 1 Mar 59. Aug 59, 55p. 39 refs. Technical rept. no. 6-521, rept. 1.
Order from LC mi$3.60, ph$9.30 PB 148 089

This report reviews the available literature and manufacturers' publications to determine the potential uses of epoxy resins on Civil Works projects. These possible uses fall into three general categories: adhesives, fillers, and coatings. Specific applications that have proved successful include: (a) bonding hardened concrete to hardened concrete; (b) bonding freshly mixed concrete to hardened concrete; (c) sealing cracks in concrete; (d) filling voids, pop-outs, and spalls in concrete; (e) refacing worn concrete or steel surfaces; (f) coating concrete or other surfaces for resistance to chemical attack; (g) protecting electrical components; and (h) bonding attached or embedded items such as dowels, reflector buttons, traffic bars, etc., to concrete. It is recommended that investigations of epoxy-resin systems be continued to: (1) define the uses that are most economically attractive; (2) develop specific performance specifications applicable to such uses; and (3) develop application procedures and information on performance in service. (Author)

Emerson and Cuming, Inc., Canton, Mass.
DEVELOPMENT OF INORGANIC FOAM MATERIAL OF CONTROLLED DIELECTRIC PROPERTIES FOR HIGH TEMPERATURE SERVICE. Final rept. 5 Nov 56-15 Dec 58 on Contract NOas-57-357-c. 18 Dec 58, 26p. AD-211 222.
Order from LC mi$2.70, ph$4.80 PB 146 291

A low density (18 to 30 lbs. per cubic foot) fine grained structural material capable of withstanding 900°F has been developed by autogenous bonding of tiny glass bubbles. Research on bonding techniques including silicone resin bonds, as well as the autogenous bond is described.) This structural material has been modified by additions of aluminum flake or titanium dioxide powder to give controlled dielectric constant structures having relatively low dielectric loss. Increase in service temperature range of these materials by 500 to 1000°F is believed possible by chemical modification of the Eccosphere glass composition.

National Research Labs., Ottawa (Canada).
A TECHNIQUE FOR PRODUCING GLASS-REINFORCED FOAM-FILLED PLASTIC MODEL PROPELLER BLADES, by A. J. Bowker and L. A. J. Pelland. Jan 60, 31p. 12 refs. Aeronautical rept. LR-273.
Order from LC mi$3.00, ph$6.30 PB 147 734

A procedure for making foam-filled glass-reinforced model plastic propeller blades is described in some detail, and the resulting blade is compared with similar blades of wood and aluminum. The plastic blade compares favourably to wood and aluminum in all respects except strength, where aluminum proves more advantageous. Also, extremely thin blades might be difficult to fabricate accurately in plastic. It would appear, with regard to strength, rigidity, duplicability, dimensional accuracy and stability, that the wood is always inferior and that the expense involved in reproducing aluminum blades is warranted only when excessive stresses or very thin sections are involved. (Author)

Springfield Armory, Mass.
INVESTIGATION OF HIGH DENSITY RIGID FOAMS, by K. A. Jorczak. Rept. on Research of Materials for High Temperature Uses. 20 Nov 59, 10p. SA-TR18-1068.
Order from LC mi$1.80, ph$1.80 PB 146 944

An investigation was conducted to obtain data to ascertain whether urethane foam materials (20 lb/cu ft)

can be increased to higher densities and to determine the practicality of using fiber glass as a filler. Results indicate that rigid urethane foams of a density greater than 20 lb/cu ft can be molded and that fiber glass filler does not influence significantly the physical properties of the foams. Test procedures are given, and results discussed. (Author)

Rubber and Elastomers

Naval Ordnance Lab., White Oak, Md.
DEVELOPMENT OF AN OZONE RESISTANT SYNTHETIC RUBBER COMPOUND FOR LOW TEMPERATURE SERVICE, by Doris V. Steele and H. E. Mathews, Jr. 4 Dec 58, 25p. 6 refs. NAVORD rept. 6241; AD-214 482.
Order from LC mi$2.70, ph$4.80 PB 146 289

A program to develop rubber diaphragms for the Hydrostatic Switch XH-46C was carried out. Various formulations based on a styrene-butadiene polymer were compounded and evaluated for low temperature flexibility, aging, and ozone resistance under outdoor and accelerated laboratory environmental conditioning.

Rubber Lab., Mare Island Naval Shipyard, Vallejo, Calif.
DEVELOPMENT OF METHOD FOR DETERMINING RESISTANCE OF RUBBER TO ABRASION BY SAND-BLAST, by J. Oser. 11 May 59, 14p. 4 refs. Rept. no. 31-5; AD-215 666.
Order from LC mi$2.40, ph$3.30 PB 146 283

An apparatus and a method were developed for quantitative evaluation of the relative abrasion resistance of vulcanizates to sandblast. A Hevea gum vulcanizate, and two Hevea vulcanizates containing 40 and 50 parts, respectively, of carbon blacks were tested by means of the apparatus. The gum vulcanizate exhibited a higher abrasion resistance than the two black-loaded vulcanizates. The abrasion resistances of all of the vulcanizates decreased as the impact angle of the abrasive was reduced.

Trionics Corp., Madison, Wis.
HEAT RESISTANT-ELASTOMERIC MATERIAL COMBINATIONS AND FORMS, by Robert E. Stapleton and James Pappis. Final rept. on Contract NOas-58-437-c. 30 Jan 59, 44p. 167 refs. AD-229 209.
Order from OTS $1.25 PB 161 813

Plasticizing of glass: A glass composition of 23.8% arsenic, 42.8% thallium and 33.4% sulfur, by weight, was prepared. A very plastic product was formed upon rapid or slow cooling of a heated composition of 60% sulfur and 40% glass. Centrifuging the product resulted in a brittle glass phase and a plastic sulfur phase. Irradiation polymerization of inorganic polymers: Phosphonitrilic chloride was prepared by the reaction of tetrachloroethane with phosphorus pentachloride and the polymerization of the resultant mixture of trimer and tetramer compounds by heat treatment. Phosphonitrilic chloride was very elastic below 300°C but gradually lost its elasticity and decomposed above this temperature. Ductile silver compounds: Rods and sheets of silver chloride were slowly bent through an angle of 90° without breaking. The ductility of the silver chloride appeared to decrease with time when the cast and pressed specimens were exposed to light after forming.

MATHEMATICS

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ALTERNATIVE SEQUENCES OF SAMPLING RATES FOR TIGHTENED MULTILEVEL CONTINUOUS SAMPLING PLANS, by Donald Guthrie and M. V. Johns, Jr. Technical rept. no. 36 on Contract N6onr-25126. 18 Feb 58, 29p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 268

The purpose of this report is to propose a new scheme for selecting the sequence of levels to be used in tightened multi-level continuous sampling plans of the type MLP-T given by Derman, Littauer, and Solomon (Annals of Mathematical Statistics, 28(1957)395-404). Certain advantages of the new levels are exhibited when k , the number of levels, is infinite and a criterion for comparison of the two schemes is proposed for the case of finite k . In addition, AOQ and AFI functions are given and contours of constant AOQL are plotted for the two schemes.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
ON SCHLICHT TRANSFORMATIONS BY FUNCTIONS OF TWO COMPLEX VARIABLES, by Zygmunt Charzynski. Rept. on National Science Foundation Grants 3661 and 10375. 4 May 60, 23p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 147 354

Brown U., Providence, R. I.
EXTENSIONS TO THEORY OF TIME SERIES ANALYSIS, by W. Freiberger. Quarterly rept. no. 5, 1 Aug-31 Oct 59, on Contract DA 36-039-sc-78130. [1959] 11p. 3 refs. AD-233 473.
Order from LC mi$2.40, ph$3.30 PB 147 414

The present study has concentrated on the case of a stochastic process where the sample values are uncorrelated (i.e., $Ex_\nu x_\mu = \sigma_{\nu\mu}$), with a flat spectral density. This would correspond either to white noise or to bandlimited noise with a correlation function $(\sin \pi t)/\pi t$, sampled at the zeros (i.e., $t = 1, 2, \ldots$).

Bureau of [Naval Weapons] Washington, D. C.
TABLE OF CIRCUMFERENCES AND AREAS. 21 Mar 47, 103p. NAVORD OD. 5797.
Order from LC mi$5.70, ph$16.80 PB 148 651

The computations are based on the value of π to eight significant figures, with a partial adjustment for the rounding error in π. The tabulated values of the Circumference and Area are in error by at most one unit in the last place. (Author)

California U. [Berkeley].
SYSTEMS OF DIFFERENTIAL FORMS, INCLUDING KURANISHI'S THEORY OF TOTAL PROLONGATIONS, by Harold H. Johnson. Technical rept. no. 2 on Contract DA 04-200-ORD-456. [1953] 84p. 6 refs. OOR rept. no. 1503.2; AD-138 694.
Order from LC mi$4.80, ph$13.80 PB 147 859

E. Cartan's theory of differential forms and their integral manifolds is outlined. Systems of differential forms are studied on a real analytic n-dimensional abstract manifold V. All the results are local so an assumption is made that V is a ball in Euclidean n-space. The fundamental concepts, which include contact elements, systems of differential forms, polar equations, independent variables, and prolongations, are explained. The Cartan-Kähler theorem and the Cauchy-Kowalewski theorem, and the systems in involution are discussed. An exposition of Kuranishi's theory of prolongation is presented in detail.

Carnegie Inst. of Tech., Pittsburgh, Pa.
AN EXTENSION OF THE CONCEPT OF THE MINIMUM IN CALCULUS, AND THE CALCULUS OF VARIATIONS, by A. Bomberault and E. Saibel. Technical rept. no 9 on Contract DA 36-061-ORD-495. [1952] 28p. 8 refs. CIT-ORD-15A-TR7; OOR rept. no. 1156.11; AD-155 100.
Order from LC mi$2.70, ph$4.80 PB 147 864

Analogs to the minimum problem of the calculus and calculus of variations are stated which may have use in describing interacting physical systems. The authors obtain necessary conditions that such generalized minima, which are called "polyminima", exist. Existence theorems which depend strongly upon fixed point theorems are also proved. Approximation methods corresponding to Rayleigh Ritz and finite difference methods are suggested. Plans are being made to give an application of the theory developed here to a physical problem. (Author)

Chicago U., Ill.
INVESTIGATIONS IN ABSTRACT ANALYSIS, by Irving E. Segal. Final rept. on Contract N6ori-02053. [1959] 4p. 13 refs. AD-225 006.
Order from LC mi$1.80, ph$1.80 PB 147 700

The project has been generally oriented towards the mathematical formulation of quantum field and elementary particle theory, and related purely mathematical questions in operator theory, harmonic analysis, and the theory of functional integration.

Chicago U., Ill.
SEMI-SIMILARITY INVARIANTS FOR SPECTRAL OPERATORS ON HILBERT SPACE, by Alvin N. Feldzamen. Technical note no. 1 on Contract AF 49(638)693. May 60, 78p. 34 refs. AFOSR TN-60-506.
Order from LC mi$4.50, ph$12.30 PB 148 091

This report presents in detail the beginnings of an equivalence theory for operators on Hilbert and Banach spaces patterned after a complete finite-dimensional theory.

[Columbia U., New York.]
A CLASS OF SMOOTH BUNDLES OVER A MANIFOLD, by James Eells, Jr. [Rept. on Contract Nonr-266(57).] [1959] 22p. 10 refs.
Order from LC mi$2.70, ph$4.80 PB 147 702

This paper illustrates certain constructions of importance in the geometry of smooth manifolds. It is proved that a homogeneous space B of a connected Lie group G can always be represented as a homogeneous space of a contractible Lie group E, necessarily of infinite demension in general. An examination is made of relations between the Lie algebra of G and that of E (this latter being a Banach-Lie algebra), in case G is compact and semi-simple.

Columbia U., New York.
THE CONTENT OF A DAM AS THE SUPREMUM OF AN INFINITELY DIVISIBLE PROCESS, by J. Gani and R. Pyke. Rept. on Contract Nonr-266(59). [1959] 23p. 16 refs. CU-7-59-Nonr-266(59)MS; AD-219 929.
Order from LC mi$2.70, ph$4.80 PB 147 693

The relation is discussed between the content of a dam and the supremum of a certain infinitely divisible process. The fact is pointed out that the distribution functions of the supremum over time $0 \leq t \leq T$ of a Poisson process with shift, and the content at time T of a dam with Poisson inputs and a constant release rate have identical forms. The backward Kolmogorov equation of the first process is shown to be identical with the forward equation of the second. A closer relation between the 2 processes is proved to exist, and a new definition for dam processes in discrete time is given. This is generalized to dam processes in continuous time whose net inputs are from a wide class of infinitely divisible processes. The distribution function of the total time during which such dams are empty and non-empty is found. A simplification of the double Laplace transform is obtained for the distribution function of the supremum over $0 \leq t \leq T$ of certain infinitely divisible processes with positive jumps. (Author)

Cornell U., Ithaca, N. Y.
A MINIMAX TEST OF FIT, by Lionel Weiss. Rept. on Contract [Nonr-266(04)]. [1959] 15p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 146 050

Two things are noted, first, limiting attention to the class of density functions which consist of horizontal line segments is not too great a restriction, since any density function satisfying mild regularity conditions can be arbitrarily closely approximated by a density function in our class. Second, our definition of distance is a rather peculiar one. Its purpose is to guarantee that the alternatives to the hypothesis differ from the uniform density function over a long enough interval to give us some chance of detecting the difference.

Georgia U., Athens.
CENTRALLY TRUNCATED SAMPLES FROM A NORMAL DISTRIBUTION, by A. Clifford Cohen, Jr. Final rept. for 1 Oct 52-31 Dec 58 on Estimation from Restricted Samples, Contracts DA 01-009-ORD-288 and DA 01-009-ORD-463. 15 Jan 59, 12p. 18 refs. AD 212 023.
Order from LC mi$2.40, ph$3.30 PB 147 871

An investigation is presented concerning the maximum likelihood estimation of the mean μ and the standard deviation σ of a complete normal distribution for which the probability density function is $f(x) = (\sigma\sqrt{2\pi})^{-1} \exp -(x-\mu)^2/2\sigma^2$, $-\infty \quad x \infty$, when samples are centrally truncated (when they are selected only from the remainder of the distribution after removal of the center section). Estimators are derived using the procedures of singly and doubly truncated samples.

Hebrew U. (Israel).
THE PRODUCT OF SUMMABILITY METHODS: NEW CLASSES OF TRANSFORMATIONS AND THEIR PROPERTIES, by Amnon Jakimovski. Technical Scientific note [no. 2, pt. 2] on Contract AF 61(052)187. Aug 59, 77p. 20 refs. AFOSR-TN-59-816; AD-232 071. AD-232 071.
Order from LC mi$4.50, ph$12.30 PB 146 101

Two new classes of transformation, which might be looked upon, respectively, as the sequence-to-function analogues to the generalized (and quasi-) Hausdorff transformations are defined and investigated. (Author)

Institute for Advanced Study, Princeton, N. J.
A MEASURE OF ASYMMETRY FOR CONVEX SURFACES, by E. Asplund, G. Bredon and B. Grünbaum. Rept. on Contract AF 49(638)253. Apr 60, 4p. 2 refs. AFOSR-TN-60-403.
Order from LC mi$1.80, ph$1.80 PB 147 518

Generalizing results of G. v. Sz. Nagy it is proved that the surface centroid of any convex body K in E^n, $n \geq 2$, divides the distance between any pair of parallel supporting hyperplanes of K in ratio less than 2n-1, this being the best possible bound. (Author)

Institute for Advanced Study, Princeton, N. J.
ON A MEASURE OF ASYMMETRY OF CONVEX BODIES, by E. Asplund E. Grosswald, and B. Grünbaum. Rept. on Contract AF 49(638)253. Mar 60, 7p. 9 refs. AFOSR-TN-60-359.
Order from LC mi$1.80, ph$1.80 PB 147 516

A new measure of asymmetry of convex bodies in Euclidean spaces is defined and some of its properties established. As far as is known, this is the first measure according to which the n-dimensional simplex is not the most asymmetric n-dimensional convex body for $n \geq 3$. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
EXTENSIONS OF THE LAPLACE CASCADE METHOD, by John Hilary Billings. Rept. on Contract AF 49(638)228. Apr 60, 133p. 40 refs. Technical note BN-209; AFOSR-TN-60-503.
Order from LC mi$6.90, ph$21.30 PB 147 525

The Laplace cascade method for hyperbolic equations $u_{xy} + a(x,y)\,u_x\, b(x,y)\,u_y + c(x,y)\,u = 0$ is extended to systems of second order hyperbolic equations.

Institute of Mathematical Sciences, New York U., N. Y.
A SPECIAL HILL'S EQUATION WITH DISCONTINUOUS COEFFICIENTS, by Harry Hochstadt. Rept. on Contract AF 49(638)229. Mar 60, 19p. 5 refs. Research rept. no. BR-32; AFOSR-TN-60-322.
Order from LC mi$2.40, ph$3.30 PB 147 560

The equation
$y'' + \lambda^2 \rho(x) y = 0$
$\rho(x) = 1 \qquad |x| \leq 1$
$= a^2 \qquad 1 < |x| < L$
is investigated. $\rho(x)$ is taken as a periodic function of period 2L and defined as above in the interval (-L, L). The nature of the characteristic values λ for which the equation has solutions of period L and 2L is investigated. Stability charts are drawn showing for which values of a^2 and λ all solutions are bounded, and for which some solutions are not bounded. (Author)

Naval Ordnance Test Station, China Lake, Calif.
ESTIMATES OF VARIANCES AND COVARIANCES OF MEASUREMENTS CORRECTED BY THE PRINCIPLE OF CONDITIONED OBSERVATIONS WITH APPLICATIONS TO DATA REDUCTION PROBLEMS, by Frank Reed. Jan 58, 37p. 5 refs. NOTS 1275; NAVORD rept. 4953; AD-219 427.
Order from LC mi$3.00, ph$6.30 PB 148 044

A method is presented for estimating variances and covariances of measurements that are corrected by the method of conditioned observations. The case where measurements are related by linear functions is discussed first. The theory developed is applied to the general data reduction problem. (Author)

Naval Ordnance Test Station, China Lake, Calif.
FIRST AID FOR PET PROJECTS INJURED IN THE LAB OR ON THE RANGE, OR, WHAT TO DO UNTIL THE STATISTICIAN COMES, by R. M McClung. 29 Jan 52, 59p. 11 refs. Technical memo. 1113.
Order from LC mi$3.60, ph$9.30 PB 148 051

The concept of confidence, the use and computation of confidence and tolerance limits, and a method for determining the significance of the difference in two or more sample means are discussed in an elementary manner. (Author)

Naval Research Lab., Washington, D. C.
A TABLE OF PROBABILITY DISTRIBUTIONS USEFUL IN WAR GAMES AND OTHER COMPETITIVE SITUATIONS, by H. L. Toothman. Final rept. 16 May 60, 92p. 1 ref. NRL rept. no. 5480.
Order from LC mi$5.40, ph$15.30 PB 145 721

A formula for a probability distribution has been computed and tabulated by a digital computer in terms of its four arguments. The formula gives the probability

of t successes, if each of m players making r successive plays has probability p_1 of success in each play, and probability of p_2 of being eliminated from subsequent play. The argument p_1 ranges from .01 to .95, p_2 ranges from .00 to .90, and m and r range from 1 to 4. The competitive situation can also be described in terms of a random walk on three points with two absorbing barriers.

North Carolina U., Chapel Hill.
ON STOCHASTIC MATRICES WITH A NON-TRIVIAL GREATEST POSITIVE ROOT, by Alfred Brauer. UNC Technical rept. no. 12 on Contract AF 18(603)38. Nov 59, 9p. 9 refs. AFOSR-TN-59-933.
Order from LC mi$1.80, ph$1.80 PB 148 024

The greatest positive characteristic root of an unreduced stochastic matrix A is the trivial root 1. In this paper such matrices A are considered which have a non-trivial greatest positive root which is less than the trivial root 1, but greater than or equal to the absolute value of all the other characteristic roots. (Author)

Purdue U. [Lafayette, Ind.]
NORMAL OPERATORS ON THE BANACH SPACE $L^p(-\infty,\infty)$. PART I. BOUNDED TRANSFORMATIONS, by G. L. Krabbe. Technical note no. 3 on Contract AF 49(638)505. 20 Nov 59, 23p. 12 refs. AFOSR TN-59-1115.
Order from LC mi$2.70, ph$4.80 PB 146 385

Purdue U. [Lafayette, Ind.]
NORMAL OPERATORS ON THE BANACH SPACE $L^p(-\infty,\infty)$. PART II. UNBOUNDED TRANSFORMATIONS, by G. L. Krabbe. Technical note no. 4 on Contract AF 49(638)505. 20 Nov 59, 8p. 5 refs. AFOSR TN-59-1116; AD-232 460.
Order from LC mi$1.80, ph$1.80 PB 146 384

RIAS, Baltimore, Md.
AUTOSYNARTETIC SOLUTIONS OF DIFFERENTIAL EQUATIONS, by D. C. Lewis. Rept. on Contract AF 49(638)382. May 60, 64p. 5 refs. Technical rept. 60-12; AFOSR-TN-60-438.
Order from LC mi$3.90, ph$10.80 PB 148 014

Rice Inst., Houston, Tex.
A NUMERICAL METHOD FOR THE SOLUTION OF A PARABOLIC SYSTEM, by Jim Douglas, Jr. Rept. on Contract AF 49(638)632. 9 Feb 60, 16p. 10 refs. AFOSR-TN-59-1121; AD-232 551.
Order from LC mi$2.40, ph$3.30 PB 146 383

A numerical method for approximating the solution of a nonlinear parabolic system is presented. An iterative method for treating the algebraic equations arising at each time step is discussed. (Author)

University Coll., Cork (Eire).
THE ABSOLUTE CONVERGENCE OF CERTAIN LACUNARY FOURIER SERIES, by Siobhan O'Shea. Technical note no. 6 on Contract AF 61(514)1399. [1956] 13p. 2 refs. AFOSR-TN-59-883; AD-226 388.
Order from LC mi$2.40, ph$3.30 PB 146 100

Let f(x) be measureable and periodic with period 2π, and satisfy a uniform Lipschitz condition of order $\alpha(0<\alpha\leq 1)$ in every finite interval. Let the Fourier series of f be $\frac{1}{2}a_0 + \sum_1^\infty (a_n \cos nx + b_n \sin nx)$. Results for the cases $0<\alpha\leq\frac{1}{2}$ are interpolated between the following 2 theorems: (1) if $\alpha>\frac{1}{2}$, then $\sum (|a_n|+|b_n|)<\infty$; and (2) if $\alpha=0$ and $a_n=b_n=0$ except possibly for $n=n_k$, where $\{n_k\}$ is a sequence of positive integers satisfying $\liminf_{k\to\infty} \frac{n_{k+1}}{n_k} > 1$, then $\sum (|a_n|+|b_n|)<\infty$ is true.

Virginia Agricultural Experiment Station, Blacksburg.
TWO-WAY RANK-SUM TESTS FOR DISPERSIONS, by A. R. Ansari and R. A. Bradley. Technical rept. no. 9 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Aug 59, 31p. 14 refs. AD-225 593.
Order from LC mi$3.00, ph$6.30 PB 148 190

Non-parametric 2-sample tests are investigated on dispersions. X- and Y-samples of m and n independent observations are considered from population with continuous cumulative distribution functions F(u) and G(u). For the basic test, the difference in locations of the 2 populations are known and the 2 samples are adjusted to have equal locations. Taking these location parameters to be zero, the hypothesis $G(u)\equiv F(u)$ is tested against alternative of the form $G(u)\equiv F(\Theta u)$, where $\Theta\neq 1$. The 2 samples are ordered in a single joint array, and ranks are assigned from each end of the joint array towards the middle. The statistic used is W, the sum of ranks for the X-sample. The distribution of W is studied, the first 4 moments of W are developed, a normal approximation to the null distribution of W is devised, and large-sample properties of the W-test are considered. Other non-parametric tests of dispersions are reviewed. A modified test is suggested where the difference in population locations is not known. Its properties are investigated for a limited sampling study. The study indicates there is no great difference in the moments of W for either test.

[Washington U., Seattle]
EXPLICIT PERTURBATION FORMULAE AND CONVERGENCE THEOREMS, by F. H. Brownell. [Rept. on Contract Nonr-477(20)]. [1958] 28p. 4 refs. AD-214 098.
Order from LC mi$2.70, ph$4.80 PB 146 295

Perturbation theory is developed for a λ in the point spectrum with finite multiplicity m of a Banach or Hilbert space linear operator by giving explicit formulas for the eigenvalue and the eigenvector series covering all possible splitting cases. The convergence of these series is proved by using majorants, and error estimates are given under suitable boundedness assumptions for a few special splitting cases. These arguments can be carried over to any given splitting case. An example is given of a nonisolated λ_0 for which the boundedness and other assumptions hold.

[Washington U., Seattle].
A NOTE ON KATO'S UNIQUENESS CRITERION FOR SCHRODINGER OPERATOR SELF-ADJOINT EXTENSIONS, by F. H. Brownell. [Rept. on Contract Nonr-477(20)]. [1951] 28p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 146 296

Wayne State U., Detroit, Mich.
ON AXIOMATIC APPROACH TO HOMOLOGY THEORY WITHOUT USING THE RELATIVE GROUPS, by Sze-Tsen Hu. Technical note no. 8 on Contract AF 49(638)179. Apr 60, 18p. 5 refs. AFOSR-TN-60-371.
Order from LC mi$2.40, ph$3.30 PB 148 023

Recently, D. Puppe proposed a new axiomatic approach to homology theory without using the relative groups. Since he used a base point in each space throughout his approach, he can prove the uniqueness theorem only for connected CW-complexes. In the present note, Puppe's axiomatic approach is improved by removing the base point. After the base point has been removed from the theory, it turns out that the uniqueness theorem can be proved for all CW-complexes. (Author)

Wisconsin U., Madison.
ALGEBRAS OF LINEAR TRANSFORMATIONS, by R. Creighton Buck. Technical rept. no. 4 on Representation and Characterization Problems for Analytic Functions, Contract DA 11-022-ORD-1851. Nov 56, 20p. 6 refs. OOR rept. 1406.4M.
Order from LC mi$2.40, ph$3.30 PB 138 139

One definition of harmonic analysis is that it is the study of a group in terms of the function spaces defined on it. In the present paper, he shall describe a general approach which is based upon a shift in the point of view, accompanied by an elaboration of the underlying structure.

Wisconsin U., Madison.
FUNCTIONS OF RESTRICTED VARIATION, by Preston G. Hammer. Technical rept. no. 8 on Studies in Numerical Analysis, Contract DA 11-022-ORD-2301. Mar 58, 26p. 15 refs. OOR rept. no. 1626.9; AD-137 081.
Order from LC mi$2.70, ph$4.80 PB 147 870

A detailed analysis is made of the oscillations or real-valued functions defined on a simply ordered set. A new class of functions, those of restricted variation, is singled out which include the class of functions of bounded variation. The concept of a function of restricted variation is a generalization of the concept of a Cauchy sequence. The concept of the k-variations of functions is introduced. This concept is derived from the restriction of the number of points in a partition to a most k and is essential to the definition of the restrictedness of variation. The syntonicity of function pairs is defined in order to obtain necessary and sufficient conditions that the total variation of a sum of two functions is the sum of their total variations. The syntonicity concept is required to obtain the full converse to the theorem giving the usual decomposition of a function of bounded variation.

Wisconsin U., Madison.
REPRESENTATION AND CHARACTERIZATION PROBLEMS FOR ANALYTIC FUNCTIONS, by R. Creighton Buck. Final rept. on Contract DA 11-022-ORD-1851. July 58, 19p. 11 refs. OOR rept. no. 1406.8; AD-200 195.
Order from LC mi$2.40, ph$3.30 PB 147 867

Expansion theory: Results of a study dealing with a general approach to the expansion of analytic functions in polynomial series are outlined and reported in Ergebnisse der Mathematik no. 19, published by Springer-Verlag in Germany. Transformation algebras: A study was made of the properties of the algebra of real valued functions on a general locally compact space. Studies were also made on the algebra of continuous linear transformations applied to topology. (Portions of this report will not reproduce)

Computing Devices

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A SURVEY OF ENIAC OPERATIONS AND PROBLEMS, 1946 - 1952, by W. Barkley Fritz. Aug 52, 27p. 53 refs. Memo rept. no. 617.
Order from LC mi$2.70, ph$4.80 PB 148 458

The primary interest of the paper is the brief descriptions given of the specific unclassified problems completed during this period. It is hoped that individuals not yet in immediate contact with high speed computers will gain some insight into the type of problems which machines make accessible to computation. Pertinent reference material is given to a variety of unclassified published material related to these completed programs. (Author)

Catholic U. of America, Washington, D. C.
RESEARCH ON HIGH TEMPERATURE FERROELECTRIC STORAGE MEDIA, by Charles F. Pulvari. Rept. on Contract AF 33(616)5736. Apr 60, 123p. 21 refs. WADD Technical rept. 60-146.
Order from OTS $2.75 PB 161 805

Work was conducted to develop a ferroelectric material capable of operating at a temperature possibly as high as 500°C., to investigate the various developed materials and their possible use as a digital computer element capable of operating at high temperatures, and to study switching phenomena and their relationship to crystal structure in order to determine the possibility of a threshold switching field.

David Taylor Model Basin, Washington, D. C.
AUTOMATIC ROUTINES FOR PROGRAMMING MANAGEMENT DATA PROBLEMS ON UNIVAC I AND II, by Rita M. Horbett, Arthur Shapiro and others. Oct 58, 73p. 2 refs. Rept. 1241; AD-206 648.
Order from LC mi$4.50, ph$12.30 PB 147 464

A collection of automatic programming routines is presented. These routines are designed for the Univac, a high-speed, automatic, electronic, digital computer. Routines are included which perform the

functions of edit, sort, merge, and data conversion. A detailed description is given of the capabilities and limitations of the routines, and full directions on how to use them. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
AUTOMATIC ERROR ANALYSIS IN DIGITAL COMPUTATION, by Ramon E. Moore. Technical rept. 28 Jan 59, 64p. LMSD-48421.
Order from LC mi$3.90, ph$10.80 PB 147 669

This technical report introduces a systematic approach to the general subject of digital computation. The objective of the study is to mechanize a complete error analysis for any digital computation. A method for such mechanization is described, by which the digital computer is to deliver error bounds along with every approximation. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
PLASTIC NEURONS AS MEMORY ELEMENTS, by D. G. Willis. Technical rept. June 59, 29p. 14 refs. LMSD-48432-1; AD-219 839; Supersedes LMSD-48432; AD-217 265.
Order from LC mi$2.70, ph$4.80 PB 147 670

A study was conducted that defines precisely a class of plastic neuron models, determines their information storage capacity, and shows the mechanism by which information can be read into and out of a system of such neurons on a random access basis. The neuron model investigated has an arbitrary number n of input leads and one output lead. At any time step the ith input lead will have some synaptic value s_i associated with it, and will be carrying some signal e_i, which is either 1 or 0 (firing or not firing). The neuron will fire and produce a 1 signal on its output lead if, at the previous time step, $\sum_n e_i s_i \geq T$ where T is some threshold value. The synaptic value s_i will increase, decrease, or remain unchanged at each time step depending upon the firing condition of the neuron and the signal just carried by the ith lead. The storage capacity of this neuron model is determined principally by the long term stability of the s values, and for any reasonable number of inputs appears to be compatible with the requirements for human memory. Two demonstrations are presented showing the read-in-read-out properties of a system of 288 plastic neurons simulated on a digital computer. An expression is derived for the output of a plastic neuron as a function of its previous history. (Author)

Office of Naval Research, Washington, D. C.
SYMPOSIUM ON SUPERCONDUCTIVE TECHNIQUES FOR COMPUTING SYSTEMS, WASHINGTON, D. C., MAY 17-19, 1960. Proceedings [1960] 419p. ONR Symposium rept. ACR-50.
Order from OTS $4.50 PB 161 763

Contents:
Outline of recent developments
Ferromagnetic superconductors
The use of superconductive devices in research at low temperatures
Physics and characteristics of the crossed film cryotron - a review
The cryosar
Closed cycle helium refrigeration
An approach to the experimental study of persistent-current devices
Thermal and electrodynamic aspects of the superconductive transition process
Some British research in superconductive switching devices
British research on superconductive switching devices
A new type of bistable element involving thermal propagation of a normal region in a thin superconducting film
Initial studies of the preparation and properties of vanadium thin films
Current induced switching of superconductive thin films
High-frequency behavior of very thin superconducting films and changes in critical temperature produced by electrostatic charging
Research on superconductive devices in Sweden
Superconducting films less than 100 angstrom units thick
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Formation of thin polymer films by electron bombardment
Characteristics of film cryotrons
Thin film cryotron catalog memory
Analysis of a crossed film cryotron shift register
Kinetics of the superconducting phase transition in thin films
Thin film cryotron time constants
Characteristics of bulk and thin film superconducting alloys
Effect of residual gases on superconducting film characteristics
Effect of defects on the superconducting properties of tantalum
Use of superconducting transmission line for measuring penetration depths
Edge effects in superconducting films
An analog solution for the static London equations of superconductivity
A computer program for simulating cryotron circuits
Properties of thin film cryotrons
Operation and analysis of planar cryotrons and simple cryotron circuits
Cryotron storage, arithmetic and logical circuits

Stanford Electronics Labs., Stanford U., Calif.
DESIGN OF A SAMPLED DATA CONTROLLER USING TRANSISTOR LOGIC, by M. Cavestany. Rept. on Contract Nonr-225(24). 13 Aug 59, 51p. 9 refs. Technical rept. no. 2100-1; AD-225 011.
Order from LC mi$3.60, ph$9.30 PB 147 692

The design and construction of a digital controller for use in the study of sampled-data control systems is discussed. The device is a hybrid computer combining digital and analog techniques to take advantage of the special properties of each. The device was designed to permit the introduction of a digital controller in an analog computer simulation which would be simpler and more flexible to use than is possible with conventional analog or digital components alone. Analog methods are used to produce sums and products, and digital methods are used to store the samples of data. A novel feature of this controller is the use of special modulators to convert the analog voltages to frequency information which is the form in which the data is

stored on a magnetic drum. An exposition of the principles of digital compensation in sampled-data systems is made, and the different steps leading to the conception and utilization of a digital controller are covered. The system is based on the utilization of a magnetic drum as data hold, storage, and delay element, with transistor digital logic circuits to perform the necessary switching. (Author)

Washington U., Seattle. Div. of Counseling and Testing Services.
REGRESSION WEIGHTS BY THE METHOD OF ADJUSTED TOTAL GROUPS: A PROGRAM FOR THE IBM TYPE 650, by Dennis E. Hamilton. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). Aug 59, 14p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 147 698

The rationale of the method (Johnson, 1959a) is summarized, the major difficulty in the procedure is discussed.

MECHANICS

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
ON THE VIBRATION OF THERMALLY STRESSED PLATES IN THE PRE-BUCKLING AND POST-BUCKLING STATES, by Yechiel Shulman. Rept. on Contract Nonr-1841(22). Jan 58, 53p. 8 refs. Technical rept. 25-25.
Order from LC mi$3.60, ph$9.30 PB 138 252

The free vibration characteristics of thermally stressed plates have been obtained in the pre-buckling and post-buckling states. The results are valid for uniformly heated plates with two opposite edges simply supported and with generalized support conditions on the other two edges. A numerical example has been worked out.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
RESEARCH PROGRAM ON STRUCTURAL DYNAMICS AND THERMO ELASTICITY PROBLEMS, by T. H. H. Pian. Summary rept. on Contract Nonr-1841(22). Jan 58, 18p. 31 refs. Technical rept. 25-27.
Order from LC mi$2.40, ph$3.30 PB 138 251

The initial phase of the program consisted only of problems related to responses of structures to shock and impact. Since September 1952, the problem of transient stresses due to aerodynamic heating was added to the research program. During the last year the field of study has been limited only to problems related to structure under thermal environment.

American Machine and Foundry Co., Alexandria, Va.
ULTRA-SHORT-TIME CREEP RUPTURE EQUIPMENT MANUAL, by Joseph S. Ives, Jr. Rept. for 1 Mar 58-31 Mar 59 on Materials Applications, Contract AF 33(616)5557. Apr 60, 52p. WADC Technical rept. 59-762, Pt. I.
Order from OTS $1.50 PB 161 789

The purpose of this program was to develop a method of heating a sample of sheet metal to a pre-determined temperature in a short period of time and to measure the creep characteristics of this material at the developed temperature. Described in this report are the special equipments designed to carry out the work together with the necessary operating instructions. Also included are the drawings required to produce the equipment at the contractor's facilities. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE LOAD-CARRYING CAPACITY OF WIDE BEAMS AT FINITE DEFLECTIONS, by R. M. Haythornthwaite and W. E. Boyce. Technical rept. no. 32 on Contract Nonr-562(10). Feb 58, 30p. 10 refs. C11-32.
Order from LC mi$2.70, ph$4.80 PB 138 131

Estimates of the post-yield carrying capacity of laterally loaded plates may be obtained conveniently from the velocity fields associated with either the limit load or the membrane solution. The latter can be used even when the limit load is not known. As an illustration, an approximate membrane solution is found for a centrally loaded rectangular plate, rigidly clamped along two opposite sides and free along the other two. The velocity field includes both a local circular symmetric deformation near the load and also a general beam bending mechanism. The rate of deflection is computed and the field is also used to obtain an upper bound to the limit load. Comparison is made with the results of tests of six steel beams of various widths. (Author)

Illinois Inst. of Tech., Chicago.
PLASTIC ANALYSIS OF CIRCULAR CONICAL SHELLS, by Philip G. Hodge, Jr. Rept. on Contract Nonr-1406(04). Aug 59, 25p. 6 refs. DOMIIT rept. no. 1-8.
Order from LC mi$2.70, ph$4.80 PB 147 724

A right circular conical shell of edge angle α is subjected to a concentrated load Q directed along the axis. The collapse load is found to be $Q = 2\pi M_0 \cos^2 \alpha$, independently of the size or support conditions of the shell. Some solutions are also obtained for the case where the load is distributed over a finite area. Bounds are found on the collapse load of a general rotationally symmetric shell under a concentrated load. (Author)

Israel Inst. of Tech., Haifa.
BUCKLING OF CONICAL SHELLS UNDER EXTERNAL PRESSURE AND THERMAL STRESSES, by Nicholas J. Hoff (Stanford U.) and Josef Singer. Technical final rept. on Contract AF 61(052)123. Dec 59, 83p. 21 refs. AFOSR-TR-59-203.
Order from LC mi$4.80, ph$13.80 PB 147 497

Simplified differential equations governing the deformations of deep thin circular conical shells subjected to arbitrary loads and arbitrary temperature distributions are derived by the principle of the minimum total potential energy. The equations reduce to Donnell's equations (extended to include an arbitrary

temperature distribution) when the cone angle approaches zero. An asymptotic solution of these simplified equations is obtained for a truncated conical shell subjected to an axisymmetrical temperature distribution. The equations are extended to include problems of elastic stability.

Lockheed Aircraft Corp., Sunnyvale, Calif.
BUCKLING OF A CYLINDRICAL SHELL SUBJECTED TO A SADDLE-TYPE LOAD, by B. O. Almroth. Apr 60, 37p. LMSD-288 242.
Order from LC mi$3.00, ph$6.30 PB 148 078

This report presents a buckling analysis for a circular cylindrical shell subjected to external lateral pressure over a portion of the cylinder length. The results are useful for determining allowable loads in motor cases and other thin-walled structures during handling and storage. The method uses a stability criterion based on the principle of minimum potential energy. The Rayleigh-Ritz procedure is used to expand the displacement components in trigonometric series.

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
CYLINDRICAL SANDWICH CONSTRUCTION DESIGN, by Sidney Allinikov. Rept. on Materials Application. Feb 60, 277p. 14 refs. WADD Technical rept. 60-133.
Order from OTS $4.00 PB 161 793

This report is a compilation of papers which present a comprehensive treatment of the theories and parameters associated with the design of cylindrical sandwich constructions. Many of the formulas developed are applicable to a wide variety of core and facing combinations. Experimental data on flat and curved sandwich sections are furnished to support the theoretical solutions related to the design of these structures. (Author)

Naval Research Lab., Washington, D. C.
EXPERIMENTAL MEASUREMENT OF MECHANICAL IMPEDANCE, by J. W. Young, Jr. and R. O. Belsheim. 24 May 60, 25p. 9 refs. NRL rept. 5458.
Order from LC mi$2.70, ph$4.80 PB 144 639

A mechanical impedance head and measuring system for experimentally determining mechanical impedance are described, following a brief review of the basic concepts. The system incorporates commercially available equipment for excitation, observation, and analysis of measurements. In order to check the measuring techniques, and to gain experience in the use of the equipment, solid blocks as well as a realistic structure were tested. The results for the various size blocks and for the structure were compared with the expected theoretical results. It is concluded that the system could be used to measure mechanical impedance over a frequency range of 10 to 500 cps. A flaw in the present system is that point-by-point measurements are required, whereas continuous measurements over the frequency range are essential for extensive measurements. The necessary revisions are feasible. (Author)

Stanford Research Inst., Stanford U., Calif.
ATTENUATION OF THE SHOCK WAVE PRODUCED IN A SOLID BY A FLYING PLATE, by G. R. Fowles. Rept. on Contract AF 49(638)625. 20 Aug 59, 30p. 11 refs. SRI Project GU-2912; AFOSR-TN-59-1281.
Order from LC mi$2.70, ph$4.80 PB 147 684

The attenuation of the plane shock wave produced in a solid by a flying plate of the same material is treated neglecting dissipative processes and effects of material rigidity. Explicit formulas for the position of the shock front and the shape of the pulse as functions of time are obtained by application of Friedrich's method. A numerical example for an aluminum target and projectile is presented to illustrate some of the features of the calculation, and an experiment is proposed to test the theory. The experiment should also allow a reasonably precise measurement of sound velocity immediately behind the shock front to be obtained. This possibility applies equally well to the case of target and projectile of different materials. (Author)

Watertown Arsenal Labs., Mass.
A CONCEPT OF FATIGUE DAMAGE, by Joseph I. Bluhm. June 58, 20p. 24 refs. WAL Technical rept. 893/202; AD-162 567.
Order from LC mi$2.40, ph$3.30 PB 148 053

The behavior of a simple conventional model of material subjected to fatigue is described and qualitatively related to the magnitude of loads. This is shown to lead to a quantitative damage concept for fatigue based upon the absolute strain in excess of the current endurance limit. This is distinct from previous suggestions for damage based upon the plastic strain. The latter criterion is shown to fail for the low stress level at which plastic flow is known to occur. (Author)

Watertown Arsenal Labs., Mass.
STRESS ANALYSIS OF A THIN STRIP CONTAINING A LARGE HOLE, by E. W. Ross, Jr. Apr 60, 52p. 3 refs. Technical rept. WAL TR 811.8/1.
Order from LC mi$3.60, ph$9.30 PB 146 163

This report treats the problem of finding the elastic strain and stress distribution around a hole in a thin strip under uniaxial tension. The hole is assumed to have two axes of symmetry, parallel and perpendicular to the direction of the applied force, and to be centrally located. In particular, a method is given for finding the limiting stress and strain distribution near the minimum sections (and so the maximum stress-concentration factors) as the hole width approaches the strip width. (Author)

Aerodynamics and Pneumatics

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
SIMILARITY LAWS REQUIRED FOR EXPERIMENTAL AEROTHERMOELASTIC STUDIES, by John M. Calligeros and John Dugundji. Rept. on Contract Nonr-1841(46). May 59, 82p. 28 refs. Technical rept. 75-1; AD-219 760.
Order from LC mi$4.80, ph$13.80 PB 146 102

The similarity laws for the study of aeroelastic phenomena in the presence of aerodynamic heating are derived. The parameters for the general aerothermoelastic problem are obtained by nondimensionalizing the governing equations relating to the external aerodynamic flow, heat conduction to the interior of the structure, and the thermal stresses and external loads applied to the structure. The investigation is limited to moderate temperatures (below about 1000°F-i.e., $M \leq 3.5$) and considers only elastic behavior of the material. Certain conflicts inherent in the general problem permit similarity only for length-scale ratios of 1. The primary conflict is found to be between the free stream Reynolds number Re, Mach number M, and the basic aeroelastic parameter $\bar{P}\mu/Eo$. Three methods of dealing with this basic conflict are presented, and in each case the importance of the similarity parameters is discussed. (Author)

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
TABLES RELATED TO AXIAL SYMMETRIC TRANSONIC FLOW PATTERNS, by Gertrude Blanch, Karl Gottfried Guderley, and Emma Marian Valentine. Rept. on Mathematical Techniques of Aeromechanics. Apr 60, 156p. 4 refs. WADC Technical rept. 59-710.
Order from OTS $3.00 PB 161 803

The functions tabulated in this report occur in the theory of axial symmetric flow patterns and Mach numbers equal to and close to one. For the convenience of the reader a summary of the theory is given in Section 1. Subsequent sections give details of the theory and the method of computation. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
AN INVESTIGATION OF THE MODEL BLOCKAGE FOR WIND TUNNELS AT MACH NUMBERS 1.5 TO 19.5, by C. J. Schueler. Rept. on ARO, Inc., Contract AF 40(600)800. Feb 60, 19p. 5 refs. AEDC-TN-59-165; AD-232 492.
Order from LC mi$2.40, ph$3.30 PB 146 115

An experimental investigation of the test section flow blockage characteristics was conducted in the 12- x 12-in. supersonic wind tunnel. The purpose of the tests was to determine whether a method of predicting the maximum size model which will permit the establishment of supersonic flow, based on the model frontal area and bow shockwave strength, is applicable over a wide range of Mach numbers. The tests were conducted over the Mach number range from 1.5 to 5 using test models consisting of 15°, 20°, and 28° half-angle cones, cone-cylinder combinations, and a series of discs. The inadequacy of the one dimensional, normal shock theory for predicting allowable model sizes was reconfirmed. A correlation based on shock wave strength and model frontal area was found to be suitable only over a limited range of Mach numbers. Permissible hemisphere-cylinder model sizes from several wind tunnels covering the Mach number range from 1.5 to 19.5 are also presented. (Author)

Arnold Engineering Development Center, Tullahoma, Tenn.
ON BASE PRESSURES AT HIGH REYNOLDS NUMBERS AND HYPERSONIC MACH NUMBERS, by Jack D. Whitfield and J. Leith Potter. Rept. on ARO, Inc., Contract AF 40(600)800. Mar 60, 21p. 3 refs. AEDC TN-60-61; AD-234 477.
Order from LC mi$2.70, ph$4.80 PB 146 332

A tentative method for estimating base pressures at hypersonic Mach numbers and at large Reynolds numbers is described. Both blunt and sharp nosed shapes are treated. The procedure is based on existing empirical methods but modifications are made in order to deal with short, blunt bodies. A tendency for base pressure ratios on conical or other flared bodies to increase with Mach number in the hypersonic regime is illustrated. This trend is dependent on body shape and is strengthened by nose bluntness. Refinement and definition of the limitations on the method must await the receipt of experimental data covering a greater range of variables. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
TESTING TECHNIQUE USED FOR FLUTTER TESTS OF MIT SEMI-SPAN WING MODELS AT SUPERSONIC SPEEDS, by L. K. Ward. Rept. on ARO, Inc., Contract AF 40(600)800. July 59, 13p. 2 refs. AEDC TN-59-74; AD-218 737.
Order from LC mi$2.40, ph$3.30 PB 147 600

A description of the testing technique used for flutter tests of cantilevered semi-span wings at high supersonic speeds is presented. Injecting the models into the airstream after the desired tunnel flow was established permitted testing of the necessarily low strength wings at high supersonic Mach numbers ($M = 1.5$ to 5.0). (Author)

Brown U. Div. of Applied Mathematic, Providence, R. I.
SUPERSONIC FLOW PAST FINITE DOUBLE WEDGE WINGS OF VARIABLE THICKNESS. PART II. SINUSOIDAL VARIATION, by Maurice Holt and Bohyun Yim. Rept. on Contract AF 49(638)232. May 60, 41p. 6 refs. AFOSR-TN-60-432.
Order from LC mi$3.00, ph$6.30 PB 147 404

In this paper a wing is considered in which maximum thickness varies sinusoidally with span. (See also PB 147 403)

Convair, Pomona, Calif.
THERMO-ELASTIC EQUATIONS APPLICABLE TO THICK-WALL, POINTED SHELLS OF REVOLUTION, by R. D. Sutherland and R. G. Shook. Rept. on Contract AF 49(638)592. Nov 59, 31p. 4 refs. TM-349-14; AFOSR TN-59-1274; AD-233 395.
Order from LC mi$3.00, ph$6.30 PB 146 439

The thermo-elastic equations necessary to define the stress distribution in a thick-wall, pointed shell of revolution are presented. A coordinate system based on the classic ogive shape which is applicable to a variety of low aerodynamic drag shapes is utilized in

the analysis. Stress functions equations are derived in these ogive coordinates. Techniques are presented for use at the boundaries of the shells of revolution and at the axis of revolution. The equations presented can be solved by numerical methods and are a basis for further work in obtaining analytical solutions to the stresses in thick-wall, pointed shell of revolution. (Author)

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
ON THE TURBULENT BOUNDARY LAYER WITH FLUID INJECTION, by Donald L. Turcotte. Rept. on Contract AF 18(600)1523. July 59, 10p. 6 refs. AFOSR-TN-59-874.
Order from LC mi$1.80, ph$1.80 PB 147 634

By introducing a sublayer region in which the intensity of turbulence grows at a prescribed rate, the reduction in wall shear stress due to fluid injection is found for a turbulent boundary layer. With the decrease in wall shear stress expressed as a function of the ratio of the injection velocity to the friction velocity, the form of the solution is particularly simple. The theory provides a free parameter which can be determined such that the available experimental data are excellently correlated. (Author)

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
POTENTIAL FLOWS IN THE APPROXIMATION OF VISCOUS ACOUSTICS, by William Joseph Rae. Rept. on Contract AF 18(600)1523. June 60, 114p. 18 refs. AFOSR-TN-60-409.
Order from LC mi$6.00, ph$18.30 PB 147 644

Steady, irrotational flows are studied in a linearized approximation, retaining the effects of dispersion and attenuation due to viscosity in the region outside the boundary layer. The differential equation for the velocity potential in this approximation is derived and discussed, and formal solutions for the flow around non-lifting two-dimensional and axisymmetric bodies are found. Approximate evaluations of the formal solution then reveal that throughout all of the subsonic, and most of the supersonic flow field, the inviscid solution is altered by a correction that is first-order in a viscosity parameter. In the supersonic cases, the familiar inviscid wave pattern tends to be dispersed in the vicinity of the body, and at great distances from the body, all disturbances decay. The rates of decay of pressure disturbances at these distances are found, and their relation to the inviscid, nonlinear treatment of the same problem is discussed. In the course of the Fourier analysis of the problem, a Fourier transform which is not listed in any of the standard tables is evaluated, and this provides a closed-form solution to a boundary-value problem involving a certain third-order partial differential equation. Both of these results are thought to be new. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
PRELIMINARY STUDIES ON BOUNDARY-LAYER TRANSITION CAUSED BY A THIN TRANSVERSE WIRE FLOATING FROM SURFACE, by Francis R. Hama. Rept. on Contract AF 49(638)645. Apr 60, 27p. 8 refs. Technical note BN-208; AFOSR-TN-60-505.
Order from LC mi$2.70, ph$4.80 PB 147 487

It is found that a thin wire, which is incapable of tripping the flow when it is attached to the surface, can cause transition if it is raised from the surface. A rough criterion of provoking transition at the wire is about 200 - 300 for the Reynolds number based upon the velocity at the top of the wire and the distance of the top of the wire from the surface, although it depends on the combination of the wire diameter and the raised distance from the surface. This criterion is approximately the same as that for the conventional trip wire attached to the surface. But a possible merit as a tripping device is that a thick wire is not required to block the entire height. The Reynolds number based upon the velocity at the top and the wire diameter can be as small as 75 to trip the flow at the wire. Important mechanics involved in this arrangement is the following: the flow underneath the wire tends to separate from the surface immediately behind the wire and to break up three-dimensionally resulting in the formation of longitudinal vortices. Transition is provoked by the coupling between the longitudinal vortices and the two-dimensional vortices formed behind the wire. (Author)

Institute of Engineering Research, U. of California, Berkeley.
THE SURFACE ABLATION OF FIBER REINFORCED PLASTICS PARALLEL TO AN OXYACETYLENE FLAME, by Robert B. Greene. Rept. on Contract DA 04-200-ORD-776. 25 Feb 60, 67p. 20 refs. Technical rept. HE-150-179; Series no. 128, issue no. 4.
Order from LC mi$3.90, ph$10.80 PB 148 008

The present study was initiated to provide some of the information required for selection and design of ablating heat shields at moderate heating rates. Specimens of twelve different fiber reinforced plastics were subjected to flat plate turbulent heating from an oxy-acetylene flame. It was found that when exposed to heating in the 20 to 40 BTU/ft^2 sec range, reinforced phenolic and melamine resins are subject to an unsteady state ablation process characterized by a charred layer of appreciable thickness. This charred layer was found to increase in thickness at a rate of 0.07 to 0.10 inches/min. The thermal diffusivities as a function of temperature were calculated from test data, and found to show a sharp decrease during the initial temperature rise. After the initial decrease the values of the diffusivities generally remained in a range of 0.4×10^{-6} to 2×10^{-6} ft^2/sec.

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME II. FLUID MECHANICS. INVISCID FLOWS. Technical rept. for Jan 58-Jan 59. Jan 59, 166p. 4 refs. LMSD-48381.
Order from LC mi$7.80, ph$25.80 PB 147 667

Contents:
Inviscid hypersonic flow around blunt bodies, by M. Vinokur
Supersonic flow around blunt bodies—an extension of Van Dyke's technique, by M. Vinokur and R. W. Sanders

Surface pressure distribution on blunt bodies at supersonic speeds, by R. M. Mark
An extension of second-order shock expansion theory, by R. Capiaux
Slender body of revolution at hypersonic speeds—"an approximation to the determination of the flow field", by R. Capiaux
A linearized method of characteristics for determining body aerodynamic forces at angle of attack, by J. Der
The Newtonian-diffuse method for computing aerodynamic forces, by W. A. Gustafson

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME V. MECHANICS OF DEFORMABLE BODIES. Technical rept. for Jan 58-Jan 59. Jan 59, 323p. 8 refs. LMSD-48381.
Order from LC mi$11.10, ph$50.10 PB 147 668

Contents:
Creep instability and collapse of initially straight columns, by W. E. Jahsman
A theory of creep instability of initially straight columns, by W. E. Jahsman and F. A. Field
A theory for predicting creep buckling of straight columns and flat plates, by R. F. Crawford
A study of creep collapse of a long circular cylindrical shell under uniform external pressure, by N. J. Hoff, W. E. Jahsman, and W. Nachbar
Oscillations of pressurized cylindrical shells, by H. V. Hahne
Discontinuity stresses in pressurized thin shells of revolution, by W. Nachbar
Analysis of thermal stress and deflection in shells of revolution, by Hsu Lo and Edward Y. W. Tsui
Buckling of a cylindrical shell pressurized over a circumferential band and stabilized by a soft, elastic core, by D. O. Brush and F. A. Field
Thermal stress analysis by energy methods, by L. A. Riedinger
Oscillations of a propellant wall, by J. Lenoir
(See also PB 147 667)

Michigan U. Research Inst., Ann Arbor.
TABLE OF PRESSURE RATIOS P_i/P_c AND P_c/P_a vs. MACH NUMBER FOR A 15° RIGHT CIRCULAR SUPERSONIC CONE ($\gamma = 1.405$) by N. W. Spencer. Scientific rept. no. ES-3 on Contract AF 19(604)1948. Sep 58, 106p. 4 refs. 2597-7-S; AFCRC-TN-58-622.
Order from LC mi$5.70, ph$16.80 PB 137 829

This report presents a table of pressure ratios to be found on a 15° right circular cone tabulated versus the free-stream Mach number. The pressure ratios are given to five significant figures against 0.001 increments of the argument. The argument ranges from $M_1 = 1.048$ to $M_2 = 3.895$. Given are the ratio of total head pressure (P_i) to the cone-surface pressure (P_c) and the ratio of the cone-surface pressure (P_c) to the free-stream static pressure (P_a). With these tables and two pressures on a right circular cone, it is possible to determine the free-stream Mach number and the free-stream static pressure. By measuring the free-stream velocity (or the velocity of the cone throught the media if that is the situation) in addition, it is possible to compute free-stream static temperatures and densities. (Author)

Oklahoma Agricultural and Mechanical Coll., Stillwater.
OPTICAL BIREFRINGENCE INDUCED BY SHEAR WAVE PROPAGATION IN AQUEOUS MILLING YELLOW SOLUTIONS, by George B. Thurston, Logan E. Hargrove, Jr. and Marvin Y. Edmison. Technical rept. no. 4 on Research in Nonlinear Properties of Fluid Flow Through Circular Orifices, Contract DA 23-072-ORD-583. June 57, 74p. 27 refs. OOR rept. no. 1336.4; AD-135 029.
Order from LC mi$4.50, ph$12.30 PB 147 857

The optical interference patterns observed in a flow-birefringent fluid when viewed between crossed plane-polarizing plates are related to the fluid motion. This work is a study of the observed optical interference patterns caused by an oscillating plane in a flow-birefringent fluid, an aqueous solution of milling yellow dye. Optical and hydrodynamic theory is reviewed and experimental methods and results are presented. It is found that the optical interference patterns exhibit wave properties which are related to the wave of transverse fluid vibrations. Properties of the optical interference patterns are presented as a function of phase, velocity amplitude, and frequency. The effects of geometry of flow facility, optical system alignment, and edge effects are discussed. Consideration is given the optical and rheological properties of the fluid. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
ANALYTIC SOLUTIONS OF PLANAR REENTRY TRAJECTORIES WITH LIFT AND DRAG, by Kenneth Wang and Lu Ting. Rept. on Contract AF 49(638)445. Apr 60, 75p. 7 refs. PIBAL rept. no. 601; AFOSR-TN-60-508.
Order from LC mi$4.50, ph$12.30 PB 148 088

The method of Lees, Hartwig, and Cohen is modified, so that the gravitational and the centrifugal terms in the equation of motion normal to the trajectory can be retained. Analytic solutions for planar shallow reentry trajectories are obtained. For constant lift and drag coefficients, algebraic relationship between the local inclination and the density or elevation and that between the velocity and density are obtained. The first relationship is independent of the drag coefficient; therefore the result of the first relationship can be tabulated for various values of lift coefficient only. If the lift and drag coefficients are given functions of elevation, similar analytic relationships can be obtained by simple quadratures. The analytic solutions are employed to determine the acceleration, in particular the maximum acceleration, along the trajectory. As applied to the skip trajectories, the minimum elevation and the exit condition of each skip are determined. (Author)

Princeton U., N. J.
THE UNSTEADY LAMINAR BOUNDARY LAYER ON A FLAT PLATE, by Sin-I Cheng and David Elliott. Rept. on Contract AF 18(600)498. Sep 55, 103p. 16 refs. Princeton rept. no. 318; AFOSR TN-56-115; AD-82 511.
Order from LC mi$5.70, ph$16.80 PB 148 037

The unsteady laminar boundary layer on a flat plate moving with an arbitrary velocity $U_\infty(t)$ into an in-

compressible fluid at rest has been investigated in this paper. The motion is taken to start from rest at a time $t = 0$ with $U_\infty(t)$ continuous at $t = 0$ and infinitely differentiable for all $t > 0$. Under these conditions a solution is constructed which is valid for all t and x, where x is the distance from the leading edge of the plate. The solution is also shown to be valid for the flow after a long time when $U_\infty(t)$ does not satisfy the above conditions. Finally, the effect of compressibility for small Mach numbers has been discussed briefly. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
SOME EFFECTS OF SURFACE CURVATURE ON THE LAMINAR BOUNDARY LAYER FLOW, by K. Toba. Rept. on Contract AF 49(638)23. Mar 60, 28p. 5 refs. TR AE 5904; AFOSR-TN-60-448.
Order from LC mi$2.70, ph$4.80 PB 147 754

In a recent report (PB 136 251) K. T. Yen presented a new theory of laminar boundary layer flow. By adopting the natural coordinates the boundary layer approximation is made so that surface curvature effects are taken into account. In this report, further elaboration of the proposed formulation is made and the effects of surface curvature are evaluated for a family of surfaces which yield similar solutions. Numerical results for the velocity profiles and the wall skin friction distribution obtained by means of a high speed computer are presented and analyzed. (Author)

Training Center for Experimental Aerodynamics (Belgium).
LAMINAR SEPARATION IN SUPERSONIC FLOW WITH EMPHASIS ON THREE-DIMENSIONAL PERTURBATIONS AT REATTACHMENT, by Jean J. Ginoux. Final rept. on Contract AF 61(514)993. Feb 60, 44p. 7 refs. TCEA Technical note 3; AFOSR-TN-60-237.
Order from LC mi$3.30, ph$7.80 PB 147 503

Regular and repeatable span-wise flow perturbations exist in the reattachment region of a laminar supersonic boundary-layer on a two-dimensional backward-facing step model. The model span and leading-edge thickness, when below 0.1 mm, had no effect on the wave-length of the flow perturbations. On backward facing-steps, at a Mach number of 2.16, the ratio of wave-length of the flow perturbations to boundary-layer thickness was a function of the ratio of step-height to boundary-layer thickness. Similar perturbations were found at the reattachment region of a laminar boundary-layer on forward-facing steps, on compression-corners, on rectangular cavities and in the case of interaction between a shock-wave and the boundary-layer. They were also detected in unseparated boundary-layers. The presence of three-dimensional perturbations seems to be related to the general question of boundary-layer stability. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
OBSERVATIONS ON BUBBLE GROWTHS IN VARIOUS SUPERHEATED LIQUIDS, by Paul Dergarabedian. Rept. on Contract N123s91875. 26 Jan 56, 19p. 5 refs. NAVORD rept. 5009.
Order from LC mi$2.40, ph$3.30 PB 148 378

Experimental data are presented for the growth of vapor bubbles in various superheated liquids, such as carbon tetrachloride, benzene, ethyl alcohol, and methyl alcohol. These data are compared with the theoretical results obtained by Plesset and Zwick who derived these results by taking into account the heat diffusion across the bubble boundary. The agreement in all cases between experiment and theory is found to be good. The growth of vapor bubbles in slightly superheated water is also presented in the form of experimental data for bubbles just beginning to grow from a point of equilibrium which is presumed to be dynamically unstable. The radii corresponding to the points of equilibrium are of the same order of magnitude as predicted by theoretical considerations. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
A MODEL OF TURBULENCE DISPLAYING AUTONOMOUS OSCILLATIONS, by R. J. Dickson. Technical memo. 25 Mar 59, 24p. 4 refs. LMSD-48466.
Order from LC mi$2.70, ph$4.80 PB 147 671

This report presents the results of the attempt to find and treat simplified examples of problems governed by nonlinear space-time systems. The introduction sketches the general setting of a "Model of Turbulence" in the sense of J. M. Burgers, and directs attention to the character of the particular problem considered here. Section 2 introduces a special class of nonlinear ordinary differential equations and explains its relationship to a partial differential system studied by Burgers. Section 3 takes the first step in a detailed study of this class of equations.

Wigley, C. (Gt. Brit.)
CALCULATION OF WAVE RESISTANCE AT LOW AND MODERATE SPEEDS, by C. Wigley. Rept. no. 1 on Contract N62558-1772. May 59, 51p. 12 refs.
Order from LC mi$3.60, ph$9.30 PB 146 294

METALLURGY

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SELECTED REFERENCES ON BRITTLE FRACTURE, by Don Owens and Lynne Doss. 5 May 60, 65p. 822 refs. DMIC memo. 55.
Order from OTS $0.50 PB 161 205

The purpose of this bibliography is to bring together the results of past and current studies of the subject in view of its renewed importance as an obstacle in the missile and space programs. The references have been categorized and cross referenced as testing techniques; low-temperature fracture; fracture of welded structures; influence of processing variables other than welding; temper brittleness; hydrogen embrittlement; influence of composition on brittle fracture; ductile-to-brittle transition; stress-corrosion cracking; fundamental studies and status of research; fracture of nonferrous materials; design considerations; case histories; and methods of circumventing brittle fracture. This collection of references is not a complete one and will be revised and expanded as the acquisition of new references makes the need apparent.

Defense Metals Information Center, Battelle Memorial Inst., Columbus.
A SUMMARY OF COMPARATIVE PROPERTIES OF AIR-MELTED AND VACUUM-MELTED STEELS AND SUPERALLOYS, by D. C. Ludwigson and F. R. Morral. Rept. on Contract AF 18(600)1375. 28 Mar 60, 147p. 58 refs. DMIC rept. 128.
Order from OTS $2.75 PB 151 085

A compilation of data comparing the mechanical properties of vacuum-poured, vacuum-induction-melted, and consumable-electrode vacuum-arc-remelted alloys with those of their air-poured or air-melted counterparts is presented. Specific alloy classes considered are (1) low-alloy steels, (2) hot-work die steels, (3) stainless steels, (4) iron-base superalloys, (5) nickel-base superalloys, and (6) cobalt-base superalloys. In most cases the vacuum-treated materials exhibited better mechanical properties. (Author)

Istituto Elettrotechnico Nazionale "Galileo Ferraris" (Italy).
INTERNAL FRICTION OF FeAl ALLOYS DUE TO SOLUTE ATOM PAIRS. REMARKS ON THE THEORY OF THE EFFECT, by Guiseppe Biorci, Andrea Ferro, and Giorgio Montalenti. Technical note 4a on Contract AF 61(514)1331. Jan 60, 56p. 42 refs. AFOSR-TN-60-495.
Order from LC mi$3.60, ph$9.30 PB 147 501

The internal friction due to directional short range order in Fe Al alloys has been studied. At the frequency of about 1 cps the effect appears at about 510°C with a relaxation time corresponding to a process of substitutional diffusion. The intensity of the effect increases rapidly for concentrations above 10%, and then drops to low values in the region of Fe_3 Al, where the order occurs. Hence the curve of the intensity of the effect as a function of concentration is, with fairly good agreement, proportional to the number of solute Al pairs, as deduced from X rays results of Bradley and Jay. However some deviation from ideality seems to be present also at low concentrations. (Author)

James Forrestal Research Center, Princeton, N. J.
SELF-DIFFUSION OF IRON AND SULFUR IN FERROUS SULFIDE, by Ralph H. Condit and C. Birchenall. Rept. on Contract AF 49(638)533. Mar 60, 126p. 67 refs. Metallurgy rept. no. 24; AFOSR-TN-60-245.
Order from LC mi$6.30, ph$19.80 PB 147 772

Measurements of the self-diffusion of iron and sulfur in ferrous sulfide single crystals are reported as a function of temperature, deviation from stoichiometric composition, and crystallographic direction. Iron self-diffusion is primarily by a vacancy mechanism, the vacancies being provided by the iron deficit plus a small intrinsic disorder. Details of the diffusion mechanism are discussed, and it is concluded that direct jumps between normal sites aligned along the c-axis are favored over jumps from normal to interstitial sites which might then be followed by later jumps into new normal sites. However, the Bardeen-Herring correlation factor appears to operate in such a way that the rate limiting step for diffusion in both crystallographic directions is the jump from normal to interstitial sites.

Metcut Research Associates, Inc., Cincinnati, Ohio.
MACHINING CHARACTERISTICS OF HIGH STRENGTH THERMAL RESISTANT MATERIALS. ITEM V, PART II:, MACHINING CHARACTERISTICS OF MOLYBDENUM - 0.5% TITANIUM ALLOY, by Leonard J. Nowikowski. Rept. for 1 Jan-30 Apr 60 on Subcontract to Contract AF 33(600)35967. 6 May 60, 75p. Wright Aeronautical serial rept. no. MP.00-210.
Order from OTS $2.00 PB 161 775

A study of the machining characteristics of a molybdenum alloy containing 1/2 percent titanium (Mo-1/2% Ti) has been conducted for turning, face milling, drilling, reaming and tapping operations. The data for the various machining tests is presented in graphical form to show the relationships between tool life, cutting speed, feed, tool geometry, tool material and cutting fluids. Grinding tests were conducted to determine the effect of grinding wheel grade, wheel speed, down feed, cross feed, and table speed on grinding ratio (G) and surface finish. The data for these studies is presented in graphical form to show G ratio as a function of grinding variables. Results of individual tests including surface finish data are shown in tabular form. Force measurements were made for turning and drilling the molybdenum alloy. The data is shown in graphical form to indicate the effect of machining variables on unit power, coefficient of friction and tool forces. (Author)

Michigan U. Research Inst., Ann Arbor.
NOTCH SENSITIVITY OF HIGH-TEMPERATURE ALLOYS, by Howard R. Voorhees and James W. Freeman. Rept. for Apr 58-June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5775. Mar 60, 55p. 50 refs. WADC Technical rept. 59-470.
Order from OTS $1.50 PB 161 796

All available results on creep-rupture of notched specimens are critically examined. Analysis of observed behavior suggests a requirement of an early redistribution of concentrated multiaxial stress. A program is outlined for research on crack initiation and propagation during creep-rupture to verify a hypothesized dual role of maximum principal stress and shear-stress invariant in notched-bar rupture behavior. (Author)

Office of Ordnance Research, Durham, N. C.
CONFERENCE ON BASIC RESEARCH IN METALLURGY, 20 MARCH 1958. [1958] 120p.
Order from LC mi$6.00, ph$18.30 PB 146 040

Contents:
Certain intermediate phases in alloys on the first, second and third long period transition elements.

Solid solution strengthening of magnesium single crystals at room temperature.
Lattice imperfections of magnesium metal and alloys.
Research on the structure of sintered carbides.
Internal friction in alloys with BCC structure.
Reports on research in progress

Ferrous Metals

Alabama U., University.
INFLUENCE OF THERMAL CYCLING ON THE BRITTLE TRANSITION TEMPERATURE OF LOW-CARBON STEEL, by Harry Majors, Jr. Technical rept. no. 2 on Contracts DA 01-009-ORD-396 and DA 01-009-ORD-454. Oct 57, 21p. 8 refs. OOR rept. no. 1230.3; AD-146 076.
Order from LC mi$2.70, ph$4.80 PB 147 861

The effects of thermal cycling on the brittle transition temperature of low carbon steels were investigated. Grooved-tension impact specimens of 2 steels were fully annealed and subjected to the following thermal cycling treatments (1) 300° to 1000° to 300°F and (2) 1000° to 1500° to 1000°F. Heating from 300° to 1000°F required 2 min and cooling from 1000° to 300°F required 45 sec. Quenching from 1500° to 1000° required 3 min. No changes in hardness (69 Rockwell B) and no alteration in grain size were effected by the 300° to 1000°F cycling. The average hardness was 75 Rockwell B with a refinement of grains after the 1000° to 1500°F cycling treatment. Tension impact tests were conducted between -100° and +90°F in a Baldwin Sountag model S1-1 testing machine. Some preliminary conclusions were (1) that thermal cycling across the thermal critical point lowered the brittle transition temperature, and at all temperatures down to -100°F there was some macroscopic plastic flow, and (2) that thermal cycling in the region of 300° to 1000°F tended to broaden the range of temperature transition from brittleness (0.00 in./in. true plastic fracture strain) to large ductility (0.35 in./in. true plastic fracture strain).

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
FATIGUE DATA ON PRECIPITATION-HARDENABLE STAINLESS STEELS, by R. J. Favor, H. J. Grover, and W. P. Achbach. 11 Mar 60, 16p. 6 refs. DMIC memo. 46; AD-234 805.
Order from OTS $0.50 PB 161 196

Naval Research Lab., Washington, D. C.
HEAT TREATMENT OF Mn-V-Mo AGE-HARDENING AUSTENITIC STEEL, by N. C. Howells and E. A. Lange. Interim rept. 16 May 60, 10p. 2 refs. NRL rept. 5464.
Order from OTS $0.50 PB 161 370

The age-hardening characteristics of Mn-V-Mo austenitic steels have been determined as a function of the temperature of the solution treatment. The optimum condition for developing the full age-hardening potential of an alloy is 1/2 hour at 2100°F followed by a water quench. Subsequent aging treatments required for maximum-hardness levels are: 1 hour at 1400°F, 6 hours at 1300°F, or 16 hours at 1200°F. An aging temperature between 1200°F and 1300°F is optimum for controlling the balance between yield strength and ductility. The yield strength of metals in the fully-aged condition is directly proportional to Brinell hardness, ranging from 80,000 to 150,000 psi for the compositions investigated. (Author)

Watertown Arsenal Labs., Mass.
CIRCULAR-PATCH TEST FOR EVALUATING ARMOR CRACK-SUSCEPTIBILITY, by Laurence E. Poteat and Richard W. Jones. May 60, 37p. 10 refs. WAL TR 710/1075.
Order from OTS $1.00 PB 161 822

An investigation was conducted to determine the effect of different procedures on the effectiveness of the circular-patch test specimen in the evaluation of plate crack susceptibility and to determine conditions suitable for a standard test. A test procedure was selected and used on several different heats of armor steel. Evaluation of these heats by this procedure placed the heats in the correct order of crack susceptibility as determined from the known fabrication history of the heats. (Author)

Watertown Arsenal Lab., Mass.
EXOTHERMIC RISERING EFFECTS ON PROPERTIES OF CAST ARMOR STEEL, by John M. Ingraham. June 60, 35p. 6 refs. WAL TR-616.1/1.
Order from OTS $1.00 PB 161 698

This is a limited study of the effects of the use of exothermic riser sleeves on the physical and mechanical properties of a cast armor test plate. The work reported herein consists of studies to determine hardness, macro- and microstructure, tensile and impact properties in areas adjacent to and removed from the riser area. (Author)

Watertown Arsenal Labs., Mass.
FORGING EFFECTS ON THE MECHANICAL PROPERTIES OF THREE BORON-TREATED STEELS, by Eugene DiCesare. July 59, 48p. 2 refs.
WAL TR 312/80; AD-219 749
Order from OTS $1.25 PB 151 814

Steel alloys 14B35, 14B50, and 10R70 containing boron and rare earth were hot forged (2250°F) by upsetting and drawing out (swaging) with reduction ratios up to 8 to 1 and 13 to 1, respectively. Longitudinal and transverse tensile and Charpy specimens, and micro and macrospecimens were tested and examined in the as-forged and in the heat-treated condition. Heat treatment resulted in optimum tensile properties and toughness in both the upset-forged and the drawnout, or swaged, ingots, at approximately 66% reduction for the swaged ingots, 50% reduction for the upset-forged 14B35 alloy, and 0% reduction for the upset-forged 14B50 and 10R70 alloys. (Author)

Watertown Arsenal Labs., Mass.
HIGH STRENGTH STEEL: EFFECT OF VARYING COMPOSITION TO A TARGET HARDENABILITY, AND AN EXPERIMENTAL SILICON-RICH BORON-TREATED LOW ALLOY STEEL, by S. V. Arnold.

Oct 59, 39p. 11 refs. WAL TR 320.1/1; AD-226 966.
Order from OTS $1.00 PB 161 007

The tensile, notched tensile and impact properties of a number of experimental 0.30% carbon nickel-chromium-molybdenum steels, made to target composition of calculated 15" DI hardenability, were determined after quenching and tempering at 450°F. Tensile notched tensile and impact properties of an experimental 0.33% carbon silicon-rich boron-treated steel with moderate amounts of chromium and molybdenum, when quenched and tempered within the range 450°-700°F, were exceptionally good. (Author)

Watertown Arsenal, Mass.
OBTAINING LEAST-COST FURNACE INPUT MIXES BY LINEAR PROGRAMMING, AND SOME INVENTORY IMPLICATIONS, by Gideon I. Gartner. July 59, 77p. 13 refs. Management Science rept. no. MS-1; AD-233 226.
Order from LC mi$4.50, ph$12.30 PB 146 836

Many combinations of furnace input materials exist, which will meet a set of given furnace output requirements. The linear programming technique can be used to choose that feasible material combination whose material cost is a minimum. The technique can be used to calculate optimal prescriptions for individual heats, or to determine which materials to buy to stock in inventory. While previous work has been done on the individual heat problem, this project is concerned with the "what to buy" decision. Several possible management policies which concern the extent to which linear programming might be used are described as are the implications of a linear programming based system to economic lot size determination. To justify the use of L. P. in this application as well as to illustrate several points, a number of problems, hypothetical and real, were solved on the IBM 704. (Author)

Watertown Arsenal Labs., Mass.
RISIDUAL TENSILE STRESS CONCENTRATIONS AND TENSILELY-STRESSED CRACKS VERSUS TOUGHNESS OF HEAT-TREATED AISI 4340 STEEL, by S. V. Arnold. May 60, 18p. 2 refs. Technical rept. no. WAL TR 834.21/1.
Order from LC mi$2.40, ph$3.30 PB 147 506

By bending standard Charpy V impact specimens over a fulcrum placed against the mouth of the notch, altered specimens were obtained with angles of permanent set ranging from a fraction to several degrees. The metal at the base of the Charpy notch underwent permanent compressive deformation and then, upon release of load, this metal was placed in residual tension by elastic recovery of the specimen. Incipient cracks formed at the base of the notch. Specimens were tested in impact over a range of temperatures to determine the effect of such alterations upon energy level and transition behavior of AISI 4340 steel quenched and tempered to various strength levels. (Author)

Watertown Arsenal Labs., Mass.
SPECTROCHEMICAL DETERMINATION OF ACID-SOLUBLE ALUMINUM IN LOW-ALLOY STEELS BY THE ROTATING-DISC METHOD, by F. G. Howell. June 59, 20p. 16 refs. Technical rept. WAL TR 804/19; AD-217 440.
Order from OTS $0.75 PB 151 812

A spectrographic method for the determination of acid-soluble aluminum in low-alloy steels was developed using a solution technique with a rotating graphite disc and a high-voltage alternating current spark. The method is rapid compared to chemical analysis, permitting a considerable saving in time. Of the common alloying elements used in low-alloy steels, only tungsten interferes. The method applies to samples containing 0.02% to 0.25% acid-soluble aluminum. This range includes most of the samples submitted for analysis. (Author)

Light Metals

Battelle Memorial Inst., Columbus, Ohio.
THE DEVELOPMENT OF MINIMUM DESIGN DATA ON THE NEW TITANIUM ALLOYS BEING CONSIDERED IN THE TITANIUM SHEET-ROLLING PROGRAM, by W. W. Breindel, C. L. Seale and others. Quarterly rept. no. 4 on Contract NOas 57-148-C. 20 Feb 58, 17p. 4 refs; AD-158 618.
Order from LC mi$2.40, ph$3.30 PB 147 733

The effect of the ratio of the pin diameter to sheet thickness on the bearing strength is discussed. The decision was made to investigate this relationship for heat-treated 6 Al-4V Ti alloy. The use of the single shear-type specimen is illustrated by the presentation of additional data. Compression test procedures are described, and data are presented on annealed 6 Al-4V Ti alloy at testing temperatures of 80°, 400°, 600°, 800°, and 900°F. A tension apparatus was evaluated which permits the use of the same extensometer as that used for compression tests.

Battelle Memorial Inst., Columbus, Ohio.
METALLURGICAL AND MECHANICAL CHARACTERISTICS OF HIGH-PURITY TITANIUM-BASE ALLOYS, by Richard W. Douglass, Frank C. Holden and others. Rept. for 15 Feb 58-15 Aug 59 on Metallic Materials, Contract AF 33(616)5462. Mar 60, 154p. 15 refs. WADC Technical rept. 59-595.
Order from OTS $3.00 PB 161 817

The relationships between mechanical properties, alloy composition, microstructure, and thermal history have been studied for high-purity titanium-base alloys. The alloy systems investigated include Ti-V, Ti-Cr, and Ti-W binary alloys, and Ti-Al-V, Ti-Al-Cr, Ti-O-V, Ti-O-Cr, and Ti-O-Mn ternary alloys. Mechanical-property data include tensile and flow properties, impact behavior, hardness, aging, and cooling-rate data. The effects of dispersions on the creep of Ti-W, Ti-Cu, and Ti-Si alloys were investigated. The metallurgical principles involved here and in previous work are discussed. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
BERYLLIUM: A SEARCH OF THE LITERATURE 1957-1959, by Kenneth D. Carroll. Technical rept. Jan 60, 116p. 349 refs. LMSD-288190.
Order from OTS $2.50 PB 161 811

The broad field of beryllium metallurgy, crystallography, fabrication methods, and the application of Be to the aircraft and missile fields has been reviewed. References to the use of Be in nuclear reactors, nuclear fuels, and the effects of radiation have been omitted. There are references included as to the toxicology of Be, its hazard limits, and means of detection; however, this phase was of tangental interest and the references are not exhaustive. References to Cu-Be alloys have been omitted, but abstracts are included covering other Be alloys. The majority of the items cited have been abstracted; however, various annual reviews and progress reports were not. (See also PB 161 012)

Lockheed Aircraft Corp., Sunnyvale, Calif.
BERYLLIUM: SURVEY OF THE LITERATURE (SUBJECT) by K. D. Carroll. Special Bibliography. 1 Apr 60, 60p. 135 refs. LMSD 288190, Suppl. no. 1.
Order from OTS $1.50 PB 161 812

See also PB 161 811

Office of Technical Services, Dept. of Commerce, Washington, D. C.
BERYLLIUM (1945-1960). June 60, 19p. 362 refs. OTS Selective Bibliography 413.
Order from OTS $0.10 OTS SB-413

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports are arranged in categories as follows: beryllium metals and alloys; beryllium compounds, carbides, and isotopes; toxicity, safe handling of beryllium; translations on beryllium.

Watertown Arsenal Labs., Mass.
DETECTION BY NONDESTRUCTIVE TESTS OF OVERHEATING IN 2014-T6 ALUMINUM ALLOY, by Patrick C. McEleney and Everett L. Reed. May 60, 44p. 4 refs. WAL TR-140/27.
Order from OTS $1.25 PB 161 516

Ultrasonic attenuation tests have proved to be successful in the detection of "overheating" or "burning" in 2014-T6 aluminum alloy. Heretofore overheating was detected only by metallographic examination. Correlation between ultrasonic attenuation tests and metallographic studies of a series of overheated and nonoverheated 2014-T6 aluminum alloy samples has been successfully accomplished. Liquid penetrant, radiographic and electromagnetic tests can also be applied in certain instances to detect this condition. (Author)

Nonferrous (except light) Metals

Battelle Memorial Inst., Columbus, Ohio.
HIGH-TEMPERATURE PROPERTIES AND ALLOYING BEHAVIOR OF THE REFRACTORY PLATINUM-GROUP METALS, by R. W. Douglass, F. C. Holden, and R. I. Jaffee. Technical phase rept. on Contract Nonr-2547(00). 14 Aug 59, 127p. 286 refs. AD-226 310.
Order from OTS $2.75 PB 161 823

A survey of the literature pertaining to the platinum-group metals and their alloys has been conducted as a part of the study of the metallurgical properties of the refractory platinum-group metals. Major emphasis was placed on the four more refractory metals: rhodium, iridium, osmium, and ruthenium. A selected bibliography and a list of references are included. (Author)

Climax Molybdenum Co. of Michigan, Detroit.
ARC-CAST MOLYBDENUM AND TUNGSTEN BASE ALLOYS (1957-1959) by M. Semchyshen and R. Q. Barr. Rept. on Contract Nonr-2390(00). 1959, 205p. 12 refs.
Order from OTS $3.50 PB 161 820

The studies can be categorized in the following manner: (1) Alloy Systems: This phase involves an investigation of molybdenum-base alloys containing substantial amounts of alloying addition. (2) Strengthening Mechanisms in Molybdenum-Base Alloys: Previous studies have shown that carbon plays a major role in the development of high temperature strength in Mo-Ti-C alloys. These studies have been continued and expanded to include Mo-Zr-C and Mo-Hf-C alloys. (3) Mechanical Properties of As-Cast Molybdenum-Base Alloys. Molybdenum-base alloys containing additions in excess of those which can be worked by presently-available facilities have demonstrated high elevated temperature hardness. (4) Evaluation of Electron-Beam Melted Molybdenum: Ingots melted by the electron-beam technique have been evaluated from the standpoint of purity and transition temperature in tension. (5) Tungsten-Base Alloys: A preliminary survey of tungsten-base alloys has been initiated. (6) Determination of Elastic Moduli of Molybdenum and Commercial Molybdenum-Base Alloys: The modulus of elasticity has been determined from tension stress-strain data for unalloyed molybdenum, Mo + 0.5% Ti, Mo + 0.5% Ti + 0.7% Zr, and Mo + 0.5% Zr over the range from room temperature to 2400 F.

Structural Metallurgy and Corrosion

Armour Research Foundation, Chicago, Ill.
PHASE RELATIONSHIPS IN SELECTED BINARY AND TERNARY VANADIUM-BASE ALLOYS SYSTEMS, by Steven A. Komjathy, Robert H. Read, and William Rostoker. Rept. for 1 May 58-31 July 59 on Solid State Research and Properties of Matter, Contract AF 33(616)5771. Jan 60, 79p. 35 refs. WADC Technical rept. 59-483.
Order from OTS $2.00 PB 161 816

In order to obtain information for the development of vanadium-base alloys, binary systems (V-La, V-Ce, V-Pr, V-Nd, V-Gd, V-Sn, V-Hf, V-Th, V-W and V-Re) and ternary systems (V-Ti-Nb, V-Ti-Mo, V-Ti-Ta, V-Ti-W, V-Ti-O, V-Ti-Si, and V-Ti-Be) were investigated for (1) the extent of the vanadium-rich solid solution between 800° and 1500°C, (2) the character of the second phase in equilibrium with the solid solution, and (3) the possible melt reaction. Metallographic examination, X-ray powder diffraction analysis, incipient melting point determination, differential thermal analysis, and microhardness tests were used as experimental technique. The experimental results are illustrated by partial phase diagrams, where it was necessary. In some cases work was done on compositions with less than 50 w/o V to resolve certain problems. Precipitation kinetics studies were carried out on selected alloy compositions in ternary systems V-Ti-O, V-Ti-Si, and V-Ti-Be. The age hardening of the alloys at 550°, 650°, and 750°C was followed by routine Vickers hardness tests. (Author)

Bureau of [Naval Weapons] Washington, D. C.
PROCESS OF APPLYING POLYTETRAFLUORETHYLENE COATINGS ON STEEL SURFACES. 11 Jan 56, 10p. NAVORD OD 10362.
Order from LC mi$1.80, ph$1.80 PR 148 650

Dayton U., Ohio.
ON THE FEASIBILITY OF USING X-RAY FLASH TECHNIQUES FOR DIFFRACTION STUDIES, by Werner R. Rambauske. Rept. for June-Dec 59 on Thermodyanmics and Heat Transfer, Contract AF 33(616)6607. Mar 60, 61p. 23 refs. WADD Technical rept. 60-55.
Order from OTS $1.75 PB 161 797

X-ray diffraction and other methods concerned with the analysis of the microstructure of matter are limited by relatively small radiation intensities. The feasibility of utilizing highly intense X-ray flash techniques are studied herein with actual Laue diffraction pictures obtained in very short times (microseconds) also presented. (Author)

Florida U. Engineering and Industrial Experiment Station, Gainesville.
THE EFFECT OF FOREIGN SUBSTANCES ON THE STRENGTH OF POWDER-METAL AGGREGATES, by Otto Zmeskal. Final rept. on Contract DA 01-009-ORD-439. 30 Sep 58, 119p. 1 ref; OOR rept. no. 1423.1: AD-206 839.
Order from LC mi$6.00, ph$18.30 PB 147 869

The report is divided in four parts, each dealing with a different pure metal. The metal matrices covered are copper, titanium, zirconium, and iron. The oxides were introduced by mixing the pure oxides with the pure metal powders. For each metal a program was devised to determine the optimum conditions of particle size, method of aggregation, pressing pressure, sintering atmosphere and temperature and additional pressing and sintering operations. The criteria used were density and hardness. Both cylinders and tensile bars were evaluated. The oxide added to copper was titania. This oxide was also used as the dispersed phase in titanium; to minimize oxide solubility, low temperature sintering was used with tin as the bonding agent. Zirconia was added to zirconium; both hydride zirconium and high purity zirconium metal were used, but in both instances the resultant products were very brittle. The greatest amount of work was done with carbonyl iron. The oxides added included zirconia, thoria, ceria, lanthana, aeodymia, dysprosia, and gadolinia. Lanthana was found to prevent bonding of the iron matrix, while the other oxides were found to be only slightly embrittling. The iron - gadolinia mixture offers considerable promise for a control rod material in nuclear applications. In general, the oxide additions to each metal investigated resulted in increased hardness and strength at elevated temperatures.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
THIN METAL FILMS AS CORROSION INDICATORS, by Richard B. Belser and Frank E. Hankinson. Rept. for 15 Nov 57-15 Nov 58 on Finishes and Materials Preservation, Contract AF 33(616)3879. May 59, 56p. 11 refs. WADC Technical rept. 59-149; AD-214 886.
Order from OTS $1.50 PB 151 974

Investigation of the corrosion behavior of thin metal films for possible utilization in economic and reliable corrosion indicators. The corrosion behavior of iron, bimetal films of iron and copper, manganese, and metal films sensitized by salts were observed in various cleaning procedures were examined. Natural corrosion of a metal film appeared to be a two-stage process. Sensitization of the metal film negates one of the steps and the film becomes primarily an integrator of the conditions of temperature and humidity to which the film is subsequently exposed. Both sensitized and unsensitized metal films may be needed to indicate corrosive conditions. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
ELECTRONIC STRUCTURE OF BERYLLIUM, by George C. Kuczynski. Technical memo. Aug 59, 28p. 10 refs. LMSD-288003; AD-226 302.
Order from LC mi$2.70, ph$4.80 PB 147 681

The theoretical model of beryllium proposed by Herring and Hill [Phys. Rev. 58:132, 1940] is capable of explaining most of the apparent anomalies of the physical properties encountered in this metal. The high Debye temperature is due to high binding energy not unusual in the metals of the first row of the periodic table, whose nuclei are only feebly screened by ls shell electrons. Although the crystallographic structure of beryllium is not predictable from the theory, the electron distribution within the first Brillouin zone seems to lead to a good qualitative correlation of the electrical magnetic properties. Further extension of the theory is capable of accounting for the apparently anomalous change of c/a ratio with temperature, as this report attempts to demonstrate. The only real anomaly which cannot be properly explained is a very low value of the Poisson's ratio. This may be because the present determinations of the elastic constants are not entirely trustworthy. (Author)

Massachusetts Inst. of Tech., Cambridge.
THE INITIAL STAGES OF PLASTIC DEFORMATION IN ALUMINUM AND COPPER, by A. R. Rosenfield (Master's thesis) and B. L. Averbach. Technical rept. no. 1 on Contract Nonr-1841(35). 1959, 48p. 22 refs. AD-226 097.
Order from LC mi$3.30, ph$7.80 PB 148 153

The early stages of plastic flow and microcreep in aluminum and copper have been studied with a strain sensitivity of 2×10^{-6} at temperatures ranging from 25°C (77°F) to -196°C (-321°F) as a function of composition and substructure. The temperature dependence of the elastic limit in both materials is interpreted as arising from a thermal activation of stacking faults under stress, and this model results in values of 65 and 210 ergs/cm^2 for the stacking fault energies of copper and aluminum, respectively. The effects of impurities differ in the two materials and have been ascribed to the presence of precipitates in aluminum and solid solution formation in the case of copper. The jog formation energy in both materials has been measured from an analysis of the stress-strain curve on unloading, giving a value of 0.49 e.v. for copper and 0.21 e.v. for aluminum. (Author)

National Research Labs., Ottawa (Canada).
THERMAL STRESSING DUE TO AN ARBITRARY HEAT SOURCE IN A CIRCULAR CUT-OUT, by G. R. Cowper. Mar 60, 26p. Mechanical Engineering rept. MS-101.
Order from LC mi$2.70, ph$4.80 PB 147 915

This report presents formulas for the thermal stresses and displacements in a circular elastic plate with a concentric circular cut-out due to an arbitrary but steady heat input at the edges of the plate. Formulas for thermal stresses in an infinite plate with a single circular cut-out are obtained as a limiting case. Numerical results are worked out for the case in which an arbitrary arc of the edge of the cut-out is held at a high temperature while the remainder of the edge remains cool. (Author)

Naval Engineering Experiment Station, Annapolis, Md.
INVESTIGATION OF CORROSION INHIBITORS FOR CLOSED COOLING SYSTEMS OF DIESEL ENGINES, by G. R. Garber. 11 May 55, 16p. 2 refs. Evaluation rept. 010162G.
Order from LC mi$2.40, ph$3.30 PB 148 704

A 1,000-hour laboratory test of corrosion inhibitors for closed cooling-water systems of naval diesel engines has been completed. Alkaline-chromate inhibitor containing phosphate gave best protection under the conditions of test. (Author)

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
CORROSION OF WELDED ALUMINUM ALLOYS IN INHIBITED RED FUMING NITRIC ACID, by M. S. Orysh, L. L. Gruss, and A. Gallaccio. Jan 60, 77p. 37 refs. Technical rept. R-1524.
Order from LC mi$4.50, ph$12.30 PB 147 905

An investigation was conducted to determine the resistance of six welded aluminum alloys to corrosion by inhibited red fuming nitric acid (IRFNA) for 40, 100, 180, and 360 days at -30°, 80°, 114°, and 150° F. The corrosion of the welded alloy combinations exposed to IRFNA progressed with time except when exposed at -30°F. The tensile strengths of the welds and base materials were not adversely affected by contact with IRFNA for the duration of one year at the temperatures investigated. The corrosion rates of the 3003/1100 and 5052/5052 combinations increased, whereas that of the 2014/4043 combination decreased as the water concentration of the IRFNA was increased to 7.5 percent.

[RIAS, Inc., Baltimore, Md.]
INVESTIGATION OF THE FRACTURE OF METALS, by I. R. Kramer. Final rept. on Contract Nonr-2616(00). 31 July 59, 22p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 147 077

The delay time for the initiation of plastic flow was studied in single crystals of aluminum, iron and zinc. The delay time of aluminum was found to be affected by pre-strain and orientation. Values for the "activated" volume are too small to be interpreted in terms of forest dislocation. The activated energy is found to vary with pre-strain. For iron, the activated energy compared favorably with values calculated from Cottrell's equation. The presence of nitrogen in zinc is found to increase the delay time. (Author)

Watertown Arsenal Labs., Mass.
NOTCH SENSITIVITY AND LAMINATED CHARPY IMPACT STRENGTH OF 1100-F AND 2024-T4 ALUMINUM ALLOY SIMULATED SHEET, by S. V. Arnold. Sep 59, 21p. 3 refs. WAL TR 341.5/1; AD-225 559.
Order from OTS $0.75 PB 151 898

Simulated sheet of 1100-F and 2024-T4 aluminum alloys were fashioned in 0.050, 0.080, 0.100, 0.133, and 0.200-inch gages by removing equal amounts of stock from each rolled surface of 0.250-inch plate. Laminated Charpy specimens 0.400-inch thick were assembled from this simulated sheet and tested over the range -196° to 400°C. Notched and unnotched tensile specimens were tested at room temperature. (Author)

Watertown Arsenal Labs., Mass.
TEMPERATURE GRADIENT: HARDNESS TECHNIQUE FOR DETERMINATION OF RECRYSTALLIZATION TEMPERATURE, by Joseph M. Dhosi and Marvin B. Pierson. May 60, 22p. WAL TR 831.1/1.
Order from OTS $0.75 PB 161 473

A technique was developed by which recrystallization temperature of alloys can be determined rapidly and with satisfactory accuracy. A 6" - 7" bar of the alloy is heated for a specific time in a specially designed gradient furnace and cooled. A hardness survey is then made along the bar and this is cross-plotted against the temperature gradient to which it had been subjected. The temperature at that point of the bar where hardness values fall off abruptly is then designated as the recrystallization temperature. (Author)

Watertown Arsenal Labs., Mass.
TITANIUM- 6% ALUMINUM - 4% VANADIUM ALLOY: EFFECT OF SPONGE PURITY, ALUMINUM CONTENT AND HEAT TREATMENT, by L. S. Croan, F. J. Rizzitano, and W. L. Warner. Sep 59, 42p. 1 ref. WAL TR 405.21/1; AD-226 305.
Order from OTS $1.25 PB 151 995

An investigation was undertaken to determine the heat treating characteristics of the 6%Al-4%V titanium alloy; the solution and aging temperatures for optimum strength properties; and the effect of varying the aluminum and the interstitial contents on the heat treatment for optimum strength. The study involved the 6%Al-4%V titanium alloy made with three hardness levels of sponge (140, 160, 180 BHN) and three levels of aluminum (6%, 7%, 8%) made with the 140 BHN sponge. A fourth alloy of interest, 5%Al-3%FeCr-3%FeMo (140 BHN sponge) was included in the study. (Author)

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Defense Atomic Support Agency, Washington, D. C.
CRYSTALLINE NUCLEUS, by Warren W. Nicholas. Techical analysis rept. 17 June 59, 30p. 8 refs. DASA-527; AD-225 170.
Order from LC mi$2.70, ph$4.80 PB 148 379

The hypothesis that nuclear protons and neutrons are located on alternate corners of a cubic lattice is found to explain asymmetric fission, spins and magnetic dipole moments of some of the lightest nuclides, certain features of mass defect in light nuclides, and the magic numbers. Several features of the radioactive series are accounted for. Definite structures are proposed for U^{238}, Pb^{208}, and some of the lighter nuclides. (Author)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
THE LATERAL DISTRIBUTION OF PENETRATING PARTICLES IN COSMIC RAY EXTENSIVE AIR SHOWERS, by James Arthur Earl. Doctoral thesis. Technical rept. no. 70 on Contract Nonr-1841(16) and National Science Foundation Grants G2055 and G3006. 31 Aug 59, 91p. 22 refs. AD-226 648.
Order from LC mi$5.40, ph$15.30 PB 147 713

The penetrating component of extensive air showers detected by the MIT air shower experiment at Harvard, Massachusetts, was observed with the aid of a large hodoscope shielded by 985 g/cm^2 of lead. The number of electrons, core location, and arrival direction of each shower were given by the air shower experiment. Mu-mesons associated with a shower could be identified by requiring the projected zenith angle as measured by the hodoscope to agree with the known arrival direction of the shower. An auxiliary detector consisting of a single heavily shielded tray of counters was operated 920 m from the center of the array. In showers with zenith angles less than 25° the density of mu-mesons is proportional to $r^{-1.0 \pm .2}$ for r between 20 and 150 m. (r is the distance from the shower core to the meson detector.) For r between 200 and 900 m the density is proportional to $r^{-2.2 \pm .1}$. The shape of the lateral distribution changes as the zenith angle of the showers is increased. The nature of this change is such that the mesons in inclined showers are more spread out than those in vertical showers. The effect of the magnetic field of the earth on the lateral distribution is small. The meson density near the core is proportional to $Ne^{-.79 \pm .05}$ where Ne is the number of electrons in the shower. For showers with a constant observed number of electrons, the meson density near the core does not change with zenith angle. (Author)

Elementary Particles

Lockheed Aircraft Corp., Marietta, Ga.
EPI-THERMAL DOSE AND ATOMIC PRODUCTION CALCULATIONS, by Walter R. Burrus. Rept. on Contract AF 33(600)32055. Jan 60, 47p. 13 refs. Nuclear rept. 40R; AD-207 003.
Order from LC mi$3.30, ph$7.80 PB 148 381

The cross sections for energy absorption were determined for several common elements as a function of energy, and average cross sections were calculated for each of 3 representative reactor neutron spectra. These average cross sections vary for different spectra, but the variations for the representative spectra selected were no larger than a factor of 2. Most of the cross sections vary from spectra to spectra in the same general manner, so comparison of one cross section with another is much more accurate that the determination of absolute value of the average cross section. The conversion of integral flux ϕ (E) (flux above energy E) to total energy flux is determined for each of the 3 representative spectra. The fraction of the absorbed dose effective in producing atomic displacements was computed for several common metals. It may be multiplied by the absorbed energy to give the energy used in formation of atomic displacements. This 2-step calculation has an advantage over a direct calculation of the number of atomic displacements in that the result is completely insensitive to the critical ionizing energy. If the displacement energy is known, the number of atomic displacements may be found by dividing the energy used in atomic displacement production by the average energy required to produce one atomic displacement, about twice the displacement energy. (Author)

Maryland U., College Park.
ABSORPTION MECHANISMS OF NEGATIVE K MESONS AND PIONS IN LIQUID HYDROGEN, by Thomas B. Day. Rept. on Contract AF 49(638)24. Apr 60, 19p. 10 refs. Physics Dept. Technical rept. no. 175; AFOSR-TN-60-501.
Order from LC mi$2.40, ph$3.30 PB 147 740

Pittsburgh U., Pa.
TIME-INDEPENDENT NON-RELATIVISTIC COLLISION THEORY, by E. Gerjuoy. Technical rept. no. 4 on Capture-Loss and Ionization Cross-Sections of Ions and Neutral Particles, Contract Nonr-624(06). Dec 57, 61p. 21 refs.
Order from LC mi$3.90, ph$10.80 PB 138 206

Arbitrarily complicated rearrangement collisions describable by the time-independent non-relativistic Schrodinger equation are treated in a wholly time-independent framework, without explicit reference to transition probabilities. Introducing a generalized probability current operator for many-particle systems, the current flow at large distances can be computed in complete analogy with one-particle scattering. This procedure leads to the same formal expressions for reaction rates as are obtained from more conventional formulations.

Texas Nuclear Corp., Austin.
ELASTIC AND INELASTIC SCATTERING OF 4.1 MEV NEUTRONS FROM Ca, Mo, Sb, AND Hg, by Lloyd D. Vincent, Ira L. Morgan and J. T. Prud'homme. Rept. for 15 Mar 59-18 Feb 60 on Contract AF 33(616)5619. Apr 60, 64p. 51 refs. WADD TR-60-217.
Order from OTS $1.75 PB 161 807

An investigation of the interaction of 4.1 Mev neutrons with calcium, molybdenum, antimony, barium, and mercury has been performed. The following determinations have been made: the angular distribution of the elastically scattered neutrons from Ca, Mo, Sb, Ba, and Hg; the angular distribution of the inelastically scattered neutrons form Mo, Sb, Ba, and Hg; energy distributions at 90° for Ca, Mo, Sb, Ba, and Hg; nuclear temperatures for the residual nucleus of Mo, Sb, Ba, and Hg; total, elastic, and non-elastic cross sections for Ca, Mo, Sb, Ba, and Hg. (Author)

Instruments and Installations

Battelle Memorial Inst., Columbus, Ohio.
EXPERIMENTAL AND RESEARCH WORK IN NEUTRON DOSIMETRY, by J. E. Drennan and C. S. Peet. Quarterly progress rept. no. 1, 15 May-15 Aug 59, on Contract DA 36-039-sc-78924. 15 Aug 59, 10p. 6 refs. AD-228 397.
Order from LC mi$1.80, ph$1.80 PB 147 980

Processing techniques for the preparation of wide-base conductivity-modulated, silicon-diffused rectifiers are used for the preparation of a set of experimental units. These techniques provide a base from which any modifications can be made. A statistically designed experimental program was initiated which should be useful for determining the optimum geometry and forward voltage for the conductivity-modulated silicon diode used in neutron dosimetry. The program should also provide necessary information for the design of associated measurement circuitry. Theoretical and experimental investigations pertaining to the physical phenomena involved in the rectifier were initiated. (Author)

Battelle Memorial Inst., Columbus, Ohio.
EXPERIMENTAL AND RESEARCH WORK IN NEUTRON DOSIMETRY, by J. E. Drennan, A. R. Zacaroli and others. Quarterly progress rept. no. 2, 15 Aug-14 Nov 59, on Contract DA 36-039-sc-78924. 15 Nov 59, 39p. 17 refs. AD-233 429.
Order from LC mi$3.00, ph$6.30 PB 147 981

Modifications in processing techniques were designed to obtain higher initial charge-carrier lifetimes, since the sensitivity of the dosimeter rectifiers to neutron exposure results primarily from a decrease in lifetime. Experiments were carried out to investigate the sensitivity of 2 sets of experimental units to pure gamma radiation and to the fast-neutron radiation in the Battelle Research Reactor. Theoretical investigations were conducted to establish the expected relative sensitivity of the dosimeter rectifiers to gamma, thermal-neutron, and fast-neutron radiation. A study of the device performance characteristics in relation to the practical read-out circuitry possibilities was conducted. The greatest sensitivity of the dosimeter rectifiers will be obtained with base widths of 0.020 in. or greater. There is evidence that gamma radiation in the dose range of practical interest will not affect the dosimeter-rectifier parameters of interest to this application significantly. Theoretical investigations indicate that the dosimeter-rectifier parameters should not be affected appreciably by either gamma or thermal-neutron radiation in the dose range of interest. (Author) (See also PB 147 980)

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
DESIGN OF A DUAL SENSOR GAMMA RAY CALORIMETER, by James R. Coss and Philip B. Hemmig. Rept. for Sep 58-Jan 60 on Materials Analysis and Evaluation Techniques. Mar 60, 17p. 12 refs. WADD Technical note 60-48.
Order from OTS $0.50 PB 161 787

The theoretical and design considerations for the construction of dual sensor gamma ray calorimeter are presented. The advantages of this type of dosimetry over commonly used present day types are pointed out and justified. The small size, high reproducibility, and small expense of this instrument made it a potentially very useful tool for use in radiation effects programs. The differences in equilibrium temperature attained by two slugs, via gamma heating, is measured as a voltage by thermocouples, and this thermocouple voltage correlated to the dose rate. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
RESPONSE OF A LOW-GEOMETRY SCINTILLATION COUNTER TO FISSION AND OTHER PRODUCTS, by P. D. LaRiviere. 4 Feb 59, 26p. 9 refs. Research and Development Technical rept. USNRDL-TR-303.
Order from LC mi$2.70, ph$4.80 PB 148 058

The theoretical response of a low-geometry scintillation counter to any photon-emitting nuclide whose decay scheme is known is developed. It is used to compute the counting rate, as a function of time, of (1) individual and total fission products resulting from 10^4 simultaneous slow-neutron fissions of U^{235} and (2) several other nuclides for 10^4 initial atoms. The calculations extend from ~45 min to 301 days after fission. (Author)

Nuclear Engineering and Power

Avco-Everett Research Lab., Mass.
MAGNETOHYDRODYNAMIC POWER GENERATION USING NUCLEAR FUEL, by Richard J. Rosa. Mar 60, 21p. 11 refs. Research rept. 87; AD-234 568.
Order from OTS $0.75 PB 161 824

A brief review is given of the basic theory of magnetohydrodynamic (MHD) power generators. The basic electrical properties of gases are reviewed briefly. Overall performance characteristics of MHD generators are presented as a function of these gas properties. This gives an indication of the future potential of MHD as a conversion technique. An experimental MHD generator which was built at the Avco-Everett Research Laboratory is described and its performance discussed. MHD power plant cycles are discussed. A cycle designed for use with a nuclear reactor is described. Some of the possibilities for the future are discussed in which more exotic forms of high temperature reactor combined with an MHD generator may make possible nuclear powered systems having, by present standards, very low cost, high efficiency, and/or light weight. (Author)

Naval Research Lab., Washington, D. C.
NEUTRON FLUX MEASUREMENTS FOR MATERIALS IRRADIATION EXPERIMENTS AT ARGONNE NATIONAL LABORATORY, BROOKHAVEN NATIONAL LABORATORY, OAK RIDGE NATIONAL LABORATORY, AND NATIONAL REACTOR TEST STATION, by L. E. Steele and J. R. Hawthorne. Interim rept. 23 May 60, 11p. 3 refs. NRL rept. 5483.
Order from OTS $0.50 PB 161 456

In studies of the effects of nuclear radiation upon the properties of steel, a continuous effort has been made to measure accurately the neutron-flux density and energy spectrum in four research reactors. Such measurement, made with various dosimeter materials, have determined which reactor facility provides the desired nuclear environment, and have served as necessary parameters in assessing mechanical property changes in irradiated steels. Flux surveys for all reactor experiments were limited to threshold detectors with nuclear and physical characteristics suitable for extended reactor exposure under varying environmental conditions. These monitors, cobalt, cadmium-shielded cobalt, nickel, and sulfur, were utilized in flux measurements. The neutron-flux data for high-flux positions in these four research reactors show a high-degree of correlation with changes in materials properties after irradiation.

Nuclear Reactions

Miami U., Coral Gables, Fla.
STUDY OF ANTIPROTON INTERACTIONS, by M. Blau, C. F. Carter, and A. Perlmutter. Rept. on Contract AF 49(638)97. 31 Mar 60, 17p. 6 refs. AFOSR-TN-60-461.
Order from LC mi$2.40, ph$3.30 PB 147 786

The work described in this report is a compilation of data obtained from the exposure of a stack of 200 Ilford G5 emulsions, of dimensions 4" x 6" x 400 μ, to a separated beam of 670 $\frac{Mev}{c}$ antiprotons.

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
ANALYTIC WAVE FUNCTIONS III. THE SPIN-ORBIT, SPIN-OTHER ORBIT AND SPIN-SPIN INTERACTIONS, by R. G. Breene, Jr. Rept. on Contract AF 04(647)269. 26 Apr 60, 19p. 7 refs. Technical Information Series R59SD414 (Revised); Supersedes PB 144 190.
Order from LC mi$2.40, ph$3.30 PB 147 522

In two earlier papers methods and programs have been described for calculations of certain classes of atomic wave functions. This paper considers the application of the wave functions so obtained to the calculation of the spin-orbit, spin-other, and spin-spin interactions.

Radioactivity

Naval Research Lab., Washington, D. C.
STUDY OF COKE-AGGREGATE CONCRETE AS A SHIELD TO ELECTROMAGNETIC RADIATION, by P. F. Nicholson. Interim rept. 6 May 60, 11p. NRL rept. 5473.
Order from LC mi$2.40, ph$3.30 PB 145 522

The electromagnetic behavior of a coke-aggregate concrete as a shield to radiation has been investigated. Measurements have been taken on a sample within the frequency range from 1 to 1000 Mc. The loss-versus-frequency characteristic can be predicted with reasonable accuracy by the adaptation of classical propagation theory to the transmission of electromagnetic waves through an imperfect conductor. With a knowledge of the approximate value of complex permittivity and a measurement of direct-current conductivity, substitution of these parameters into a general equation will then yield the total insertion loss at the desired frequency. (Author)

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON SEMICONDUCTOR MATERIALS, by F. J. Reid, J. W. Moody, and R. K. Willardson. Rept. on Contract AF 33(616)5171. 20 Dec 57, 48p. 44 refs. REIC rept. no. 1; AD-147 399
Order from LC mi$3.30, ph$7.80 PB 147 101

A literature survey is presented on radiation effects in semiconductor materials. Results indicate that Ge is relatively radiation resistant. For 1 to 30 ohm-cm Ge the minority-carrier lifetime and the conductivity begin to be affected at about 10^{11} fast neutrons/sqcm. Less pure Ge(<1 ohm-cm) gives greater radiation resistance. Si appears to be less radiation resistant than Ge by as much as a factor of 2.

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON SEMICONDUCTOR MATERIALS (FIRST ADDENDUM) by L. W. Aukerman. Rept. on Contract AF 33(616)5171. 31 Mar 59, 36p. 116 refs. REIC rept. no. 1 (Addendum); AD-210 758.
Order from LC mi$3.00, ph$6.30 PB 147 101-S-1

The literature on the effects of high-energy-radiation semiconductor materials received by the Radiation Effects Information Center during 1958 and 1959 has been reviewed and compared. The materials covered are germanium, silicon, and several compound semiconductors including indium antimonide, gallium antimonide, indium arsenide, aluminum antimonide, and gallium arsenide. All types of irradiation capable of producing permanent damage are considered. A rather serious discrepancy between theory and experiment appears to be present in most cases investigated. (Author) (See also PB 147 101)

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON STRUCTURAL METALS, by B. C. Allen, A. K. Wolff and others. Rept. on Contract AF 33(616)5171. 31 May 58, 43p. 62 refs. REIC rept. no. 5; AD-157 170.
Order from LC mi$3.30, ph$7.80 PB 147 103

This report presents the state of the art on the effects of nuclear radiation on structural metals from 1943 through 1957. The general effects of various types of radiation on metals are discussed and the damage mechanisms are outlined. Following this is a topical discussion of the effects of fast neutrons on the physical and electrical properties and corrosion resistance of metals. Tabular data are presented on these effects. Experimental evidence to date indicates that structural metals are quite resistant to nuclear radiation when compared to such things as organic compounds or electronic components. Fast neutrons in integrated flux levels above 10^{19} nvt represent the only reactor radiation that can significantly affect the properties of structural nonfissionable metals. (Author)

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
SURVEY OF IRRADIATION FACILITIES (FIRST ADDENDUM) by J. F. Kircher and J. L. McFarling. Rept. on Contract AF 33(616)5171. 15 Feb 59, 66p. 14 refs. REIC rept. no. 7 (Addendum); AD-210 767.
Order from LC mi$3.90, ph$10.80 PB 139 042 S-1

This report is an addendum to REIC Report No. 7 (PB 139 042) and contains brief descriptions of reactor facilities completed in the past years, those under construction, and those in the planning stage. Additional gamma facilities are listed also. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Arctic Aeromedical Lab., Ladd AFB, Alaska.
COLD WEATHER EVALUATION OF PROTECTORS, EAR, SOUND, TYPE PRU-1/P AND HELMET, SOUND PROTECTOR ACCOMMODATING, TYPE HGU-1/P, by Norman C. Van Tassel. May 59, 9p. Technical note AAL-TN-59-1; AD-230 841.
Order from LC mi$1.80, ph$1.80 PB 146 120

The HGU-1/P helmet and PRU-1/P ear protector were evaluated for use with the AF parka hood in arctic weather. The wool-backing helmet was designed to accommodate the ear protectors. The ear protectors consist of close-fitting muffs held in place over the ears by an adjustable headband. Tests indicated that the helmet and ear protector are compatible for wear with the AF parka hood. Of the 5 individuals who evaluated the helmet, 3 stated it provided adequate thermal protection at -40°F, one at -5°F, and one at 0°F. The design of the helmet and ear protector was considered satisfactory. Low-frequency sounds or (Personnel Supplies and Personal Equipment, speaking tones can be heard while wearing the helmet and ear protector. Helmet and protector did not cause any undue discomfort to the user.

Army Chemical Warfare Labs., Army Chemical Center, Md.
PHYSIOLOGICAL EVALUATION OF THE E52R26 CIVILIAN PROTECTIVE MASK, by E. G. Cummings, F. N. Craig, and W. V. Blevins. Nov 59, 26p. 14 refs. CWLR-2323.
Order from LC mi$2.70, ph$4.80 PB 146 458

Air-flow measurements by the new Gulton transducer and pressure measurements resulted in inspiratory resistance of 0.5 mm H_2O/l/min at flows of 85 l/min and expiratory resistances of 0.2 mm H_2O/l/min. Dead space, measured by continually monitoring mask CO_2 and flow, varied from 0.35 to 0.55 l, depending upon the tidal volume. The E52R26 mask does not impose excessive physiological stress on the wearer in environments tested for periods of 1 hr and under light exercise conditions. In environmental temperatures below 40°F, fogging was severe, necessitating the use of the antidim cloth in order to produce good visibility. Indications are that lens frosting may produce poor visibility when the mask is worn at temperatures below freezing. If the filter pads absorbed over 20 g, breathing became difficult, thus shortening the wearing time. In a moderate to heavy natural rain, the mask can be worn for an hour without difficulty. However, in torrential downpours (3.7 in./hr), the maximum mask-wearing time was 20 to 25 min, because of high resistance.

Quartermaster Research and Engineering Center, Natick, Mass.
AUXILIARY HEATING SYSTEMS FOR COMBAT CLOTHING, by Leo A. Spano and Theodore L. Bailey. July 59, 67p. 15 refs. Technical rept. QMRE-20 (APO-1); AD-226 500.
Order from LC mi$3.90, ph$10.80 PB 146 126

Findings revealed that: (1) auxiliary heating systems for the inactive or moderately active soldier operating in cold-dry climates are needed to compensate for the heat debt experienced by individuals clothed in the present 4.3 Clo cold-dry ensemble; (2) protection of the hands and face is presently a serious and urgent problem; (3) protection of the feet, although serious, is not as critical as that of the hands and face; and (4) no present standard combat clothing system provides or even approaches the protective requirements stipulated by the approved military characteristics covering cold-dry body clothing, handwear, footwear, and headgear. A program was undertaken to (1) develop and evaluate auxiliary heating systems for rewarming troops that have been exposed to deep cold; (2) develop auxiliary heating devices and systems for the extremities to increase the combat-effective time a soldier can be exposed to extreme cold environments; and (3) to design and develop a combat clothing ensemble provided with an integral auxiliary heating system to keep the wearer combat-effective at all times when operating in extremely cold climates.

PHYSICS

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
BUCKLING OF CLAMPED SHALLOW SPHERICAL SHELLS, by Bernard Budiansky. Technical rept. no. 5 on Contract Nonr-1866(02). Aug 59, 44p. 16 refs. AD-225 640.
Order from LC mi$3.30, ph$7.80 PB 147 719

This paper is concerned with the axisymmetric buckling under uniform pressure of a shallow portion of a spherical shell, clamped along a circular boundary. The present analysis, which exploits an integral-equation formulation of the problem, should give results of uniform accuracy for all thicknesses.

National Bureau of Standards, Boulder, Colo.
A BIBLIOGRAPHY OF THE PHYSICAL EQUILIBRIA AND RELATED PROPERTIES OF SOME CRYOGENIC SYSTEMS, by Thomas M. Flynn. May 60, 126p. 681 refs. Technical note no. 56.
Order from OTS $1.75 PB 161 557

A bibliography of approximately 700 references is presented on the physical equilibria and related properties of several important cryogenic systems. The systems considered are the pure components and mixtures of: hydrogen, helium, nitrogen, carbon dioxide, carbon monoxide, methane, ethane, and propane. (Author)

Acoustics

Aeronutronic, Newport Beach, Calif.
STUDY OF INFLUENCE OF SOUND WAVES ON CHEMICAL REACTION RATES, by H. M. Wight. Rept. on Contract AF 49(638)311. 31 Mar 60, 49p. 37 refs. Technical rept. U-858; AFOSR-TR-60-60.
Order from LC mi$3.30, ph$7.80 PB 147 936

Within the general context of exploring possible mechanisms contributing to resonance combustion instability in rocket motors, a study has been made of the interaction of sound waves and homogeneous gas phase chemical reactions. This has involved two aspects: (1) the enhancement of reaction rates by sound waves, and (2) the amplification or absorption of a traveling sound wave by a gas phase reaction. Theoretical analysis relating to (1) and (2) indicate that gas phase enhancement and amplification are not expected to be mechanisms of major importance contributing to resonance. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
ON THE PROPAGATION OF ACOUSTIC WAVES IN GASES AT HIGH TEMPERATURES AND REDUCED PRESSURES, by G. L. Vick. Technical rept. 30 June 59, 31p. 16 refs. LMSD-49762; AD-228 429.
Order from LC mi$3.00, ph$6.30 PB 147 679

Thermodynamic theory is reviewed, as it applies to the propagation of acoustic waves in gases at elevated temperatures and reduced densities. The results of this study establish the applicability of acoustic methods to the measurement of gas temperature and to research on vibrational relaxation, dissociative relaxation, and viscosity phenomena under high temperature, low density conditions. It is concluded that acoustic waves will be propagated with a dispersion of less than $a/a_o = 1.1$ at frequencies below 1 mc at a temperature of 5000°K. Viscosity effects become predominant above 1 mc, resulting in greatly increased dispersion. Two absorption peaks occur at frequencies lower than 0.1 mc corresponding to vibrational and dissociative relaxation. This study of dispersion and absorption indicates that the velocity of acoustic waves may be reliably used as a measure of gas temperature at frequencies below 1 mc. This could have wide application for shock-tube instrumentation. Measurements of acoustic attenuation below 0.1 mc would yield information concerning vibrational and dissociative relaxation. Viscosity effects may be studied from acoustic wave velocity data at frequencies above 1 mc. (Author)

Watertown Arsenal Labs., Mass.
ULTRASONIC METHODS FOR NEAR-SURFACE FLAW DETECTION, by Otto R. Gericke. Nov 59, 16p. 5 refs. WAL TR-143/33; AD-229 387.
Order from OTS $0.50 PB 161 048

In order to detect near-surface defects, either extremely short ultrasonic pulses or an artificial pulse delay are required. The objective of the work covered by this report was to investigate the possibilities of pulse delay, and develop methods which can be used for practical applications. Three of the procedures which are discussed show promising experimental results. Defects as close as 0.015" to the test surface can be detected, although fairly long pulses of 3 to 10 microseconds duration are used. (Author)

Electricity and Magnetism

Arizona U. [Tucson].
ELECTRICAL AND SPECTRAL CHARACTERISTICS OF HIGH CURRENT SPARK DISCHARGES, by Leon Blitzer. Final rept. for 20 Feb 56-28 Feb 59 on

Contract DA 04-495-ORD-434. [1959] 27p. 10 refs.
OOR rept. 786-...; AD-217 573.
Order from LC mi$2.70, ph$4.80 PB 147 592

A study was made of the electrical and spectral characteristics following breakdown of high-current condensed spark discharges. The discharge current was found to be very nearly the same as in an ordinary LCR circuit. Gap voltages in all cases were observed to fall from initial high values (3.5-6.0 kv) to about 50 v in about 1.0 μsec and to decrease thereafter linearly with time. The gap resistance was found to be very small compared to the resistance of the remainder of the circuit. In general, the electrical parameters were little affected by the material of the electrode. From relative intensities of spectral lines of Fe I, Ni and Ti II a study was also made of excitation temperatures in the discharge column. In all cases the relative line intensities were consistent with a Boltzmann distribution of the atoms among the excited states. Wide variations in temperature during the history of the discharge point led to an absence of any well-defined equilibrium. At the same time no significant differences were observed from one spectrum to another, calculated temperatures being essentially in the region 6000-8000°K both for damped and oscillatory discharges. (Author)

California U., Berkeley.
MATHEMATICAL ASPECTS OF ELECTROMAGNETIC THEORY I, by Bernard Friedman. Technical rept. no. 2 on Contract Nonr-222(60). Aug 59, 65p.
AD-225 473.
Order from LC mi$3.90, ph$10.80 PB 147 699

Problems in the diffraction of electromagnetic waves are discussed as examples of boundary value problems in partial differential equations. Maxwell's equations are first presented and then the Schwartz distribution theory is introduced to show how point, line and surface charge distributions may be represented mathematically. After a short discussion about plane waves and the impedance concept, a derivation is given of the field produced by a line source situated above an impedance plane. (Author)

Case Inst. of Tech., Cleveland, Ohio.
SPIN WAVE CALCULATIONS FOR FERRIMAGNETICS, ANTIFERROMAGNETICS AND FERROMAGNETICS, by Henry Unruh, Jr. Technical rept. no. 3 on Contract Nonr-1141(07). Aug 59, 88p. 21 refs.
AD-229 391.
Order from LC mi$4.80, ph$13.80 PB 147 723

The spin wave dispersion law for simple cubic and body centered cubic crystals of ferrimagnetic materials is derived. The result allows arbitrary g factors, spins, externally applied field and anisotropy fields if their interaction energy with the spins is in the cosine dependent form. If the interaction energy is in the cosine squared dependent form then the externally applied field must lie in the plane determined by the anisotropy fields on the 2 sublattices. Tables giving the integrated results for the specific heat and the deviation of the magnetization from its saturation value are given for a wide range of crystal constants and externally applied fields. (Author)

Geophysical Inst., U. of Alaska, College.
EARTH CURRENT ACTIVITY AT COLLEGE, ALASKA, 1956-1958, by V. P. Hessler and E. M. Wescott. Scientific rept. no. 2 on Contract AF 19(604)3075 and NSF Grant C 4193. Feb 60, 68p. 18 refs. AFCRC-TN-60-293.
Order from LC mi$3.90, ph$10.80 PB 147 513

This report presents 3-hourly scalings of earth current activity for the entire period from January 1956 through December 1958. The data are analyzed for diurnal, seasonal, and yearly averages of activity. There is a pronounced diurnal variation in activity with a maximum at local midnight. The principal direction of the earth current disturbances at College is about N 33° W and is so constant that total activity in mv/km can be determined with sufficient accuracy from N-S records. Earth current activity has a high correlation with magnetic activity and other polar ionospheric phenomena. The average of six monthly correlation coefficients between magnetic daily A figures and earth current average daily mv/km is .948. Thus, the earth currents constitute a useful indicator of ionospheric activity. (Author) (See also PB 142 027)

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
MICROWAVE RESONANCE IN FERROMAGNETIC SYSTEMS AT HIGH-SIGNAL LEVELS, by J. J. Green. Scientific rept. no. 2, Series 2, on Contract AF 19(604)5487. 1 Dec 59, 122p. 48 refs. AFCRC-TN-60-367.
Order from LC mi$6.30, ph$19.80 PB 147 761

A study of ferromagnetic resonance at high-peak powers has been made in a series of rare earth garnets and in several ferrite spinel systems. The results are analyzed on the basis of a theory developed by Suhl and later modified by Schlömann. The onset to saturation observed in polycrystalline materials is in good agreement with the predictions of the modified theory. According to Suhl, the saturation at high-power levels is due to an exponential-type growth of certain spin waves. The line width of the unstable spin waves has been calculated from the slope of the saturation curve at high-power levels. The presence of rare earth impurities in YIG or cobalt in nickel ferrite leads to a rapid increase in the spin wave line width. This increase can be understood on the basis of a recent theory by Kittel. It has been observed that porosity does not affect the spin wave line width. Experiments on thin rods lead to the conclusion that the spin wave line width in YIG is a rapidly increasing function of k at X band. Numerous measurements of a fine structure in the saturation curves in YIG single crystals gave results which are in good agreement with a theory proposed by Schlömann. Investigations of single crystal GdIG revealed an anisotropy of the spin wave line width comparable to the anisotropy of the uniform mode line width. In nickel ferrite, the addition of zinc results in an increase in magnetization and a transition in the cause of resonance saturation from one type of spin wave to another.

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
EFFECT OF NEUTRON BOMBARDMENT ON THE MAGNETIC PROPERTIES OF IRON AND NICKEL OF VERY HIGH PERMEABILITY. III, by Giuseppe Biorci, Andrea Ferro, and Giorgio Montalenti. Final rept. (3b) on Contract AF 61(514)1331. Feb 60, 66p. 42 refs.
AFOSR-TR-60-66.
Order from LC mi$3.90, ph$10.80 PB 147 502

Several ring specimens of Cioffi-type iron and of very pure nickel have been prepared to measure the effects of neutron bombardment on the magnetic properties (magnetization curve and hysteresis loop). By proper heat treatments in hydrogen we have obtained maximum permeabilities of the order of 150.000 in iron and 5.000 in nickel. The irradiation has been made with large doses of fast neutrons (integrated flux of about 10^{19} n/cm^2 nvt). No remarkable variations in the magnetic properties of nickel have been observed after irradiation. The iron specimens have been examined before and after irradiation at fields (up to 150.000 A/m). In the region from 1.000 A/m up no appreciable variation has been observed in the curve of approach to saturation. At low fields the iron samples show a remarkable increase of coercive force and a relevant decrease (about 30%) of the maximum permeability. The conclusion is that the irradiation produces also some defects stable at room temperature whose size (or range of influence) are of the order of, or larger than, 1000 A. (See also PB 146 436)

Lockheed Aircraft Corp., Palo Alto, Calif.
THE MAGNETIZATION REVERSAL AND MICROWAVE RESONANCE PROGRAM DURING 1958, by R. W. Moss, C. F. Kooi and others. 26 Dec 58, 42p. 14 refs. LMSD-48359.
Order from LC mi$3.30, ph$7.80 PB 147 666

This program aims at the determination of the magnetization reversal mechanism in high-speed computer ferrites. The mechanisms, domain wall motion and domain rotation, depend on the damping parameter in different ways. Measurement of the damping parameter by microwave resonance means and by switching experiments shows that wall motion is the preferred mechanism in weak switching fields. This report also describes the experimental apparatus and the method of approach to the problem. (Author)

Maryland U., College Park.
NON-LOCAL CURRENT-FIELD RELATIONSHIP IN METALS, by John L. Warren (Doctoral thesis) and Richard A. Ferrell. Rept. on Contract Nonr-1797(00). Aug 59, 18p. 11 refs. Physics Dept. technical rept. no. 150; AD-229 341.
Order from LC mi$2.40, ph$3.30 PB 148 180

Chamber's formula for the response of the conduction electrons of a metal to an internal transverse electric field is supplemented by a diffusion current when it is used for longitudinal fields. A new derivation of Chambers' formula is given by means of the Boltzmann transport equation, and the additional diffusion term in the current is exhibited explicitly. (Author)

Pennsylvania U., Philadelphia.
THE MEASUREMENT OF MAGNETIC LOSSES BY ROTATING FIELD AND BY ROTATING SAMPLE EXPERIMENTS. by K. Atkins, H. Callen and others. Technical rept. no. 2 on Contract Nonr-551(28). [1959] 21p. 8 refs. AD-225 111 and AD-225 761.
Order from LC mi$2.70, ph$4.80 PB 147 601

Two types of experiments, designed to measure the intrinsic rotational damping in ferromagnetic materials, are discussed. The first type measures the mean angular deviation of the magnetization vector from the direction of a large applied magnetic field when the sample is rotated. The second type measures the torque on the sample when the sample is stationary but the applied magnetic field rotates. Analysis of these experiments sheds light on the physical basis of the dynamical equation, and particularly of the Landau, Lifshitz and Gilbert equations, which are equivalent in stationary-sample experiments for small damping. It is shown theoretically, and corroborated experimentally, that the losses in ferrites are too small to make a rotating sample experiment feasible with ferrite materials. A rotating sample experiment with thin metallic disks or films is theoretically feasible with the experimental set-up. (Author)

Electronics

Aerojet-General Corp., Azusa, Calif.
A SEARCH FOR THE IONIZATION OF H_2 ON DIFFUSION THROUGH Pd, by J. R. Radbill and R. J. Sunderland. Rept. on Contract AF 49(638)214. Feb 60, 20p. 26 refs. Aerojet rept. TN-34; AFOSR-TN-60-426.
Order from LC mi$2.40, ph$3.30 PB 147 505

A search has been made to detect the ionization of hydrogen through palladium. Using as a source a 0.005-in. palladium foil maintained at 1000°K, the mass spectrum of the emission has been determined, with and without the diffusion of hydrogen. Ions corresponding to singly charged Na^{23}, K^{39}, and K^{41} were detected with the Na^{23} mass peak predominating. No other ions were found within the mass range capability (1-240 amu) of the magnetic fields used. Our results indicate that the individual ion current densities at the emitter, due to thermally ionized hydrogen atoms or molecules, must be less than 10^{-9} amp/cm^2. (Author)

Battelle-Institut E. V., Frankfurt-am-Main (West Germany)
THEORETICAL INVESTIGATION AND DESIGN STUDIES FOR THE EVENTUAL CONSTRUCTION OF A MEASURING DEVICE IN THE FIELD OF PLASMA ELECTRONICS. Annual rept. no. 1, 1 Dec 58-30 Nov 59, on Contract DA 91-591-EUC-1018. 31 Dec 59, 22p. 18 refs. AD-230 772.
Order from LC mi$2.70, ph$4.80 PB 146 043

Contents:
Theoretical studies
Studies on the possibility of measuring the properties of plasma
Studies on the properties of the ionosphere
Examination of errors in the location determination of bodies

Possibilities for the technical representation of the correction values.
Planning of experiments for the measurement of the properties of plasma
Cavity resonator method
Phase method
Experimental studies
Preliminary test for the frequency control
Preliminary tests for the plasma investigations
Test method by application of electromagnetic waves passing through a plasma

Chalmers U. of Tech. (Sweden).
THE INFLUENCE OF THE ELECTRON VELOCITY DISTRIBUTION ON SPACE CHARGE WAVES, by Olof E. H. Rydbeck and K. H. B. Wilhelmsson. Rept. no. 3 on Contract AF 61(052)159. [1959] 26p. 3 refs. Research rept. no. 1, 1959; AFCRC-TN-60-352.
Order from LC mi$2.70, ph$4.80 PB 147 509

The purpose of this paper is to study the influence of an electron velocity distribution upon the wave propagation properties of electron beams with special regard to modern space charge wave amplifiers. The velocity distribution considered is the simplest possible one, namely a pulse of certain width and constant amplitude.

Chalmers U. of Tech. (Sweden).
OSCILLATORY PROPERTIES OF GYROMAGNETIC ELECTRONIC COLD PLASMAS WITH DRIFT MOTION. A STUDY OF CIRCULARLY BOUNDED AND INFINITELY EXTENDED MEDIA INCLUDING THE INFLUENCE OF COLLISIONS, by Hans Wilhelmsson. Rept. no. 4 on Contract AF 61(052)159. June 59, 46p. 23 refs. Research rept. no. 2, 1959; AFCRC-TN-60-353.
Order from LC mi$3.30, ph$7.80 PB 147 510

The result of a recent work by O. E. H. RYDBECK [1944] shows that radiation can be produced when space charge waves are carried by an electron beam through an ionized medium. The purpose of the present paper is to extend the treatment of the earlier publication by considering the influence of collisions. The collisional effects are described by means of effective collisional frequencies which are assumed different for the drifting electrons and for the electrons without drift motion. As in the previous investigation special attention is paid to the influence of the drift LORENTZ terms and of the relativistic corrections. Although the calculations, especially in the relativistic case, give rise to a considerable number of terms, the final expressions have a neat and concise form. The result of the investigation is that although the collisions affect the dispersion relations, the same types of waves will be excited under the same excitation conditions as in the absence of collisions. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
THERMIONIC THEORY AND TECHNIQUE, by John Cobb, William Cutler, and Anthony F. Dugan. Technical memo. Sep 59, 25p. 2 refs. LMSD-311695. AD-226 847.
Order from LC mi$2.70, ph$4.80 PB 147 682

The vacuum diode as a means of producing power by thermionic emission has been studied theoretically with respect to efficiency and power. Experimental results, however, indicate that no simple theory is adequate to predict the effect of interelectrode space charge. The parameters which govern the magnitude of the space charge also affect the specific power and efficiency. A simultaneous analysis of space charge, specific power, and efficiency is required to predict effectively cell performance and to facilitate cell design. If the analysis can be made to agree with the experiment, in general, a large part of the experimental program may be circumvented and more time devoted to the search for basic information concerning thermionic phenomena. This report presents the agreement already achieved between the actual experiment and a theory which embraces the cathode electron effect upon space charge. (Author)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
ELECTROMAGNETIC WAVE PROPAGATION IN THE HIGH TEMPERATURE PLASMAS, by Romayne F. Whitmer. Technical rept. on Contract AF 30(604)1944. 9 Apr 59, 46p. 5 refs. RADC-TN-59-81; AD-214 944.
Order from LC mi$3.30, ph$7.80 PB 147 027

Propagation through high temperature plasmas was studied for 2 different types of high-temperature plasmas. In the first type the electrons are at a relatively high temperature, whereas the ions and neutral particles are at, or near, room temperature. In the second type all the constituents of the plasma are at a fairly high temperature. The high electron temperature plasma can be produced by means of microwave breakdown at electron cyclotron resonance. Electrons receive energy very efficiently from the microwave field and lose energy slowly to the other particles. Hence, the neutral particles and ions remain at a relatively low temperature. The second type of plasma can be produced by means of a shock wave. In the region of the shock front all the particles are at a high temperature. Propagation studies will be performed for both types of high temperature plasmas. However, the propagation measurements reported are limited to the high electron temperature plasma. The microwave measurements include the measurement of attenuation, phase, signal distortion, and harmonic content. Both phases of this program are studied theoretically and experimentally. (Author).

Navy Electronics Lab., San Diego, Calif.
SYMPOSIUM ON TROPOSPHERIC RADIO WAVE PROPAGATION WITHIN THE HORIZON, HELD AT NAVY ELECTRONICS LABORATORY, 30 MARCH-2 APRIL, 1953. 2 Sep 53, 72p. 19 refs. Rept. no. 409.
Order from LC mi$4.50, ph$12.30 PB 148 649

The symposium covered three major topics -- terrain effects, refraction effects, and combined and other effects -- on which papers were presented by participants from the United States and several foreign countries. The present report includes these papers and on edited transcript of the summary session during which the main points of each topic session were reviewed. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
REFLECTION OF ELECTROMAGNETIC WAVES FROM A DIELECTRIC-MAGNETIC MATERIAL TERMINATED BY A HIGHLY REFLECTIVE MATERIAL, by Edward J. Calucci. May 60, 25p. 3 refs. RADC-TN-60-25.
Order from LC mi$2.70, ph$4.80 PB 147 850

A method is described for approximating the magnitude of electro-magnetic energy reflected from a dielectric-magnetic material terminated by a highly reflective material. Equations, sample calculations, and a series of graphs are presented, showing the power-reflection coefficient as a function of thickness for varying dielectric-loss tangents, magnetic-loss tangents, and permeability. (Author)

Tung-Sol Electric Inc., Bloomfield, N. J.
UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION, by B. G. Firth and Warren C. Johnson. Rept. no. 4 (Final) 1 Oct 58-30 Sep 59, on Contract DA 36-039-sc-73051. [1959] 42p.
Order from LC mi$3.30, ph$7.80 PB 147 990

A 5 inch cathode ray tube with MgO cold cathode was made with a spot size 3 to 4 times that in a thermionic cathode tube, and a low beam current of 3 μa, operating at 3,000 volts on all high voltage elements. MgO cathode surface potentials for parallel plates 2 cm sq. and 4 mm apart have been measured in the order of 145-190 volts for plate potentials of 151-211 volts. Magnetic analysis of electron energy distribution from the MgO cathode showed a peak at 13.5 volts and 90 per cent of electrons less than 65 volts. Cold cathode emission starting and sustaining, cathode testing, and cathode current characteristics are discussed. Tests on secondary emission preamplifiers indicate that control of secondary emission rather than primary emission may be a promising method of improving both transconductance and frequency response of cold cathode tubes. A cold cathode dynatron oscillator was made to operate up to and beyond 20 mc with sufficient power and voltage for a local oscillator circuit. Audio power amplifier tubes Type DT-812B have been made to operate with dynamic Gm = 600 μmhos and 900 milliwatts audio output at tolerably low noise level and harmonic distortion. Cathode temperatures were measured within an accuracy of a few per cent by checking the resistance of the inactive heaters in them. (See also PB 147 988)

[Willow Run Labs.] U. of Michigan, Ypsilanti.
PREDICTION AND FILTERING FOR RANDOM PARAMETER SYSTEMS, by Frederick J. Beutler. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. June 58, 24p. 16 refs. 2144-259-T; AD-202 607.
Order from LC mi$2.70, ph$4.80 PB 145 972

An investigation was conducted in order to generalize the Wiener-Kolmogorov theory of optimum linear filtering and prediction of stationary random inputs. It is assumed that signal and noise have passed through a random device before being available for filtering and prediction. A random device is a unit whose behavior depends on an unknown parameter for which an a priori probability distribution is given. A number of engineering applications are cited. Two of these are worked out in some detail to illustrate the optimization procedure. (Author)

Molecular Physics and Spectroscopy

Institute of Engineering Research, U. of California, Berkeley.
NEW STUDIES OF MOLECULAR SCATTERING AT THE SOLID SURFACE, by F. C. Hurlbutt and D. E. Beck. Rept. on Contract Nonr-222(45). 11 Aug 59, 36p. 11 refs. Rept. no. HE-150-166; Series no. 20, issue no. 127; AD-228 255.
Order from LC mi$3.00, ph$6.30 PB 148 164

A molecular beam apparatus is used to study the physics of interaction at the gas surface interface. The spatial distributions of the flux of particles scattered from various surfaces are presented. Data is presented for the scattering of Argon atoms and Nitrogen molecules from teflon, glass, cleaved crystals of zinc and lithium fluoride, and liquid metal surfaces of gallium and indium. (Author)

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
FORCE CONSTANT CALCULATIONS IN LINEAR TRIATOMIC MOLECULES FROM INFRARED AND MICROWAVE DATA, by Peter H. Verdier and E. Bright Wilson, Jr. Rept. on Contract Nonr-1866(14). [1959] 6p. 10 refs. AD-211 282.
Order from LC mi$1.80, ph$1.80 PB 146 185

Calculations of the complete quadratic potential energy function were made for the $O^{16}C^{13}S^{32}$ isotope and N_2O by using centrifugal distortion constants from microwave spectra and infrared frequencies. The potential function was $2V = f_{11}r_1^2 + 2f_{12}r_1r_2 + f_{22}r_2^2$, where r_1 and r_2 are the increases in the 2 bond lengths and the f's are the force constants. The sensitivity of the force constants was checked in each case. The sensitivity calculations indicated that corrections of vibrational frequencies to zero amplitude and for Fermi resonance and the use of equilibrium rotation constants (B_e and D_e) rather than observed values can have appreciable effects upon the computed force constants. By judicious choice of corrections to the rotational constant, B, and the stretching frequencies, force constants for N_2O can be obtained which agree with the accepted values to within 15% for the bond stretching constants and 75% for the interaction constant. The sensitivity of the calculated force constants to the value of the rotational constant, D, was determined.

Materials Research Lab., Watertown Arsenal, Mass.
A SIMPLE CORRELATED WAVE FUNCTION, by R. J. Weiss. May 60, 6p. 5 refs. MRL rept. no. 75.
Order from LC mi$1.80, ph$1.80 PB 147 484

A simple correlated ground state wave function for He like atoms is suggested. It has the proper behavior at the singularities and enables several of the observables to be evaluated analytically. (Author)

Minnesota U., Minneapolis.
STRUCTURAL INVESTIGATIONS OF LARGE MOLECULES BY X-RAY DIFFRACTION, by William N. Lipscomb. Final rept. on Contract AF 49(638)485. Oct 59, 4p. 4 refs. AFOSR-TR-60-31.
Order from LC mi$1.80, ph$1.80 PB 147 659

The three-dimensional structure, except for the absolute configuration, has been determined in an X-ray diffraction study of ψ-conhydrine hydrobromide. In agreement with recent chemical evidence, the OH and propyl groups are found to be trans to each other, and in the equatorial position relative to the saturated six-membered ring. The unit cell is orthorhombic in the space group D 4/2-P2$_1$2$_1$2$_1$, contains four $C_8H_{18}NOBr$, and has dimensions a =15.15, b=9.38, c =7.72 A.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORETICAL AND EXPERIMENTAL STUDY OF MOLECULAR-BEAM MICROWAVE SPECTROSCOPY, by Martin Peter and M. W. P. Strandberg. Rept. on Contract DA 36-039-sc-64637 and Technical rept. no. 1 on Contract DA 36-039-sc-73014, 25 Aug 57, 52p. 42 refs. Technical rept. 336; AD-200 421.
Order from LC mi$3.60, ph$9.30 PB 147 455

A variety of topics that bear directly upon the use of molecular-beam spectroscopic methods for precise frequency determination with the use of alkali-halide molecules are discussed. The rotational-energy spectrum, including resolvable hyperfine structure arising from quadripole and magnetic interactions, is calculated. An analysis of integrated line strength, or intensities, is presented. State selection is discussed in terms of the appropriate high-field Stark effect, for which new calculations are given. State selection with both axial and transverse-rod configurations is discussed, and trajectories for sodium chloride with the use of a transverse-rod state selector are indicated. The limitations of any selector which arise from nonadiabatic losses are analyzed. The design parameters of a microwave spectroscope, including signal-to-noise ratio and ultimate precision, are related to its geometric configuration, and a description of an apparatus that is adequate for high-resolution work is given. Related topics, such as the concept of efficiency of frequency measurements and frequency pulling, are discussed in generalized fashion. Conclusions that can be derived from this work, as to both present limitations and necessary future development, are drawn. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE FREE-FREE CONTINUUM OF OXYGEN, by R. G. Breene, Jr. and M. C. Nardone. Rept. on Contract AF 04(647)269. 29 Apr 60, 13p. 7 refs. Technical Information Series R60SD365.
Order from LC mi$2.40, ph$3.30 PB 147 523

Oxygen is treated in an example calculation of the free free absorption cross section. Wave functions for the free electron in the field of an oxygen atom under the assumption of no electron exchange or core polarization are calculated on the IBM 704. These wave functions are applied to the calculation of the free free absorption corresponding to a particular continuum frequency and initial state energy. In this calculation the dipole acceleration form of the matrix element is computed. The matrix element calculation is carried out on the LGP-30. These partial cross sections are smeared over a Maxwell Boltzmann distribution of initial electronic energies in order to obtain the free free cross section. The results are in approximate agreement with the familiar classical Kramers result for an effective $\bar{Z}$ of 0.31. (Author)

Tennessee U., Knoxville.
THE INFRARED SPECTRUM OF HCOF AND DCOF, by Roy F. Stratton, Jr. (Doctoral thesis) and Alvin H. Nielsen. Technical rept. no. 4 on Contract DA 33-008-ORD-1166. 5 Dec 57, 169p. 17 refs. OOR rept. 1505.6; AD-150 592.
Order from LC mi$7.80, ph$25.80 PB 147 862

The absorption spectra of formyl fluoride (HCOF) and deutro-formyl (DCOF) were studied in the gaseous state in the IR region. The gases were studied at room temperature which is essentially in the ground electronic and vibrational state. Nine bands were observed in HCOF and 13 in DCOF. A rotational analysis was completed on 5 of the fundamental bands in each molecule. The moments of inertia were used to determine the approximate position of the H atom. The band centers were used to determine some of the vibrational constants.

Optics

Institute of Optics, U. of Rochester, N. Y.
ASPHERICAL LENS DESIGN AND FABRICATION. Final rept. for 1 June 52-30 Nov 54 on Contract DA 30-115-ORD-358. Dec 54, 172p. 5 refs.
Order from LC mi$8.10, ep$28.80 PB 148 060

Itek Corp., Waltham, Mass.
OPTICAL IMAGE FORMATION IN TERMS OF ENTROPY TRANSFORMATIONS, by E. L. O'Neill and T. Asakura. Final rept. on Contract AF 49(638)577. Apr 60, 34p. 20 refs. Itek P-163; AFOSR-TR-60-63.
Order from LC mi$3.00, ph$6.30 PB 147 851

The intimate relationship of the theory of partial coherence, the matrix approach to image formation, and the application of Communication and Information Theory to optics are presented. It is shown that both matrix and communication approaches flow natural from E. Wolf's general theory of image formation in terms of the mutual coherence function. The matrix and communication approaches themselves are closely related. New results are also presented from both a geometric and physical optics point of view showing the change in entropy loss as a function of focal position. The arguments presented are confined to the case of quasi-monochromatic illumination. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
THE DIFFRACTION OF RADIATION BY INHOMOGENEOUS LENSES, by Calvin H. Wilcox. 15 Aug 58, 92p. 15 refs. LMSD-5126.
Order from LC mi$5.40, ph$15.30 PB 147 665

The present method is both a generalization and a refinement of the traditional geometrical optics method. The new features of the method are (1) The approximations are deduced directly from the rigorous mathematical formulation of the problem starting with Maxwell's equations. (2) The vector nature of the field, and the associated polarization phenomena, are preserved in the present approximations. (3) Approximations are obtained for the field at any point in space, including those in the "shadow" region of classical geometrical optics (i.e., points that are reached by no light rays).

Massachusetts U., Amherst.
A PHOTOGRAPHIC METHOD FOR THE STUDY OF LIGHT SCATTERED FROM POLYMER FILMS AT SMALL ANGLES, by Alphonse Plaza and Richard S. Stein. Technical rept. no. 13 on Contract Nonr-2151(00). 1 Aug 59, 10p. 10 refs. AD-225 702.
Order from LC mi$1.80, ph$1.80 PB 148 137

An apparatus is described for measuring the scattering of light from films of high polymers at angles of 0^0 to 10^0 from the incident beam. The spherulites in polyethylene films are in such a size range that the scattering technique is of value in determining their size, properties, and internal structure. Light from an arc source is rendered parallel with a lens and a pinhole system and monochromatic with filters. A shutter and iris diaphragm serve to define the beam. A polaroid polarizer and analyzer may be inserted when polarization studies are desired. Collimation of the incident beam is such that scattered light down to about 0.3^0 from the incident beam may be resolved. A maximum in scattering occurs at an angle of about 1.8, and there is a rapid decrease in scattering with increasing angle.

Ramo-Wooldridge, Canoga Park, Calif.
INFRARED BACKGROUND INVESTIGATION, by R. E. Eisele. Scientific rept. no. 2 on Contract AF 19(604)3473. 15 Mar 60, 48p. 6 refs. [AFCRC] TN-60-408.
Order from LC mi$3.30, ph$7.80 PB 147 544

A measurement field trip was made to Key West, Florida, during the month of June 1959, for the purpose of making sky background measurements. This report contains only the gradient measurements made on this field trip along with enough description of the instrumentation to understand the methods of obtaining the data. (See also PB 143 106)

Visibility Lab., U. of California, San Diego.
THE MEASUREMENT OF LIGHT IN NATURAL WATERS: RADIOMETRIC CONCEPTS AND OPTICAL PROPERTIES, by Rudolph W. Preisendorfer and John E. Tyler. Rept. on Contract NObs-72092. 17 Nov 58, 95p. 17 refs. SIO Reference 58-69; AD-212 695.
Order from LC mi$5.40, ph$15.30 PB 147 598

The object of this note is: (i) to define and discuss those recently developed concepts of geometrical radiometry which are of greatest use in the experimental study of the light field in natural waters; and (ii) to present a systematic development and discussion of the inherent and apparent optical properties of natural waters which are used in modern hydrological optics.

Visibility Lab., U. of California, San Diego.
WATER CLARITY METER: OPERATING AND MAINTENANCE INSTRUCTIONS, by Roswell W. Austin. Rept. on Contract NObs-72092. Feb 59, 109p. SIO Reference 59-9.
Order from LC mi$5.70, ph$16.80 PB 147 597

The Water Clarity Meter, (WCM), has as its purpose the measurement of those optical properties of natural ocean waters which will permit the determination of the optical clarity of these waters in the visible portion of the spectrum. The data obtained from the Water Clarity Meter can be used to determine the depth profiles of attenuation coefficients with sufficient accuracy for hydrographic survey purposes. Such survey data may be used for the computation of sighting ranges for underwater swimmers and underwater television equipment using natural illumination.

Solid State Physics

Brown U., Providence, R. I.
INVESTIGATIONS OF SURFACE PROPERTIES OF SILICON AND OTHER SEMICONDUCTORS, PHASE I [and] II, by H. E. Farnsworth, D. Haneman and others. Scientific rept. no. 2, 1 Jan-31 Mar 60, on Contract AF 19(604)5986. Apr 60, 23p. 5 refs. AFCRC-TN-60-378.
Order from LC mi$2.70, ph$4.80 PB 147 758

Using measurements with an omegatron, the ambient in a low-energy electron-diffraction tube which was pumped but not baked was found to consist mainly of water vapor and mass 28 gas (largely CO). An intense and reproducible diffraction pattern was obtained from a (11$\bar{1}$) surface of GaSb cleaned by ion bombardment and annealing. An n-type germanium crystal of 17 ohm-cm resistivity was subjected to a series of dry-air and vacuum cycles, and simultaneous measurements of filament lifetime and surface conductivity were taken. Further experimental data concerning the formation of p-type films on heat-treated silicon are presented. (See also PB 145 624)

Brown U. Div. of Applied Mathematics, Providence, R. I.
A SYSTEMATIC CALCULATION OF ELASTIC-PLASTIC DEFORMATION OF FRAMES AT IMMINENT COLLAPSE, by Hishashi Tanaka. Technical rept. no. 49 on Contract Nonr-562(10). Aug 59, 50p. 7 refs. Rept. C11-49; AD-226 257.
Order from LC mi$3.30, ph$7.80 PB 147 708

A systematic calculation is shown to estimate the deformation of a frame when plastic collapse is imminent. The method proposed in this paper is convenient in the case of overcomplete collapse as well as in the other cases. (Author)

Carnegie Inst. of Tech., Pittsburgh, Pa.
THEORY OF BLOCH ELECTRONS IN A MAGNETIC FIELD: THE EFFECTIVE HAMILTONIAN, by Walter Kohn. Technical rept. no. 6 on Contract Nonr-760(13). [1959] 69p. 23 refs.
Order from LC mi$3.90, ph$10.80 PB 146 184

The Hamiltonian of a Bloch electron in a static magnetic field is $H = \frac{1}{2}\underset{\sim}{p}^2 + V(\underset{\sim}{r})$, where $V(\underset{\sim}{r})$ is the periodic potential, $\underset{\sim}{P} = \underset{\sim}{p} + \frac{1}{c}\underset{\sim}{A}$, and $\underset{\sim}{A}$ is the vector potential giving rise to the magnetic field $\underset{\sim}{\mathcal{H}}$. We consider the case of a non-degenerate band m. It is then shown that, with an error vanishing with $\mathcal{H}$ like $\mathcal{H}^{N+1}$ (N arbitrary), the eigenstates of H can be calculated from an equivalent Hamiltonian $\overline{H}_m(\underset{\sim}{P})$.

Eagle-Picher Research Labs., Miami, Okla.
RESEARCH ON GROWING OF CADIUM SULFIDE FOR DOSIMETER PURPOSES, by W. E. Medcalf, K. E. Bean, and J. E. Powderly. Quarterly rept. no. 1, 17 Apr-17 July 57, on Contract DA 36-039-sc-73270. [1957] 56p. 24 refs.
Order from LC mi$3.60, ph$9.30 PB 137 662

Single crystals of cadmium sulfide 10 mm x 10 mm x 25 mm were prepared by sublimation-recrystallization of cadmium sulfide with crystal growth occurring on a polished clear quartz plate. Dark resistivities of the crystals ranged from 25 thousand ohm-centimeters to 140 million ohm-centimeters. In ten runs cadmium sulfide was doped with indium sulfide (In_2S_3) in amounts ranging from .02 to .055 percent by weight of the cadmium sulfide.

Eagle-Picher Research Labs., Miami, Okla.
RESEARCH ON GROWING OF CADMIUM SULFIDE CRYSTALS FOR DOSIMETER PURPOSES, by J. E. Powderly and K. E. Bean. Quarterly rept. no. 4, 17 Apr 58, on Contract DA 36-039-sc-73270. [1958] 46p.
Order from LC mi$3.30, ph$7.80 PB 137 647

Studies were made of the growth of cadmium sulfide in alumina tubes. The two crystals having the best properties from the standpoint of gamma ray detection had a silicon concentration of 10 to 20 parts per million which is less than the normal concentration. The presence of a small amount of either zinc or silver improved the seeding characteristics of the cadmium sulfide. Cadmium sulfide crystals of high resistivity gave better and more reproducible response to gamma rays when the sample was electroded parallel to the growth axis. (See also PB 137 660)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Samuel N. Witt, Jr. and Vance Keith Woodcox. Final rept. for 15 Oct 57-14 Oct 58 on Contract DA 36-039-sc-74948, [1958] 123p. AD-212 021.
Order from LC mi$6.30, ph$19.80 PB 148 105

The major developments were concerned with improving the Crystal Measurements Standard System. A new General Radio Admittance Meter was obtained for use with the Standard. Two commercial chain amplifiers were added to the Crystal Measurements Standard to provide isolation and signal gain between the signal generator and Admittance Meter, and between the frequency measuring equipment and the Admittance Meter. The original mixer, i-f amplifier, and local oscillator null detection system was replaced by an Eddystone UHF Receiver to improve the null detection sensitivity. A simplified crystal measurement method, known as the equivalent Circuit Crystal Measurement Method, was developed mathematically. The crystal Measurements Standard System was used to measure the holder and overtone responses of approximately 25 VHF quartz crystals.

Hoffman Electronics Corp., El Monte, Calif.
INVESTIGATION OF LARGE AREA SOLAR CELLS UTILIZING SPHERES OF SILICON, by Eugene L. Ralph and Heinz F. Biekofsky. Technical summary rept. no. 1, 1 Oct-31 Dec 59, on Contract DA 36-039-sc-85243. [1959] 48p. 3 refs.
Order from LC mi$3.30, ph$7.80 PB 148 111

Theoretical analysis and experimental tests indicate, that the preparation of photovoltaic energy converters several square feet in area is possible by using a composite of a multitude of intimate individual cells, prepared from spheres of semiconducting material. Investigations were started to determine the optimum performance of this type device and to determine the parameters on which it is dependent. Sphere arrangements intercepting 98% of the incident light were prepared. Geometrical-optical factors studied are sphere arrangement, sphere size and spacing, and effects due to reflections from the meniscus around the sphere. A theoretical analysis of a honeycomb lens system shows capabilities of achieving 100% light utilization with loose packing of spheres. Preliminary electrical tests show present efficiencies in the 3 to 5% range with improvements expected. (Author)

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
GENERALIZATION OF THE THEORY OF THE ISOTHERMAL BLEACHING OF F-CENTERS IN X-RAYED ALKALI HALIDES, PART A [and] ELECTRON MICROSCOPY EXAMINATION OF TRACKS OF FISSION PRODUCTS IN MICA CRYSTALS, PART B, by Guido Bonfiglioli, Peiro Brovetto and others. Final rept. on Contract AF 61(514)1333. Mar 60, 40p. 7 refs. AFOSR-TR-60-67.
Order from LC mi$3.00, ph$6.30 PB 147 500

This report completes the previous note on the theory of the isothermal bleaching of F Centers in X-rayed alkali halides. The calculations are developed in a more general way; an iteration procedure is introduced to improve the accuracy of the solution; the solution used in comparing theory to experiment is justified, showing that it does not change appreciably after a further iteration step. The report also deals with some experiments intended to clear the information which electron microscopy could offer in problems concerning the effect of fast particle irradiation of non metallic crystals. The tracks are essentially cylindrical thermal spikes of a diameter consistent with the theoretical estimates. The peculiar dashed aspect of some tracks is discussed and related to interference contrast effects or possibly incipient annealing. (See also PB 145 681)

Lockheed Aircraft Corp., Sunnyvale, Calif.
IMPLICATIONS OF PARITY NONCONSERVATION AND TIME REVERSAL NONINVARIANCE IN ELECTROMAGNETIC INTERACTIONS. PART II. ATOMIC ENERGY LEVELS, by M. Sachs, and S. L. Schwebel. Technical rept. July 59, 59p. 18 refs. LMSD-49760; AD-227 949.
Order from LC mi$3.60, ph$9.30 PB 147 678

It was pointed out previously (Annals of Physics, 6:244, 1959) that the premises of Lorentz and gauge invariance in electromagnetic interactions are consistent with a theory which violates both parity conservation and time reversal invariance through a symmetrization of these interactions in terms of the electric and magnetic field variables. Such a symmetrization enlarges the class of scalar interaction terms to include corresponding pseudoscalar terms in the interaction Hamiltonian operator. The existance of such interactions in nature has not thus far been established. The purpose is to explore the implications of the existence of these interaction terms in a variety of different physical situations involving the interactions of charged particles. The implications of this theory is derived with regard to the properties of atoms and their associated spectra. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
HARTREE-FOCK ATOMIC SCATTERING FACTORS FOR THE NEUTRAL ATOM IRON TRANSITION SERIES, by A. J. Freeman and R. E. Watson. Apr 60, 13p. 20 refs. MRL rept. no. 74.
Order from LC mi$2.40, ph$3.30 PB 146 399

Atomic scattering factors for the lowest neutral atom $3d^{n-2}\ 4s^2$ states have been calculated for the atoms Ti through Zn using recently computed Hartree-Fock analytic wave functions for the ground state of the atom. Also given are tabulations of the individual transforms for the 3d and 4s electrons. The results are compared with previous calculations for these atoms and the effect of the 4s electrons on the form factors of the 3d and core electrons is discussed. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
CONDENSATION COEFFICIENTS FOR SILVER, CADMIUM AND ZINC IN ULTRAHIGH VACUA, by R. A. Rapp, J. P. Hirth, and G. M. Pound. Technical rept. no. 2 on Contract Nonr-760(17). 18 Aug 59, 88p. 58 refs. AD-226 229.
Order from LC mi$4.80, ph$13.80 PB 147 722

A condensation coefficient of unity has been determined for silver at high fluxes over a temperature range of 45°C to 440°C and at residual gas pressures ranging from 10^{-4} to 6 x 10^{-10} mm Hg. Condensation coefficients of unity have been established for Zn at 68°C and Cd at 18°C in ultrahigh vacuum. The adsorption of gaseous impurities at residual gas pressures of 10^{-4} mm Hg did not affect the condensation coefficient of cadmium at 23°C for condensation at high fluxes. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
ON TWO DIMENSIONAL NUCLEATION, by J. P. Hirth. Rept. on Contract Nonr-760(08). [1959] 5p. 9 refs.
Order from LC mi$1.80, ph$1.80 PB 147 710

New York U., N. Y.
PARAMAGNETIC RESONANCE IN THE SOLID STATE, by Hartmut Kallmann. Quarterly rept. no. 6, Oct-Dec 59, on Contract DA 36-039-sc-78056. Feb 60, 7p.
Order from LC mi$1.80, ph$1.80 PB 147 931

Instrumental equipment has been improved with respect to sensitivity. Investigation of the radiation chemistry of benzene-carbon tetrachloride mixtures has been continued. The number of free radicals produced by ionizing radiation is determined by the decrease in the concentration of diphenylpicrylhydrazyl as detected by EPR. The presence of trapped electrons in zinc sulfide phosphors is now investigated at low temperatures. Early results indicated that no increase in number of unpaired electron spins occurred at low temperature. The effect is to be studied under conditions more favorable for the trapping of electrons. (Author)

Pennsylvania State U., University Park.
RESEARCH AND DEVELOPMENT ON X-RAY ANALYSES OF SINGLE CRYSTALS OF MICROSCOPIC SIZE, by Ray Pepinsky. Final rept. on Contract DA 36-061-ORD-478. 15 Oct 58, 4p. 1 ref. OOR rept. 761.10P; AD-117 850.
Order from LC mi$1.80, ph$1.80 PB 147 855

Philco Corp., Philadelphia, Pa.
RESEARCH INVESTIGATION OF RADIATIVE RECOMBINATION AND LIFETIME IN SEMICONDUCTORS, by C. V. Bocciarelli. Final rept., 1 May 57-30 Apr 58, on Contract NObsr-72695. [1958] 31p. 7 refs. Philco no. H-2126; AD-207 055.
Order from LC mi$3.00, ph$6.30 PB 148 032

The radiation recombination from germanium was found to be the result of direct band to band hole-electron recombination. Optical injection experiments demonstrated that this radiation depends on injected carrier densities. Measurements of the recombination radiation from germanium diodes showed that the intensity of radiation, U, follows a power law $U\ I^a$ where a, a constant for a given sample, varies between 1.2 and 1.6 for different diodes. The peak of the radiation corresponds to an energy of 0.70 ev for both electrically and optically induced radiation. Experiments on optically excited indium antimonide showed no radiation that could be attributed to recombination. The luminescent radiation emitted from activated cadmium sulphide excited by blue or ultraviolet light can be accurately controlled (modulated) by the application of very low AC or DC fields. When the cadmium sulphide is insulated from the field plates, the percentage modulation is very small. When the cadmium sulphide is in electrical contact with the field

plates, the percentage modulation is large and is proportional to the intensity of the excitation. The recombination radiation from cadmium selenide and from red fluorescent cadmium sulphide (in the visible region) can be modulated in a similar way.

Polytechnic Inst. of Brooklyn, N. Y.
LATTICE III, by E. Banks. Progress rept. no. 1, 1 June-31 Aug 56, on Contract DA 36-039-sc-71242. 24 Sep 56, 35p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 138 210

New magnetic oxides have been prepared by reaction of rare-earth, sodium and iron oxides, and sodium, zinc and iron oxides. The latter appear to have distorted spinel structures. Magnetization and Curie point measurements are reported. Progress is reported on investigations of copper-iron selenides and related compounds. Some observations on visible fluorescence in sulfate-sulfide systems are presented (Author)

Polytechnic Inst. of Brooklyn, N. Y.
LATTICE III, by E. Banks. Progress rept. no. 2, 1 Sep-31 Oct 56, on Contract DA 36-039-sc-71242. 23 Dec 56, 26p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 209

Preparations in which ZnO (and MgO) were substituted in $BaFe_{12}O_{19}$ show an increase in magnetization at room temperature and 78°K over the parent compound. Some strongly magnetic compositions, in the system Na_2O-ZnO-Fe_2O_3, have been prepared, with maximum near composition $Na_{0.33}Zn_{0.32}Fe_{2.33}O_4$. A cubic phase exists near $CuFe_2Se_3$, becoming noncubic in the region of $Cu_{0.75}Fe_{2.25}Se_3$ and $Cu_{0.50}Fe_{2.50}Se_3$. (See also PB 138 210)

Poulter Labs., Stanford Research Inst., Menlo Park, Calif.
STUDIES IN THE THEORY OF SHOCK PROPAGATION IN SOLIDS. CHAP. I. THE PERMANENT REGIME SOLUTION. CHAP. II. FORMAL THEORY OF ANELASTICITY. CHAP. III. STEADY-STATE COMPRESSION PROFILES PROPAGATING IN HEAT-CONDUCTING ANELASTIC SOLIDS, by William Band. Rept. on Contract AF 49(638)625. 3 Sep 59, 61p. 21 refs. SRI Proj. CU-2912. AFOSR-TN-59-1280.
Order from LC mi$3.90, ph$10.80 PB 147 515

This report, in three sections, presents a theoretical treatment of compressive wave propagation in an anelastic solid. In such a solid stress depends not only on strain but also on strain rate or stress rate. The theory leads to a prediction of the shape or profile of shock fronts in such solids. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
RESEARCH ON PARAMAGNETIC RESONANCES, by M. W. P. Strandberg and R. L. Kyhl. Quarterly progress rept. no. 8, 15 May-15 Aug 59, on Contract DA 36-039-sc-74895. [1959] 20p. 4 refs. AD-228 372.
Order from LC mi$2.40, ph$3.30 PB 147 970

The saturation of a paramagnetic-spin system by 13-mc phonons was studied as a function of the paramagnetic-spin resonance frequency. Both frequency-dependent and frequency-independent effects are reported. A preliminary comparison is made of the ratio of the specific paramagnetic ion density to the average paramagnetic ion density in flame-fusion and hydrothermally grown ruby. No significant differences were observed. A modification to the Bloch equations is proposed. This modification is based on recent analytical results. A short description of a unidirectional amplifier formed from a cascade of regenerative cavities is presented. (Author)

St. Louis U., Mo.
SEMICONDUCTING PROPERTIES OF BORON, by Vincent P. Jacobsmeyer, Frank L. Gebhart, and Edward F. Juenke. Final technical rept. for 1 Feb 57-31 Jan 58 on Contract DA 23-072-ORD-1101. [1958] 61p. 39 refs. OOR rept. 1845.1; AD-156 536.
Order from LC mi$3.90, ph$10.80 PB 147 866

Growth of B single crystals by recrystallization methods: Attempts were made to grow B crystals by a solid state transformation process. A study was made of the depositional forms of B by means of x-ray diffraction patterns. Patterns were obtained for representative samples deposited in the 550° to 1500°C range; at least 2 crystalline forms of B were clearly indicated. Samples deposited in the range from 772° to 125°C were subjected to heat-treatment. The crystalline structure of the B specimen was independent of the method of cooling after the heat-treatment. Recrystallization in the higher temperature phase was studied in a single specimen at 1482°C. An x-ray transmission pattern obtained after cooling was identical to a pattern obtained from a typical 1500°C deposit. AC apparatus: The apparatus was constructed around a feedback amplifier with a gain of the order of 10^5 and a bandwidth of 2 c centered about 24 c. The apparatus was tested on Ge; it detected a large signal from this material.

Stanford Electronics Labs., Stanford U., Calif.
STUDIES OF MICROPLASMAS AND HIGH-FIELD EFFECTS IN SILICON. Quarterly status rept. no. 1, 15 Feb-15 May 59 on Contract DA 36-039-sc-78272. [1959] 10p. 2 refs. AD-226 660.
Order from LC mi$1.80, ph$1.80 PB 146 272

Research is reported, having as its objective the study of microplasmas in silicon and related effects. Hot electrons in silicon are to be studied, since the technology of this material is under good control and the effect is present to a fairly strong degree. The preparation of appropriate silicon specimens was accomplished by the diffusion of boron into silicon. A limited degree of success was achieved and the system is described in detail. Basically, an open tube system is used to establish a neutral atmosphere. Contained within this atmosphere is a quartz box which maintains a separate atmosphere. A neutral atmosphere is important since there is leakage between the two atmospheres. A basic experiment relating directly to the behavior of electrons in high fields is being conducted on photoelectric emission of electrons from the conduction bands. Work is also underway to fabricate devices for the high field studies.

Stanford Electronics Labs., Stanford U., Calif.
STUDIES OF MICROPLASMAS AND HIGH-FIELD EFFECTS IN SILICON. Quarterly status rept. no. 2, 16 May-15 Aug 59, on Contract DA 36-039-sc-78272. [1959] 35p. 1 ref. AD-231 563.
Order from LC mi$3.00, ph$6.30 PB 147 932

Progress is reported in the following areas: device techniques, experimental techniques for studying hot electrons, and a study of hot electrons in silicon by photoemission. Discussions are appended on (1) an expression for the total photoelectric current, and (2) the effect of field and photoelectric emission of a hot electron.

Stanford Electronics Labs., Stanford U., Calif.
STUDIES IN MICROPLASMAS AND HIGH-FIELD EFFECTS IN SILICON. Quarterly status rept. no. 3, 16 Aug-15 Nov 59, on Contract DA 36-039-sc-78272. [1959] 14p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 147 933

An apparent correlation has been observed between surface imperfections and the breakdown phenomenon. Two methods for observing the nature of the imperfections are being considered. An experiment is described which is designed to investigate electron distribution in the conduction band of n-type silicon. (See also PB 147 932)

Stanford U., Calif.
PARAMAGNETIC RELAXATION IN SOLUTIONS OF VO^{++}, by R. N. Rogers and G. E. Pake. Technical note no. 4 on Paramagnetic Resonance, Contract AF 18(603)131. Apr 60, 21p. 15 refs. AFOSR-TN-60-429.
Order from LC mi$2.70, ph$4.80 PB 147 741

The ESR spectrum of vanadyl ion in solutions has the interesting feature that the linewidths of the individual hyperfine components depend on the nuclear spin orientation, m_I. We have determined that the origin of the effect is the mechanism proposed by H. M. McConnell, namely, that the existence of a "microcrystal" about the VO^{++} ion which gives rise to anisotropies in the g-tensor and hyperfine interaction. By comparing the results of linewidth measurements made at 9.25 kmc and at 24.3 kmc with the results of calculations made by D. Kivelson, we were able to conclude the validity of the microcrystallite model. (Author)

Syracuse U. Research Inst., N. Y.
MEAN ADSORPTION LIFETIME OF Rb ON ETCHED TUNGSTEN SINGLE CRYSTALS. I. IONS, by F. L. Hughes and H. Leninstein. Final rept. pt. 1 on Interaction of Thermal Atoms with Surfaces, Contract DA 30-115-ORD-815. 1 Sep 58, 31p. 31 refs. OOR rept. no. 1844.3; AD-201 153.
Order from LC mi$3.00, ph$6.30 PB 147 868-1

Syracuse U., Research Inst., N. Y.
MEAN ADSORPTION LIFETIME OF Rb ON ETCHED TUNGSTEN SINGLE CRYSTALS. II. NEUTRALS [and] SURFACE PROPERTIES OF ETCHED TUNGSTEN SINGLE CRYSTALS, by F. L. Hughes, H. Levinstein, and R. Kaplan. Final rept. pt. 2 on [Interaction of Thermal Atoms with Surfaces.] Contract DA 30-115-ORD-815. [1 Sep 58] 35p. 32 refs. OOR rept. no. 1844.3; AD-201 153.
Order from LC mi$3.00, ph$6.30 PB 147 868-2

Transitron Electronic Corp., Wakefield, Mass.
THE EPITAXIAL GROWTH OF HEXAGONAL SILICON CARBIDE ONTO SEEDS, by Karl M. Hergenrother. Scientific rept. no. 2 on Contract AF 19(604)4989. 1 Apr 60, 18p. 6 refs. AFCRC-TN-60-372.
Order from LC mi$2.40, ph$3.30 PB 147 769

It has been found possible to grow single crystal epitaxial films of silicon carbide from the vapor phase onto a silicon carbide seed. These crystals are grown in a specially designed furnace which is capable of reaching 2800°C, is vacuum tight and clean enough to permit the control of the resistivity and type of film grown. Details of the furnace design and operation are discussed. The various parameters which control the properties of the films are discussed. (Author)

Wayne State U., Detroit, Mich.
1/f NOISE IN SINGLE-CRYSTAL GERMANIUM FILAMENTS, by V. E. Noble and J. E. Thomas, Jr. Technical note no. 4 on Contract AF 49(638)158. 1 Mar 60, 113p. 84 refs. AFOSR-TN-60-311.
Order from LC mi$6.00, ph$18.30 PB 147 774

The variation of 1/f noise in germanium filaments as a function of the surface potential has been investigated by varying the gaseous ambient surrounding the noise sample. Noise measurements on 32 ohm cm n-type, 8.5 ohm cm n-type, and 9 ohm cm p-type material showed a definite noise minimum when the value of the surface potential corresponded with the sample conductance minimum. Noise amplitude calculations, based on McWhorter's majority carrier trapping effect, were within a factor of two of the observed accumulation-layer noise observed in the case of the near-intrinsic material. The inversion-layer noise was greater than both the predicted value and the observed accumulation-layer noise.

Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRON-SPIN-LATTICE RELAXATION IN DILUTE POTASSIUM CHROMICYANIDE AT HELIUM TEMPERATURES, by J. G. Castle, Jr., P. F. Chester, and P. E. Wagner. Rept. for 2nd quarter on Contract AF 19(604)5589. 7 Mar 60, 42p. 37 refs. Research rept. 403FD449-R4; AFCRC-TN-60-179.
Order from LC mi$3.30, ph$7.80 PB 147 303

Measurements have been made of the electron spin lattice relaxation of the - 1/2, + 1/2 line of Cr^{+++} in $K_3Co(CN)_6$ at 9 KMc/sec as a function of temperature, chromium concentration, and the proximity of the - 3/2, - 1/2 line. The experimental procedure, involving inversion of the line, is capable of distinguishing a "bottleneck" relaxation time from a true spin-phonon relaxation time, T_1. At Cr^{+++} concentrations up to 0.5 per cent, the relaxation data are fitted well by single exponential functions of time. Between 1.3°K and 4.8°K, T_1 varies approximately at $T^{-1.2}$ indicating

that the single phonon process is dominant. No phonon-bath bottleneck is observed, in agreement with calculations based on the measured parameters. A "proximity effect" is observed in which the relaxation rate of the - 1/2, + 1/2 line is enhanced when the - 3/2, - 1/2 line is within 20 linewidths. At one per cent Cr^{+++}, the relaxation behavior is markedly different: the recovery is considerably faster and can no longer be described by a single time constant. This change and the proximity effect are interpreted qualitatively in terms of spin cross relaxation. The measured linewidth increases with concentration from 0.03 per cent to 2 per cent Cr^{+++}, even though the line is observed to be inhomogeneous at and below 0.5 per cent Cr^{+++} (Author)

Theoretical Physics

Air Force Cambridge Research Center, Bedford, Mass.
CONTRIBUTIONS TO THE THEORY OF PARTIAL COHERENCE, by George B. Parrent, Jr. (Victoria U. of Manchester). Doctoral thesis. Mar 60, 106p. 53 refs. AFCRC-TR-60-124.
Order from LC mi$5.70, ph$16.80 PB 147 645

A brief survey of previous developments in the theory of partial coherence is given in Chapter 1 and the relations between the complex degree of coherence (see Wolf 1955) and the measures of coherence introduced by earlier authors are given. Coherence theory is formulated in terms of correlation functions and analytic signals and the developments of this thesis required several new theorems concerning the convolution and cross-correlation of analytic signals. These theorems are developed in Chapter 2. In Chapter 3 these theorems are applied to the detailed analysis of the limiting forms of the mutual coherence function for both polychromatic and quasi-monochromatic fields. In Chapter 4 the propagation of mutual coherence is studied. The results of the previous chapters are applied in Chapter 5 to a frequency domain analysis of the optical imaging problem.

Air Force Cambridge Research Center [Bedford, Mass.]
PROCEEDINGS OF SYMPOSIUM ON THE PLASMA SHEATH 7-9 DECEMBER 1959, VOLUME 1. [1960] 228p. 73 refs. AFCRC-TR-60-108(I).
Order from LC mi$9.90, ph$34.30 PB 147 639

This initial Symposium was directed toward bringing together those people interested in the Plasma Sheath problem as it affected communication to and from a plasma sheathed hypersonic vehicle and the detection of this vehicle by radar techniques. The proceedings have been divided among three publications. Pergamon Press will publish 20 of the unclassified papers in book form available to the public. This publication includes 8 additional unclassified papers. AFCRC-TR-60-108-II will contain 5 Classified papers. To assist the reader both AFCRC publications will include a table of contents listing the papers in all three publications and a copy of all unclassified abstracts. (Author)

Avco-Everett Research Lab., Mass.
BIBLIOGRAPHY ON MAGNETOHYDRODYNAMICS, PLASMA PHYSICS, AND CONTROLLED THERMONUCLEAR PROCESSES, by Barbara A. Spence. Oct 59, 101p. 1562 refs. AMP 36; AD-233 709.
Order from OTS $2.50 PB 161 825

Reference sources for the bibliography included Physics Abstracts; Nuclear Science Abstracts; Mathematical Reviews; Technical Translations, and U.S. Government Research Reports, published by the Office of Technical Services of the Department of Commerce; the Armed Services Technical Information Agency's Technical Abstract Bulletin, reference lists published in conference proceedings, publishers' catalogs, publications lists which we received from several agencies performing work in these fields, and recent issues of certain journals themselves. References are included to books, reports, conference proceedings and papers published in the open literature between 1925 and September, 1959. Books and journal articles are listed under the name of the first author. Reports are referenced under the name of the issuing agency. The name of each author of a report is included in the Author Index, so that, by using the Author Index, the user can quickly locate all references to work of a single author.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
INVESTIGATION OF MICROWAVE DUPLEXER SWITCHING MECHANISMS, by A. Aharoni, K. Rose, and S. Takeda. Quarterly progress rept. no. 1, 1 Mar-31 May 59, on Contract DA 36-039-sc-78313. [1959] 46p. 8 refs. AD-229 822.
Order from LC mi$3.30, ph$7.80 PB 148 109

Optical and microwave measurements of shock wave phenomena in gases excited by ultra fast-high energy electrical discharges are reported. Special microwave techniques have been developed to measure the electron density and collision frequency. Difficulties were encountered in separating the shock wave from the "blow down" plasma. An analysis of second harmonic effects in semiconductors was completed. Further investigation proved that the extra pulse effect could be attributed to the influence of the magnetron second harmonic output power. Work was initiated to extend the "hot electron" effect to higher and lower semiconductor conductivities. Microwave transmission measurements through TE mode semiconductor filled cavities are reported. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
INVESTIGATION OF MICROWAVE DUPLEXER SWITCHING MECHANISMS, by A. Aharoni, K. Rose and others. Quarterly progress rept. no. 2, 1 June-31 Aug 59, on Contract DA 36-039-sc-78313. [1959] 40p. AD-232 124.
Order from LC mi$3.00, ph$6.30 PB 148 110

Experiments on the production and study of shock waves of moderate strengths, in gaseous discharges, were continued. A new method of determining the various characteristics of these shock fronts was developed. Research on semi-conductor behavior in high level microwave fields was continued using resonant cavity techniques at 8-mm wavelengths. ILLIAC computations have been completed to determine the resonance conditions for a high resistivity semiconductor sample in a TM_{011} mode cylindrical cavity of circular cross section. The results of these calculations have been compared with those based on an impedance-matching technique, thereby confirming and extending them. In addition, an improved method has been developed for relating the parameters of the cavity to the experimental measurements using equivalent circuit concepts. Preliminary measurements have been made on the TM mode cavity with high conductivity and high resistivity samples. The high conductivity samples are found to interact more strongly with the microwave field than was the case with the TE mode cavity. (Author) (See also PB 148 109)

Institute of Field Physics, U. of North Carolina, Chapel Hill.
INVARIANT COMMUTATORS FOR THE QUANTIZED GRAVITATIONAL FIELD, by Bryce S. DeWitt. Rept. on Contract AF 49(638)563. Jan 60, 24p. 11 refs. Publication no. 6; AFOSR-TN-60-87; AD-233 367.
Order from LC mi$2.70, ph$4.80 PB 146 949

The difficulties encountered in applying quantum mechanics to Einstein's theory of gravitation are twofold: (1) the nonlinearity of the theory, and (2) its coordinate invariance, which leads to constraints on the Cauchy data for the dynamical equations. These difficulties are shown not to be so severe, and the basic commutators of the theory are displayed in co-variant form. The commutators are approached through the canonical theory of Poisson brackets to emphasize the applicability of the results to classical and quantum theory. The derivations are based on the recognition of the action as the generator of a finite canonical transformation and on the use of the fundamental theorem of classical transformation theory; the variation in the functional form of the generator of a finite canonical transformation, due to independent infinitesimal canonical transformation of its arguments is equal to the difference of the associated independent infinitesimal generators.

Maryland U., College Park.
DISTRIBUTION FUNCTIONS AND QUANTUM STATISTICS, by Robert Ayres. [Rept. on Contract AF 49(638)399]. May 60, 46p. 19 refs. Dept of Physics Technical rept. no. 179; AFOSR-TN-60-522.
Order from LC mi$3.30, ph$7.80 PB 147 937

A new formulation of quantum statistical mechanics is given, in terms of distribution functions. It is shown that all quantities of interests are obtained directly from the distribution of particles in k-space, $n(\vec{k}, \beta)$ and the reaction operator K (often called the Brueckner K-matrix) which is familiar from stationary-state many-body perturbation theory. An integral equation for $n(\vec{k}, \beta)$ is found, which can be solved by a converging iteration process. Some remarks are included on the application of the virial theorem to systems characterized by zero pressure. (Author)

Maryland U., College Park.
THE ZERO-POINT ENERGY OF AN ELECTRON LATTICE, by Alexei A. Maradudin (Inst. for Fluid Dynamics and Applied Mathematics) and Rosemary A. Coldwell-Horsfall. [Rept. on Contract AF 49(638)24.] May 60, 36p. 23 refs. Technical rept. no. 177; AFOSR-TN-60-446.
Order from LC mi$3.00, ph$6.30 PB 147 739

At very low densities an electron gas in a compensating uniform background of positive charge crystallizes into a body-centered cubic lattice for which the correlation energy per electron is $(-1.792/r_s)$ Ry. At higher densities the first correction to this result arises from the zero-point energy of the electrons, which can be expanded in terms of the even moments of the frequency spectrum. We have computed the first five non-vanishing moments and have estimated the contribution to the zero-point energy from the remaining moments using their known asymptotic behavior. This procedure leads to the value $(2.638/r_s^{3/2})$ Ry. for the zero-point energy per electron. The low temperature specific heat per electron is found to be $56.21\ k\ r_s^{9/2}.(kT)^3$Ry. The range of r_s values for which these results should be valid is discussed on the basis of Lindemann's melting formula. (Author)

Microwave Lab., Stanford U., Calif.
GENERALIZATION OF THE LAGRANGE EXPANSION, WITH APPLICATION TO PHYSICAL PROBLEMS, by P. A. Sturrock. Scientific rept. no. 18 on Contract AF 19(604)1930. Dec 59, 15p. 6 refs. M. L. rept. no. 668; AFCRC TN-60-117; AD-233 866.
Order from LC mi$2.40, ph$3.30 PB 146 326

Problems of fluid dynamics are discussed in the Lagrangian description by means of the displacement-vector function. The Eulerian variables describing the motion may be obtained from the displacement-vector function by a generalization of the Lagrange expansion which is established. Two examples of the application of this expansion are given: the derivation of the Fokker-Planck equation, and the description of the surface conditions of a rippling electron stream by the device of equivalent surface charges. (Author)

Naval Research Lab., Washington, D. C.
STARK BROADENING OF HYDROGEN LINES IN PLASMA, by H. R. Griem, A. C. Kolb, and K. Y. Shen. 4 Mar 60, 26p. NRL rept. 5455.
Order from LC mi$2.70, ph$4.80 PB 144 638

The frequency distributions of hydrogen lines broadened by the local fields of both ions and electrons in a plasma are calculated in the classical path approximation. A complete set of curves is presented for electron densities in the range 10^{14} to 10^{19} cm^{-3} for the temperature range 10,000°K to 40,000°K.

Polytechnic Inst. of Brooklyn, N. Y.
ELECTRON DISTRIBUTION ACROSS A DISCONTINUITY OF ION DENSITY IN A PLASMA, by Manlio Abele. Rept. on Contract AF 30(602)2045. Mar 60, 16p. 2 refs. PIBAL rept. no. 549; RADC-TN-60-77.
Order from LC mi$2.40, ph$3.30 PB 146 769

The problem of the electron distribution in the vicinity of a discontinuity of ion density is discussed in the present report, assuming that a plane infinite surface separates a uniform plasma from a vacuum. The density of electrons in the vacuum is always very small compared to the ion density of the plasma. The results indicate that the electron density vanishes at large distance from the interface with a rate of decrease which is small compared to the rate of change of the electron density within the plasma. (Author)

Republic Aviation Corp. [Farmingdale, N. Y.]
AN OUTLINE OF THE BASIC THEORY OF MAGNETOHYDRODYNAMICS, by P. N. Hu. Technical rept. on Contract AF 29(601)1218. 15 Nov 58, 60p. 30 refs. MSD Rept. no. 206-950-2; AFSWC-TR-58-46; AD-208 851.
Order from LC mi$3.60, ph$9.30 PB 146 108

A survey of the basic theory of magnetohydrodynamics is given together with a review of the fundamental concepts of electrodynamics and the motion of a charged particle. The basic equations used for a viscous, heat-conducting, radiating, electrically-conducting, and compressible fluid are the Maxwell's equations, the momentum equation, the continuity equation, the ideal gas law, the energy equation, and Ohm's law. The most general form of these equations is derived and then reduced to various approximate forms. The associated boundary conditions for the electric and magnetic fields, pressure, velocity, and heat energy are also derived. Solutions to several problems are noted. (Author)

Schwinger, Julian, Cambridge, Mass.
INVESTIGATION OF HIGH FREQUENCY LIMITATIONS IN MILLIMETER WAVE GENERATORS, by Julian Schwinger. Final rept. for Aug 59-Feb 60 on Contract DA 36-039-sc-78282. [1960] 38p. 7 refs.
Order from LC mi$3.00, ph$6.30 PB 147 983

Need of a quantum-mechanical formalsim for systems with dissipation, applicable to the radiation field of a cavity, is discussed. Approximations with respect to loss mechanism which underlie the concept of dissipation are discussed. A generalization of the solution, to provide for a classical driving force and coupled atomic systems, is given. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
PLASMA SHEATH CHARACTERISTICS ABOUT HYPERSONIC VEHICLES, by H. G. Lew and V. A. Langelo. Rept. on Contract AF 04(647)269. 6 Apr 60, 49p. 7 refs. Technical Information Series R60SD356.
Order from LC mi$3.30, ph$7.80 PB 147 636

This paper considers vehicle induced interferences to signal transmission and presents some results for a typical re-entry body. The shock layer for such a body is investigated including the effects of non-equilibrium. The ionized wake behind the body is discussed for both the continuum and rarefied gaseous states. Finally, an estimate of the attenuation of a plane wave through the ion sheath is given. (Author)

Thermodynamics

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
THERMODYNAMIC PROPERTIES OF AIR AT HIGH TEMPERATURES, by James E. Weidenborner. Dec 56, 66p. 8 refs. AFSWC-TN-56-48; AD-96 301.
Order from LC mi$3.90, ph$10.80 PB 148 280

This report presents, in graphical form, a number of thermodynamic properties and shock parameters based upon a new equation of state for air computed by the National Bureau of Standards. Isotherms, adiabats, and shock-front parameters at varying altitudes for air were computed from the NBS equation of state data, which is also included in this report, and plotted in appropriate graphical form over a wide range of density, pressure, and temperature. A study of the isotherms, adiabats, and shock parameters shows that these curves do not deviate greatly from similar curves obtained by previous investigators using other equations of state for air. The isotherms in this report, however, cover a wider range of density, pressure, and temperature than any set of curves heretofore available. The graphs of shock parameters show that these vary with altitude, not greatly, but in an orderly manner. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
MOLLIER DIAGRAM FOR NITROGEN, by R. L. Humphrey, W. J. Little, and L. A. Seeley. Rept. on ARO, Inc. Contract AF 40(600)800. May 60, 39p. 4 refs. AEDC-TN-60-83.
Order from LC mi$3.00, ph$6.30 PB 147 728

Thermodynamic data for nitrogen are presented in Mollier diagram form covering the temperature range of $30^{o}K$ to 15,000 ^{o}K and the density range of 10^{-6} to 10^{3} atmospheres. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
HIGH TEMPERATURE THERMAL RADIATION PROPERTIES OF SOLID MATERIALS, by Henry H. Blau, Jr., Eleanor Chaffee and others. Scientific rept. no. 2 on Contract AF 19(604)2639. 31 Mar 60, 61p. 7 refs. AFCRC-TN-60-165.
Order from OTS $1.75 PB 161 773

This report describes the first phase of an experimental study of the thermal radiation properties of solid materials at elevated temperatures. The basic objectives of the study have been: (a) to establish techniques for measurement of spectral and total emissivity and emittance of solid materials at temperatures as high as 4000K, (b) to determine the practical accuracy of these techniques, and (c) to determine the thermal radiation characteristics of selected materials of interest.

Polytechnic Inst. of Brooklyn, N. Y.
TEMPERATURE DISTRIBUTION AND THERMAL STRESSES IN STRUCTURES WITH CONTACT RESISTANCES, by Frederick V. Pohle, T. J. Lardner, and Francis W. French. Rept. on Contract AF 49(638)302. May 60, 32p. 22 refs. PIBAL rept. no. 557; AFOSR-TN-60-504.
Order from LC mi$3.00, ph$6.30 PB 147 783

The temperature distribution in a built-up structure in the form of an I-section composed of cover plates and a web is investigated for the case of a contact resistance at the junction of the cover plates and the web. The temperature-discontinuity condition is discussed in the light of previous experimental work, and a new junction condition is proposed. Graphs of temperatures and stresses are presented for the case of constant flux of heat to the cover plates. (Author)

Woods Hole Oceanographic Institution, Mass.
MEASUREMENTS OF RADIATIVE FLUX FROM AN AIRBOURNE RADIOMETER, by David B. Clarke. Technical rept. no. 43 on Marine Meteorology, Contract Nonr-1721(00). Aug 59, 22p. 7 refs. Ref. no. 59-40; AD-226 010.
Order from LC mi$2.70, ph$4.80 PB 148 175

An airborne instrument is described that is being developed to investigate the radiative heat balance in the lower troposphere. The instrument, a radiometer, essentially derives the radiative flux by measuring the temperature on opposite sides of an insulator. The radiometer was mounted on an R4D Naval research airplane on 2 struts trailing from the port wing, and in Nov 1958, was flown from Woods Hole to Trinidad and back. Radiation measurements were obtained along the route but most measurements were obtained in an area about 50 mi east of Trinidad. The radiometer's construction consists of a disc of aluminum foil 2 in. in diameter which acts as the sensor that receives the radiation. A small bead thermistor is sandwiched between the disc's under side and another small piece of aluminum foil to measure the disc's temperature. The bead and the small foil are taped tightly to the larger disc to insure good thermal contact. Results indicate that the radiometer was not too satisfactory. It was too slow in response and not constructed carefully enough to give the desired accuracy needed for net fluxes, flux divergence, and radiative cooling. The radiometer had the advantage of being relatively inexpensive to build and maintain, and of being simple in principle and construction.

Wave Propagation

Institute of Mathematical Sciences, New York U., N. Y.
SCATTERING OF A SURFACE WAVE BY A DISCONTINUITY IN THE SURFACE REACTANCE ON A RIGHT ANGLED WEDGE, by Frank C. Karal, Jr. and Samuel N. Karp. Rept. on Contract AF 19 AF 19(604)5238. Feb 60, 29p. 23 refs. Research rept. no. EM-146; AFCRC-TN-60-196.
Order from LC mi$2.70, ph$4.80 PB 147 526

This report considers the electromagnetic field that arises when a surface wave travels along the front face of a right angled wedge and is scattered by the tip. An impedance type boundary condition is prescribed on the front face of the wedge and a simple boundary condition (that for perfect reflection) is prescribed on the other. The impedance boundary condition is such that surface waves are generated. An exact mathematical solution is presented in elementary form for this problem and the amplitude of the reflected surface wave is found. A simple representation for the radiated far field amplitude is given. The important special cases of small and large reactance are discussed. For large reactance the wave is closely bound to the surface, which may then be regarded as a surface-wave-guide. In this limit there is complete reflection of the surface wave, with a change in phase of $\pi/3$. The question is raised as to what change of phase ought to be assigned, in general, so as to describe reflection at an 'open end' of a surface-wave-guide. (Author)

National Bureau of Standards, Boulder, Colo.
A SURVEY AND BIBLIOGRAPHY OF RECENT RESEARCH IN THE PROPAGATION OF VLF RADIO WAVES, by James R. Wait. May 60, 47p. 326 refs. Technical note no. 58.
Order from OTS $0.75 PB 161 559

Attention is confined primarily to terrestrial propagation, and thus solar and exospheric phenomena are generally excluded although certain germane references dealing with these subjects are given in the bibliography. First a brief description of recent advances of ground wave propagation is given. This is followed by sections on ray and mode concepts of ionospheric propagation. The research dealing with the waveforms of atmospherics is also considered. Finally some recent applications of VLF propagation are described.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Armed Services Technical Information Agency, Arlington, Va.
FIELDS OF INTEREST OF DEPARTMENT OF DEFENSE CONTRACTORS AND OTHER NON-MILITARY ORGANIZATIONS SERVICED BY ASTIA. Sep 59, 216p.
Order from OTS $2.50 PB 161 810

The compilation is based on a special run, in mid-September 1959, of the machine-converted Field-of-Interest Registers in the ASTIA file. These registers show, in some detail, the scientific and technical fields of interest which have been approved for each of the defense contractors and other non-military organizations established to receive ASTIA's service. Part I lists the organizations alphabetically, showing the ASTIA mailing code, which is used here as a cross-reference key. Part II, which is arranged in mailing code sequence, shows the field of interest of each organizations, in the form of a grid of numbers referring to the major divisions and sections of the ASTIA distribution Guide. Part III lists the mailing codes in numerical sequence under each major division, and Part IV gives the names of divisions and sections.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
MARK I PERCEPTRON OPERATORS' MANUAL (PROJECT PARA) by John C. Hay, Ben E. Lynch and others. Rept. on Contract Nonr-2381(00). 15 Feb 60, 62p. 6 refs. Rept. no. VG-1196-G-5.
Order from LC mi$3.90, ph$10.80 PB 147 661

The Mark I Perceptron is a pattern learning and recognition device. It is intended as an experimental tool for the direct study of a limited class of perceptrons. This manual is intended primarily as a guide to the setting up and operation of the machine. It does not require extensive familiarity with the theory of perceptron systems. For those familiar with the theory, but not necessarily concerned with actually operating the machine, the manual should serve to indicate the machine's potentialities as a research instrument.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ON THE CONVERGENCE OF REINFORCEMENT PROCEDURES IN SIMPLE PERCEPTRONS, by Frank Rosenblatt. Rept. on Proj. Para, Contract Nonr-2381(00). 15 Feb 60, 58p. 9 refs. Rept. no. VG-1196-G-4.
Order from LC mi$3.60, ph$9.30 PB 148 227

Previous reports have described a number of theoretical nerve nets called perceptrons, and have attempted to analyze their ability to associate responses to stimuli using a variety of training procedures and memory functions. Proofs have been found for a number of theorems of fundamental importance for the theory of such networks. The main findings are summarized: (1) there exist certain simple memory functions and training procedures by which it can be guaranteed that a perceptron will ultimately arrive at a solution to any given response-association problem; (2) a variety of problems are shown to be soluble; (3) the same procedures which yield solutions for binary classification problems can be employed to assign arbitrary response functions to stimuli; and (4) a considerable variety of perceptron models, differing from one another in the transfer functions of their association units, are shown to be identical with respect to their ability to arrive at solutions to learning problems.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
POSSIBLE APPLICATIONS OF ELECTRONIC SCANNING AND COMPUTER DEVICES TO THE ANALYSIS OF GEOGRAPHIC PHENOMENA, by James P. Latham. Technical rept. no. 1 on Contract Nonr-551(29). 31 Aug 59, 27p. 16 refs. AD-227 257.
Order from LC mi$2.70, ph$4.80 PB 148 145

Methods are examined: (1) which analyze the distribution of geographic phenomena by measurement, and thereby provides an objective basis for regionalizing and describing distributions; and (2) to improve the speed, accuracy, utility, and economic feasibility of such methods by applying modern instrumented systems of measurement and data processing. The possibility and present practicability is explored of utilizing electronic scanning devices to measure and record the linear distances of the intercepts resulting when traverses sample a mapped distribution of areal units. Ways and means are developed for recording the above measurements in a manner which will permit the use of mechanical and/or electronic sorting. Computing equipment is investigated for organizing and statistically evaluating the data. (Author)

Communication Theory

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
REPRESENTATION OF COMPLEX SIGNALS BY MEANS OF DAMPED OSCILLATORY BASE FUNCTIONS, by Ladislav Dolansky. Scientific rept. no. 59-1 on Contract AF 19(604)4979. 10 Aug 59, 68p. 53 refs. AFCRC-TN-59-648; AD-232 538.
Order from LC mi$3.90, ph$10.80 PB 146 112

Traditionally, the more complicated communication signals have been most often expressed in terms of Fourier series components or as time functions specified at a large number of points. Such approaches are usually mathematically complete and may be useful in many respects; however, for good insight and simplicity of the associated equipment, they are often inferior to approaches using component functions more directly related to the process which generates the particular class of signals studied. An orthonormal set of decaying oscillatory base functions was obtained and the problem of expressing voiced speech sounds by means of a small number of such functions, and of obtaining their coefficients by measurement, was studied. The experimental results indicate that an analysis of the speech waveform into damped oscillatory base functions and subsequent synthesis within a good approximation is indeed possible. The essential information about each sound can be condensed into a vector or a row matrix, to which all known methods of mathematical analysis can be applied. The method is not limited to speech sounds. It can be applied to other complex experimental signals as well, although for different classes of signals different base functions may be found to be more advantageous. (Author)

Ohio State U Research Foundation, Columbus.
AN EXAMINATION OF THE SPOKEN VOCABULARY USED IN AIR TRAFFIC CONTROL, by Henry M. Moser and Robert E. Durham. Technical rept. no. 55 on Contract AF 19(604)4575. Nov 59, 39p. 13 refs. AFCRC-TN-59-73; AD-233 255.
Order from LC mi$3.00, ph$6.30 PB 146 306

Word counts were made of air traffic communications at three domestic and two international airports located in high-traffic areas in the United States. Consecutive segments of two-way radiotelephones messages were analyzed for type-token ratios. Pilots and controllers use a very limited basic vocabulary. Although there are similarities in the vocabularies employed in tower, Ground Control, and Approach Control, there are characteristic differences. In general, there are more differences between the several control facilities of one airport than among the vocabularies of the same control facility at different airports. (Author)

Speech Research Lab., U. of Michigan, Ann Arbor.
AN ACOUSTIC-PHONETIC STUDY OF INTERNAL OPEN JUNCTURE, by Ilse Lehiste. Rept. no. 2 on Contract Nonr-1224(22). Aug 59, 122p. 166 refs. AD-226 319.
Order from LC mi$6.30, ph$19.80 PB 147 690

The phonetic manifestations of internal open juncture in standard Midwestern American English were explored. Several phonetic factors were observed which indicate the presence of internal open juncture. Internal open juncture can be defined as a boundary point between 2 phonological units in English, here called bounded sequences. A bounded sequence is an ordered set of phonemes that starts with an initial allophone, ends with a final allophone, and possesses a typical intensity and duration pattern which unites the segmental phonemes into the higher-level unit. The various prejunctural and post-junctural allophones are described. The intensity pattern associated with a bounded sequence involves a rapid increase in intensity during the initial phase, followed by a slow decrease associated with deceleration in tempo during the terminal phase.

Photographic Equipment

Naval Ordnance Test Station, China Lake, Calif.
A BASIC STUDY ON IMAGE DEGRADATION RESULTING FROM VIBRATION IN A PHOTOGRAPHIC SYSTEM, by D. R. Hornbaker and R. O. White. 9 Mar 60, 24p. 1 ref. NOTS TP-2440; NAVORD rept. 7048.
Order from LC mi$2.70, ph$4.80 PB 147 491

A study to determine quantitatively the effect of simple harmonic vibration on photographic image resolution was performed. Two primary effects were found: (1) an image shift, and (2) an image smear. The first, not readily predictable, is dependent on frequency and phase as related to the exposure period. The second is readily predictable from a ratio, dependent on film resolution quality, relating image vibration amplitude to image width. (Author)

X-Ray and Crystal Analysis Lab., Pennsylvania State U., University Park.
X-RAY CAMERA FOR USE WITH UNICAM. S25 OSCILLATION GONIOMETER FOR MICROBEAM APPLICATIONS, by K. Drenck and R. Pepinsky Rept. on Contract DA 36-061-ORD-478. [1956] 8p. 3 refs. OOR rept. no. 761.4; AD-143 149.
Order from LC mi$1.80, ph$1.80 PB 14[illegible] 860

A miniaturized single-crystal X-ray diffraction camera was constructed as an attachment for the Unicam . S25 oscillation-rotation goniometer. This camera is designed for use with the high-brilliance micro-focus X-ray diffraction tube.

SOCIAL SCIENCES

Documentation

Benson-Lehner Corp., Santa Monica, Calif.
A STUDY OF THE FUNDAMENTALS OF INFORMATION STORAGE AND RETRIEVAL, by Peter K. Worslet, Roger D. Dittman and others. Final rept. no. 417 on Contract Nonr-2666(00). 20 Aug 59, 99p. 2 refs.
Order from LC mi$5.40, ph$15.30 PB 147 726

The key concept is one of searching for documents not by physically shuffling and moving them to expose for inspection a reference on their surface, but rather one of allowing all of the documents to remain static and subjecting them to a paging or broadcasting system. The basic concept is one of creating a document, or document envelope, which by virtue of a sensitized coding system, would be alert rather than passive, awaiting call from a central interrogation system. It became evident that it was necessary to retreat further toward the fundamentals of Data Banking to increase the understanding of the nature of the intercommunication between human minds through documents. With this new information it was then possible to proceed to work on the technology of creating coded documents with the ability to respond to particular coded call signs. The study has contributed to the understanding of the man-document communication problem and it has contributed towards solving the extremely difficult problem of creating "alert" rather than passive documents.

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
MECHANIZED SEARCHING EXPERIMENTS USING THE WRU SEARCHING SELECTOR, by Janet Rees and Allen Kent. Technical note no. 1 on Contract AF 49(638)357. 15 May 58, 31p. 59 refs. AFOSR TN-58-445; AD-158 250.
Order from LC mi$3.00, ph$6.30 PB 146 386

One of the applications of the Western Reserve University Searching Selector is to conduct test searches on a file of encoded abstracts prepared for the American Society for Metals. This report presents typical results of pilot searches. Their evaluation as to pertinent interest and general usefulness has also been carried out by persons and organizations that originated information requests. The results of such evaluation and the procedures involved in making them are also presented. (Author)

Herner and Co., Washington, D. C.
AN EXPERIMENT IN THE DESIGN OF A NON-MANIPULATIVE CORRELATIVE INDEX, by Saul Herner and Mildred H. Heatwole. Technical note no. 2 on Contract AF 30(602)1857. 27 Apr 59, 29p. 6 refs. RADC-TN-59-169; AD-215 860.
Order from LC mi$2.70, ph$4.80 PB 147 031

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, July 60.
Order from OTS $1.25, $10.00/year PB 161 283

Contents:
Articles:
NRL satellite solar photometry experiment, by R. W. Kreplin, T. A. Chubb, and H. Friedman
Preliminary UHF propagation predictions for Project Trade Winds III, by C. G. Purves
Scientific program:
Astronomy and Astrophysics: Atmospheric radioactivity in South America and Antartica
Chemistry: Stabilization of silicon lubricating liquids above 200°C. Force-area study of catalase films. Evaluation of creosote-resin solutions and creosote distillation fractions. Studies on the fuel-ignition-suppression capability of foam-covered aircraft runways.
Mechanics: Further verification of the significance of shock spectrum dip applicable to the design of structures
Metallurgy and Ceramics: Deoxidation of molybdenum with selected reducing agents. Stress-rupture strength of notched and unnotched metal alloy specimens in air and vacuum at 1500 F. On the protection of columbium at high temperatures
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Study of equilibrium between metals and their polyvalent chlorides in LiCl–KCl eutectic melt, by L. Yang, R. G. Hudson, and C. Chien. Carneg Institute of Tech., Metals Research Laboratory, Pittsburgh, Pa. 1959. 27p. Order from LC. Mi $2.70, ph $4.80. AECU-4544

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The surface chemistry of thoria. Progress report for February 1, 1959 to January 31, 1960, by H. R. Bradford and others. University of Utah, Institute of Metals and Explosives Research, Salt Lake City, Utah. Jan 60. Contract W-7405-eng-

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Final report, January 20, 1948 - September 14, 1959, by D. Lipkin. Washington University, St. Louis, Mo. Contracts AT-29-1-GEN-77 and AT(11-1)-268. 17p. Order from LC. Mi $2.40, ph $3.30. AECU-4614

Properties of hydrided yttrium, by D. S. Parker. General Electric Co. Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. May 60. Contracts AF 33(600)-38062 and AT(11-1)-171. 23p. Order from OTS. 50 cents. APEX-558

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Rearrangements in 3-aryl-1-butyl systems. Final report, by A. W. Fort and R. E. Leary. University of Kentucky, Lexington, Ky. Oct 59. Contract AT(40-1)-2067. 118p. Order from LC. Mi $6.00, ph $18.30. ORO-227

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Flame spectrophotometric determination of calcium in lead metal, by R. E. Barringer. Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. June 60. Contract W-7405-eng-26. 21p. Order from OTS. 75 cents. Y-1295

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Thermodynamic properties of carbides at high temperatures. Annual report and renewal proposal, by S. Fujishiro and N. A. Gokeen. University of Pennsylvania, Philadelphia, Pa. Sep 59. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4346

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Magnetic determination of impurities in uranium fuel slugs, by D. Whal and A. Liboff. Atomic Energy Division, Sylvania Electric Products, Inc., Bayside, N. Y. June 56. Decl. May 18, 1960. Contract AT-30-1-GEN-366. 21p. Order from OTS. 35 cents. SEP-167

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SEP-187

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Dimensional instability of uranium - I. First annual progress report for June 30th, 1955 to June 30th, 1956, by R. Resnick and L. Seigle. Atomic Energy Division, Sylvania Electric Products, Inc., Bayside, N. Y. June 56. Decl. May 23, 1960. Contract AT-30-1-GEN-366. 22p. Order from OTS. 30 cents. SEP-228

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Welding and brazing. A literature search, by T. F. Davis. AEC Technical Information Service Extension, Oak Ridge, Tenn. Feb 60. 100p. Order from OTS. $2.50. TID-3546

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Development of boron-bearing materials for application as lumped burnable poisons, by D. Jaffe, E. E. F. Losco, and S. F. Kaufman. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. May 60. Contract AT-11-1-GEN-14. 64p. Order from OTS. $1.75. WAPD-221

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Particle Accelerators and High-Voltage Machines

Electron model of a spiral sector accelerator, by D. W. Kerst and others. Midwestern Universities Research Association, Madison, Wis. [nd.] 136p. Order from OTS. $2.75. MURA-559

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Technical progress report. Part I. High-speed computer program. Part II. Mathematical methods.

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Radioisotope X-ray generator. Quarterly progress report no. 2 covering the period from October 1, 1959 to December 31, 1959, by M. W. Chisholm, R, J. Lambert and J. Kastner. Picker X-Ray Corp. Picker Research Center, Cleveland, Ohio. 1959. Contract AT(11-1)-746. 20p. Order from LC. Mi $2.40, ph $3.30. AECU-4632

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Finite cylinder gamma heating program (Monte Carlo Research Series), by General Electric Co. Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. May 58. Contracts AF 33(600)-38062 and AT(11-1)-171. 18p. Order from OTS. 75 cents. APEX-552

High-temperature hydraulic rod control. General Electric Co. Aircraft Nuclear Propulsion Department, Light Military Electronics Department, Cincinnati, Ohio. May 60. Contracts AF 33(600)-38062 and AT(11-1)-171. 92p. Order from OTS. $2.25. APEX-556

Liquid metal fuel reactor experiment. Quarterly Technical report for October to December 1958. The Babcock and Wilcox Company, Atomic Energy Division, Lynchburg, Va. 1958. Contract AT (30-1)-1940. 139p. Order from OTS. $2.75. BAW-1135

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A method for measuring the U^{239} fission cross section, by M. Clark. Brookhaven National Laboratory, Associated Universities, Inc., Upton, N. Y. June 52. Decl. April 13, 1960. 21p. Order from OTS. 30 cents. BNL-205

A study of the wind profile in the lowest 400 feet of the atmosphere. Progress report no. 5 for October 16, 1959 to January 15, 1960, by I. A. Singer. Brokkhaven National Laboratory, Upton, N. Y. 1960. 43p. Order from OTS. $1.50. BNL-596 (T-170)

Sodium component study. Combustion Engineering, Inc., Nuclear Components Engineering Dept., Chattanooga, Tenn. Feb 59. Contract AT(11-1)-665. 292p. Order from LC. Mi $11.10, ph $45.00. CENC-1038

Temperature distribution in thin walled heat-exchangers having non-circular flow passages, by W. S. Farmer. Oak Ridge National Laboratory, Oak Ridge, Tenn. Oct 51. Decl. with deletions February 19, 1957. 15p. Order from LC. Mi $2.40, ph $3.30. CF-51-10-178(Del.)

Basic inelastic neutron data for age calculations for various fuel and moderator compositions, by C. M. Copenhaver. Oak Ridge National Laboratory, Oak Ridge, Tenn. June 6956. Decl. with deletions March 15, 1957. Contract W-7405-eng-26. 14p. Order from LC. Mi $2.40, ph $3.30. CF-56-6-40(Del.)

Present and proposed methods for calculating absorption and radial divergence corrections for diffraction line contours from debyescherrer powder patterns, by J. M. Carter and F. J. Musil. Goodyear Atomic Corp., Portsmouth, Ohio. Oct 59. Contract AT(33-2)-1. 43p. Order from LC. Mi $3.30, ph $7.80. GAT-T-689

The detection of freon leaks in converters by infrared methods, by D. L. Scott. Goodyear Atomic Corp., Portsmouth, Ohio. Dec 59. Contract AT(33-2)-1. 17p. Order from LC. Mi $2.40, ph $3.30. GAT-T-707

Water loss rates following a piping failure in the PRTR, by T. W. Ambrose. Hanford Atomic Products Operation, Richland, Wash. Feb 60. Contract AT(45-1)-1350. 21p. Order from OTS. 75 cents. HW-60654 REV-2

Equations of state for steamwater mixtures and some representative applications analysis, by W. J. Love. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Nov 59. Contract AT(45-1)-1350. 20p. Order from LC. Mi $2.40, ph $3.30. HW-62858

Coordinates for semi-rigid molecules, by H. L. McMurry. Phillips Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho. May 60. Contract AT(10-1)-205. 31p. Order from OTS. $1.00. IDO-16600

Materials testing reactor. Engineering test reactor technical branches. Quarterly report for October I to December 31, 1959, by J. R. Huffman and others. Phillips Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho. May 60. Contract AT(10-1)-205. 65p. Order from OTS. $2.00. IDO-16620

Tram, a Monte Carlo thermal neutron code for the IBM 704, by M. A. Martino and W. W. Stone. General Electric Co., Knolls Atomic Power Laboratory, Schenectady, N. Y. June 59. Contract W-31-109-eng-52. 33p. Order from OTS. $1.75. KAPL-2039

Long term irradiation of natural dysprosium, by E. C. Hansen. Knolls Atomic Power Lab., Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 22p. Order from LC. Mi $2.70, ph $4.80. KAPL-M-ECH-2

Isotopic shielded poison burnout, by E. L. Wachspress. Knolls Atomic Power Lab., Schenectady, N. Y. Nov 59. Contract W-31-109-Eng-52. 7p. Order from LC. Mi $1.80, ph $1.80. KAPL-M-ELW-10

Increasing convergence rates by transforming the multigroup operator--application to one space dimension problems, by E. L. Wachspress. Knolls Atomic Power Lab., Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 12p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-ELW-11

A variational procedure for obtaining spatially dependent thermal spectra, by G. P. Calame and P. D. Federighi. Knolls Atomic Power Lab., Schenectady, N. Y. Dec 59. 44p. Order from LC. Mi $3.30, ph $7.80. KAPL-M-GPC-2

Some asymptotic results for a coverage problem, by M. Halperin. Knolls Atomic Power Lab., Schenectady, N. Y. Sep 59. Contract W-31-109-Eng-52. 23p. Order from LC. Mi $2.70, ph $4.80. KAPL-M-MH-2

Performance and evaluation of natural circulation power plants, by M. M. Schorr. Knolls Atomic Power Lab., Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 48p. Order from LC. Mi $3.30, ph $7.80. KAPL-M-NPA-1

Jet pump test for NCR application, by M. Nazar and R. Eisenstadt. Knolls Atomic Power Lab., Schenectady, N. Y. Jan 60. Contract W-31-109-Eng-52. 63p. Order from LC. Mi $3.90, ph $10.80. KAPL-M-NPA-4

Numerical solution of transient and steady-state neutron transport problems, by B. Carlson. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. May 59. Contract W-7405-eng-36. 30p. Order from LC. Mi $2.60, ph $3.30. LA-2260

Collision integrals and transport properties for gases obeying an exponential repulsive potential. Application to hydrogen and helium, by J. B. Mann. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. June 60. Contract W-7405-ENG-36. 58p. Order from OTS. $1.75. LA-2383

Solution of a problem to obtain the optimum energy for a rocket initially in a circular orbit, by G. A. Baker, Jr. and J. G. Wills. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. Contract W-7405-ENG-36. 20p. Order from OTS. 75 cents. LAMS-2403

The structure of certain finite difference schemes, by B. Wendroff. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. June 60. Contract W-7405-ENG-36. 11p. Order from OTS. 50 cents. LA-2410

Study of slightly-enriched uranium-water lattices with high conversion ratio. Quarterly progress report for August 1, 1959, to October 31, 1959, by Combustion Engineering, Inc., Nuclear Div., Windsor, Conn. May 60. Contract AT(30-1)-2379. 59p. Order from OTS. $1.50. NYO-2702

Nuclear data processing on an IBM-704 computer with the Condac program, by C. D. Goodman and B. D. Williams. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 27p. Order from OTS. $1.00. ORNL-2925

High energy nuclear reactions. A literature search, by J. Hudis. Brookhaven National Laboratory, Upton, N. Y. Mar 60. 40p. Order from OTS. $1.00. TID-3901

Ionic mass transport by free convection to horizontal electrodes. Thesis, by E. J. Fenech. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Apr 60. Contract W-7405-eng-48. 81p. Order from OTS. $2.25. UCRL-9079

Microscope equipment for nuclear emulsion analysis, by J. C. Hodges. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Feb 60. Contract W-7405-eng-48. 132p. Order from OTS. $2.75. UCRL-9089

Some nuclear and electronic ground-state properties of Pa^{233}, Am^{241}, and 16-hr Am^{242}. Thesis, by J. Winocur. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Apr 60. Contract W-7405-eng-48. 128p. Order from OTS. $2.50. UCRL-9174

Relativistic and diamagnetic corrections of atomic g values, by I. P. K. Lindgren. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. 31p. Order from OTS. 75 cents. UCRL-9184

SN5001--An IBM-650 code for steady-state thermal evaluation of an instrumented multi-fuel-plate subassembly, by E. Arbtin and R. B. Westphal. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Apr 60. Contract AT-11-1-GEN-14. 21p. Order from OTS. 75 cents. WAPD-TM-146

Calculation of thermal neutron fluxes in primary shields, by D. C. Anderson and K. Shure. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Nov 59. Contract AT-11-1-GEN-14. 41p. Order from OTS. $1.25. WAPD-TM-193

ABRAC - an IBM-704 three dimensional nuclear-thermal depletion program with distributed void effects, by W. M. Jacobi and others. Westinghouse Electric Corp., Bettis Atomic Power Lab., Pittsburgh, Pa. Mar 60. Contract AT-11-1-GEN-14. 130p. Order from OTS. $2.75. WAPD-TM-203

Euripus-3 and daedalus--Monte Carlo density codes for the IBM-704, by H. J. Amster, H. G. Kuehn and J. Spanier. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Feb 60. Contract AT-11-1-GEN-14. 91p. Order from OTS. $2.25. WAPD-TM-205

An experiment to measure effective delayed neutron fractions, by S. Kaplan and A. F. Henry. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Feb 60. Contract AT-11-1-GEN-14. 29p. Order from OTS. $1.00. WAPD-TM-209

A dimensional analysis of the departure from nucleate boiling heat flux in forced convection, by P. Griffith. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh Pa. Dec 59. Contract AT-11-1-GEN-14. 25p. Order from OTS. 75 cents. WAPD-TM-210

Temp-2 a one dimensional transient thermal stress program for the IBM-704, by L. M. Culpepper and D. Jortner. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Apr 60. Contract AT-11-1-GEN-14. 17p. Order from OTS. 50 cents. WAPD-TM-214

*Reports to the AEC Nuclear Cross Sections Advisory Group, Washington, D. C. April 28-29, 1960, by J. A. Harvey. Oak Ridge National Laboratory, Oak Ridge, Tenn. 1960. 74p. Order from OTS. $2.25. WASH-1028

Radiation Effects on Materials

Effects of irradiation on some corrosion-resistant fuel alloys, by J. H. Kittel and K. F. Smith. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 18p. Order from OTS. 50 cents. ANL-5640

A study of the effects of fission fragment recoils on the oxidation of zirconium, by W. C. Yee. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 90p. Order from OTS. $2.50. ORNL-2742

Radioactive Waste

Effect of atomic interaction potential on defect production in metals, by E. Brown and G. H. Goedecke. Rensselaer Polytechnic Institute, Troy, N. Y. 195?. Contract AT(30-1)-1995. 11p. Order from LC. Mi $2.40, ph $3.30. AECU-4564

Capacity test data for the adsorption of volatile ruthenium on silica gel, by D. R. Anderson and D. W. Rhodes. Phillips Petroleum Co., Atomic Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho. June 60. Contract AT(10-1)-205. 22p. Order from OTS. 75 cents. IDO-14510

Winchester Laboratory, quarterly report for January 1, 1960 to March 31, 1960, by A. C. Herrington. National Lead Company, Inc., Winchester Laboratory, Winchester, Mass. 1960. Contract AT(49-6)-924. 38p. Order from OTS. 75 cents. WIN-116

Reactors—General

Fate of fission product gases in the coolant stream, by L. Brewer. General Atomic Division, General Dynamics Corp., San Diego, Calif. Aug 59. Contract AT(04-3)-314. 3p. Order from LC. Mi $1.80, ph $1.80. AECU-4536

Vaporization processes in a runaway reactor, by L. Brewer. General Atomic Division, General Dynamics Corp., San Diego, Calif. Aug 59. Contract AT(04-3)-314. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4539

The helium cooled loop in the GETR, by R. F. Hausman. General Electric Co., Atomic Equipment Dept., San Jose, Calif. 1959? 11p. Order from LC. Mi $2.40, ph $3.30. AECU-4621

Initial testing and operation of the Argonne low power reactor (ALPR), by E. E. Hamer. Argonne National Laboratory, Argonne, Ill. Dec 59. Contract W-31-109-eng-38. 261p. Order from OTS. $4.00. ANL-6084

The internal feedback of EBR-I Mark-III, by J. C. Carter. Argonne National Laboratory, Argonne Ill. Feb 60. Contract W-31-109-eng-38. 72p. Order from OTS. $2.00. ANL-6124

Studies of reactor containment. Summary report no. 2 for August 1, 1959 to January 31, 1960, by T. A. Zaker. Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill. Feb 60. Contract AT(11-1)-528. 80p. Order from OTS. $2.25. ARF-4132-13

The BMI-16 recirculating gas loop installed at the ETR, by J. V. Baum and others. Battelle Memorial Institute, Columbus, Ohio. Mar 60. Contract W-7405-eng-92. 43p. Order from OTS. $1.50. BMI-1429

Industrial chemical production by chemo-nuclear processes with special reference to the production of fixed nitrogen, by G. Lellouche and M. Steinberg. Brookhaven National Laboratory, Upton, N. Y. Sep 59. 59p. Order from OTS. $2.00. BNL-574 (T-157)

Metal-water reactions: V. The kinetics of metal-water reactions -- low pressure studies, by S. C. Furman. General Electric Co., Vallecitos Atomic Laboratory, Atomic Power Equipment Dept., Pleasanton, Calif. July 59. Contract AT(04-3)-189. 64p. Order from OTS. $1.75. GEAP-3208

Metal-water reactions: VII. Reactor safety aspects of metal-water reactions, by L. F. Epstein. General Electric Company, Vallecitos Atomic Laboratory, Atomic Power Equipment Dept., Pleasanton, Calif. Jan 60. Contract AT(04-3)-189. 73p. Order from OTS. $2.00. GEAP-3335

Status report on control rod materials research and development program, by C. G. Andre and others. General Electric Co., Vallecitos Atomic Laboratory, Atomic Power Equipment Dept., Pleasanton, Calif. Feb 60. Contract AT(04-3)-189. 55p. Order from OTS. $1.50. GEAP-3355

The MTR/ETR safeguard committee, by R. J. Nertney. Phillips Petroleum Company. Atomic Energy Division, Idaho Falls, Idaho. Apr 60. Contract AT(10-1)-205. 12p. Order from OTS. 50 cents. IDO-16569

Safeguard report on the proposed method of annealing graphite in the X-10 reactor, by L. E. Stanford. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 146p. Order from OTS. $3.00. ORNL-2725

Effect of heat flux on the corrosion of aluminum by water. Part I. Experimental equipment and preliminary test results, by J. C. Griess and others. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 44p. Order from OTS. $1.50. ORNL-2939

Reactors—Power

Experimental gas cooled reactor. Preliminary proposal, by Henry J. Kaiser Company Kaiser Engineers Division, Oakland, Calif. and Allis-Chalmers Manufacturing Company, Nuclear Power Department, Washington, D. C. Aug 59. Contract AT(10-1)-925. 150p. Order from OTS. $4.00. AECU-4701(Pt. 1)

Annual report for February 1958 to February 1959. Prepared by ALCO Products Ind. Staff, Ft. Belvoir, Va. ALCO Products, Inc., Schenectady, N. Y. June 1959. Contract AT(30-3)-326. 74p. Order from OTS. $2.00. APAE-47

Liquid metal fuel reactor experiment. Nonnuclear instrumentation for liquid bismuth service, by B. L. Birch. Babcock and Wilcox Company, Lynchburg, Va. Apr 60. Contract AT(30-1)-1940. 32p. Order from OTS. $1.75. BAW-1069

Liquid metal fuel reactor experiment. Investigation and testing of welded and brazed molybdenum joints. Final report, by R. E. Pavlak. The Babcock and Wilcox Company, Lynchburg, Va. Apr 60. Contract AT(30-1)-1940. 38p. Order from OTS. $1.25. BAW-1098

Maritime gas-cooled reactor program. Quarterly progress report for the period ending June 30, 1959, by S. A. Bernsen and others. General Dynamics Corporation, General Atomic and Electric Boat Division, San Diego, Calif. 1959. Contract AT(04-3)-187. 180p. Order from OTS. $3.50. GD-1099

Corrosion of beryllium in flowing sodium, by W. W. Kendall. General Electric Company. Atomic Power Equipment Department, Schenectady, N. Y. Jan 60. Contract AT(04-3)-189 PA#6. 27p. Order from OTS. $1.00. GEAP-3333

Exponential pile measurements with hollow slugs in graphite-uranium lattices, by E. D. Clayton and others. Hanford Atomic Pooducts Operation, Richland, Wash. Apr 55. Decl. June 17, 1960. Contract W-31-109-Eng-32. 32p. Order from OTS. 35 cents. HW-36174

ETR cycle 18 thermal and fast neutron flux measurements, by L. D. Weber and C. H. Hogg. Phillips Petroleum Co. Atomic Energy Division, Idaho Operations Office, Idaho Falls, Idaho. June 60. Contract AT(10-1)-205. 49p. Order from OTS. $1.00. IDO-16563

Thermal performance of the SRE main intermediate heat exchanger, by K. W. Foster. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 66p. Order from OTS. $1.50. NAA-SR-3775

OMRE fuel plate surface temperature measurement, by S. Sudar. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 38p. Order from OTS. $1.25. NAA-SR-4047

Piqua prototype handling system, by H. Nadler. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 94p. Order from OTS. $2.25. NAA-SR-4361

Hydraulic characteristics of HNPF preliminary design fuel elements, by S. Sudar and D. Rosh. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 31p. Order from OTS. $1.00. NAA-SR-4385

Dielectric properties of terphenyl mixtures, by R. J. Sullivan and F. C. Silvey. Atomics International A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 17p. Order from OTS. 75 cents. NAA-SR-4764

Plutonium-Enriched OMR cores, by T. J. Connolly. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 45p. Order from OTS. $1.25. NAA-SR-4812

OMR degasifier loop experiment, by G. W. Corporales and P. R. Benson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. May 60. Contract AT(11-1)-GEN-8. 44p. Order from OTS. $1.25. NAA-SR-4886

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Technology—Feed Materials

The influence of lubrication on the compactability of magnesium-green salt blends for bomb reduction, by S. J. Paprocki, R. J. Carlson, and E. G. S Smith, Jr. Battelle Memorial Institute, Columbus, Ohio. June 57. Decl. May 16, 1960. Contract W-7405-eng-92. 14p. Order from OTS. 30 cents. BMI-1193

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Process development quarterly report. Part I, Laboratory work, by B. Elliott and others. Mallinckrodt Chemical Works, St. Louis, Mo. July 57. Decl. June 18, 1960. Contract W-14-108-eng-8. 202p. Order from OTS. $3.00. MWM-1403

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Green salt moving bed process, by R. W. LeGassie and others. New Brunswick Laboratory, New Brunswick, N. J. June 55. Decl. June 17, 1960. 66p. Order from OTS. 50 cents. NBL-105

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Technology—Raw Materials

Controlled pH stripping of uranium from amines, by D. J. Crouse. Oak Ridge National Laboratory, Chemical Techn logy Division, Chemical Development Section C, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 23p. Order from OTS. 75 cents. ORNL-2941

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Engineering Supervision Co., New York.
LITERATURE SURVEY ON RESEARCH AND DEVELOPMENT ON HIGH PRESSURE TECHNOLOGY, by Lawrence Berg and Harry Herman. Rept. for June-Oct 59 on Metallic Materials, Contract AF 33(616)6729. Mar 60, 54p. 295 refs. WADC Technical rept. 59-730.
Order from OTS $1.50 PB 161 887

This bibliography lists alphabetically by author the results of a survey of available literature, both foreign and domestic, classified and unclassified, in the field of high pressure technology. The compiled information includes, for each article, the title, source, page number, number of pages, Chemical Abstract number (CA) Physical Abstract number (Ph. A.), and a general description of the subject matter. Co-authors of any given publication have been cross-referenced. It is intended to reissue this report from time to time as new authors emerge and new publications are reviewed. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
SOLAR ENERGY APPLICATIONS. July 60, 5p. 68 refs. OTS Selective Bibliography SB-418.
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A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations.

ASTRONOMY

Air Force Missile Development Center, Holloman AFB, N. Mex.
PLANETARY ASTRONOMY FROM SATELLITE-SUBSTITUTE VEHICLES, by John D. Strong, Gérard H. de Vaucouleurs, and Fritz Zwicky. Mar 60, 163p. 142 refs. AFMDC-TR-60-6; AD-234 813.
Order from LC mi$7.80, ph$25.80 PB 146 964

Contents:
A review of meteorological and astrophysical programs for observatories carried effectively into space by satellite-substitute vehicles
A survey of physical problems of the nearer planets and a review of observational techniques applicable to balloon-borne telescope systems
Program for novel observations from high altitude balloons
(See also PB 145 737)

Air Force Missile Development Center, Holloman AFB, N. Mex.
PLANETARY ASTRONOMY FROM SATELLITE-SUBSTITUTE VEHICLES. II. A SURVEY OF PHYSICAL PROBLEMS OF THE NEARER PLANETS AND A REVIEW OF OBSERVATIONAL TECHNIQUES APPLICABLE TO BALLOON-BORNE TELESCOPE SYSTEMS, by Gerard de Vaucouleurs. Dec 59, 128p. 123 refs. AFMDC-TN-59-37; AD-233 561.
Order from LC mi$6.30, ph$19.80 PB 146 381

A survey is presented of the various techniques immediately available, or soon to become practicable, to solve the main outstanding problems of planetary astronomy. Particular attention is given to the nearer planets, Venus, Mars, and Mercury, which together with the earth form the so-called terrestrial planets group. Special emphasis is placed on the potentialities of balloon-borne instrumentation and on proven techniques rather than experimental developments. (Author) (See also PB 143 187)

Yerkes Observatory [Williams Bay, Wis.]
THE HYDROGEN EMISSION LINES IN POPULATION II VARIABLE STARS, by Robert P. Kraft (Yerkes and McDonald Observatories) David C. Camp, and William T. Hughes (Goethe Link Observatory). Rept. on Contract Nonr-2323(00). [1959] 15p. 23 refs. AD-219 583.
Order from LC mi$2.40, ph$3.30 PB 146 354

Three groups of variables generally assigned to Population II are considered: RR Lyrae Stars, W Virginis stars, and high-velocity long-period variables. If t is the time hydrogen emission is present in the spectra of these stars, and P is the period, it is shown that

log t ∝ log P. If one assumes that strong shock waves are responsible for the emission, it is found that the strength of the Hβ emission in W Vir can be predicted. It is suggested that the pulsation constant is the same for the stars in all 3 groups, and that the mass of a high-velocity long-period variable is of the order of 1μ.

Ohio State U. Research Foundation, Columbus.
RADIO STAR SCINTILLATION AT 915 Mc, by H. C. Ko. Final rept. on Contract AF 19(604)1591. Apr 59, 48p. 21 refs. Radio Observatory rept. no. 12. AFCRC-TR-59-182; AD-225 686.
Order from LC mi$3.30, ph$7.80 PB 146 611

Observations of radio star scintillation at 915 mc over a 12-month period (October 1957-September 1958) are described. By daily observations of the star constellation Cygnus A (IAU 19N4A) over a wide range of elevation angles, both the amplitude and rate of scintillation were studied. Results show that the amplitude of scintillation is strongest near the horizon and decreases rapidly as the altitude increases. The amplitude of the intensity fluctuation ranges from less than 3% to over 50% of the undisturbed intensity while the rate of fluctuation varies from 1/2 to 8 peaks per min. The fluctuation amplitude was greater than 10% at low altitudes for 71% of the total observations. The frequency of occurrence of scintillation had two maxima: one in the winter and the other in the summer. During these periods the mean fluctuation amplitude was higher than during other periods. The mean fluctuation rate in the winter is about 3 times faster than that in the summer. (Author)

Astrophysics

Aeronautical Instruments Lab., Naval Air Development Center, Johnsville, Pa.
THE EFFECT OF CELESTIAL BODIES ON THE GRAVITATIONAL CONSTANT OF THE EARTH, by Ronald S. Vaughn. Technical note. 15 Oct 59, 19p. 3 refs. Rept. no. NADC-AI-5990(TN); AD-231 985.
Order from LC mi$2.40, ph$3.30 PB 146 963

The gravitational potential at a point near the earth due to the moon and the sun is evaluated in terms of the net specific force with respect to the earth. The maximum possible value near the earth's surface is shown to be about 2.4×10^{-7} g. A constant residual is shown to affect the interpretation placed on the measured value of the earth's gravitational constant. This effect is about 4.5×10^{-6} g. (Author)

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
THE LIMITING DETECTIVITY OF OPTICAL AMPLIFYING EQUIPMENT, by R. K. H. Gebel and Lee Devol. Dec 59, 26p. WADC Technical note 59-405.
Order from OTS $0.75 PB 161 876

The limits in the ability to detect very faint stars in the presence of the sky background by conventional photography and by employing optical amplification are investigated and compared in this paper. Equations are developed which show the effects of the different variables involved for three types of imaging system; the conventional photographic system, the image-converter, and the closed circuit television type of optical amplifier. In this paper, the last named system is found capable of detecting smaller differences in brightness than the two other systems. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
BIBLIOGRAPHY OF EXTRATERRESTRIAL RADIO NOISE: QUARTERLY LIST OF RECENT PUBLICATIONS [NO. 6] by Martha Stahr Carpenter. Rept. on Contract Nonr-401(22) and National Science Foundation Grant G5964. 15 Dec 58, 19p. 132 refs. Research rept. EE-417.
Order from LC mi$2.40, ph$3.30 PB 148 345

Most of the references pertain to material received between 1 Sep 58 and 1 Dec 58. Also included are certain references to earlier publications that were not mentioned in previous "Quarterly Lists," and a few revised statements of previously listed references about which further information is now available. (See also PB 146 094)

Cornell U., School of Electrical Engineering, Ithaca, N. Y.
RADAR ECHO FROM A ROUGH ROTATING PLANET, by M. H. Cohen. Technical rept. no. 1 on Radio Astronomy, Contract Nonr-401(27). 1 June 59, 23p. 7 refs. Research rept. EE-428; AD-225 628.
Order from LC mi$2.70, ph$4.80 PB 146 587

An assumption is made that the reflection properties of a planet are like those of a rough rotating sphere. A monochromatic wave incident on such a body has an echo whose spectrum is shown to be of the form, $I(\nu) = I_m [1 - 2(\nu - \nu_m)^2/B^2]$ where I is the spectrum, ν is the frequency, and m is the peak intensity. The effect of orbital motions on the width, B, of the spectrum of the echo is deduced. Earth-Mars and Earth-Venus situations are considered. Measurements of B for Venus over a range of orbital positions may fix the rotation period and the heliocentric ecliptic latitude and longitude of the pole, except for one ±ambiguity. If a 2-wk rotation period for Venus is assumed, B has a maximum value of 120 c. (Author)

Iowa State U., Iowa City.
INSTRUMENTATION FOR AURORAL ZONE BALLOON EXPERIMENTS AND SUMMARY OF FIELD OPERATIONS, by Donald C. Enemark and Kinsey A. Anderson. [Rept. on Contract N9onr-938(03)]. June 59, 28p. 4 refs. Rept. SUI-59-17; AD-219 097.
Order from LC mi$2.70, ph$4.80 PB 146 705

Twelve balloon flights were made to obtain information on high latitude cosmic ray effects and x-ray occurring in connection with magnetic storms and other geophysical or solar phenomena. Approximately 150 hours of data were obtained above 100,000 ft altitude (30 Km). Five flights were made from Fairbanks, Alaska, during April, 1959. This site was chosen because of the very low ground winds encountered there which would facilitate launching large volume balloons. These were desired in order to make measurements with an auroral photometer at altitudes where the Rayleigh scattered sunlight was comparable with auroral brightness. Another feature of the extreme altitude flights was the possibility of studying x-ray effects at very small atmospheric depths. (Author)

Kiruna Geophysical Observatory (Sweden)
STUDIES OF CORRELATIONS BETWEEN UPPER ATMOSPHERE VARIABLES IN THE AURORAL ZONE, by Bengt Hultqvist, Alv Egeland and others. Technical summary rept. Task 6, 15 Oct 58-15 Oct 59, on Contract AF 61(514)1314. 26 Oct 59, 28p. 6 refs. AFCRC-TN-60-148.
Order from LC mi$2.70, ph$4.80 PB 148 810

Study of correlations of satellite data, visual aurora, magnetic variations, and VHF auroral reflections.

Kiruna Geophysical Observatory (Sweden).
STUDIES OF TRANSMISSIONS FROM SATELLITES WITH EMPHASIS ON PROPAGATION ASPECTS, by Ludwik Liszka. Technical summary rept. Task 5, 15 Oct 58-15 Oct 59, on Contract AF 61(514)1314. 15 Oct 59, 46p. 3 refs. AFCRC-TN-60-147.
Order from LC mi$3.30, ph$7.80 PB 148 809

This report contains a discussion of the methods of Doppler and signal strength measurements and of the analysis of the measurements of 1958 δ 2 transmissions. The following phenomena have been studied: (1) the shape of the region of reception and its dependence on ionospheric conditions; (2) from observations of Faraday fading some estimates have been made by means of a digital computer of the total electron amount, and of the components of the unit vector of the geomagnetic field in the ionosphere; (3) the sudden fadeouts of signals which seems to be caused by strong absorption in "clouds" existing at heights of about 300 km; (4) a type of variations of the signal strength possibly connected with ionization produced by the satellite.

Kiruna Geophysical Observatory (Sweden).
A STUDY OF AURORAL PROPAGATION OF 90 Mc/s RADIATION, by Johannes Ortner, Alv Egeland, and Sven Olsen. Technical summary rept. Task 1 and 2, 15 Oct 57-15 Oct 59, on Contract AF 61(514)1314, 20 Oct 59, 109p. 19 refs. AFCRC-TN-60-144.
Order from LC mi$5.70, ph$16.80 PB 148 806

Contents:
Part I: Radio interference in the frequency range 35-100 Mc/s at Kiruna Geophysical Observatory
Part II: A study of auroral propagation of 90 Mc/s radiation by Johannes Ortner
Part III: Studies of the angular properties of VHF-auroral reflections
Part IV: The aurograph, a recorder for receptions obtained by means of rotary antennas

Kiruna Geophysical Observatory (Sweden).
A STUDY OF TRANSPOLAR HF-PROPAGATION, by Johannes Ortner. Technical summary rept. Task 3, 15 Oct 57-15 Oct 59, on Contract AF 61(514)1314. 30 Oct 59, 100p. 5 refs. AFCRC-TN-60-145.
Order from LC mi$5.40, ph$15.30 PB 148 807

HF pulse propagations on 12, 18 and 24 Mc/s have been studied on the transpolar transmission path College, Alaska - Kiruna, Sweden continuously since 20 May 1958. The technical performance of these experiments is described and the reception signal strength tables are given for the observation period June 1958 to August 1959. The monthly mean signal strength diurnal variation curves are presented. Furthermore some examples of multipath propagation are shown and the effect of strong absorption events on the pulse transmissions is discussed. (Author) (Portions of this report will not reproduce well)

Smithsonian Institution, Astrophysical Observatory, Cambridge, Mass.
STUDY OF ATMOSPHERIC ENTRY AND IMPACT OF HIGH VELOCITY METEORITES, by Fred L. Whipple. Quarterly status rept. no. 17, 1 Jan-31 Mar 60, on Contract AF 18(600)1596. 25 May 60, 4p.
Order from LC mi$1.80, ph$1.80 PB 148 019

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
A GENERAL PROCEDURE FOR SYSTEMS STUDY, by George O. Wright. Jan 60, 17p. 2 refs. WADD Technical note 60-18; AD-236 040.
Order from OTS $0.50 PB 161 873

The creation of an abstract system model is presented. The model is developed around the concepts of process, data input, system output, function, data transformation, mediation, and operation, outcomes and the output criteria, feedback control, and data flow. The system model also is considered in cultural terms. The thesis is set forth that the man-machine complex is a cultural system whose limits are set by culture. The paper also proposes a methodology for system study. The general procedure is to locate appropriate places in the system to manipulate selected variables and to evaluate the resulting changes in the system performance. A set of principles is developed to assist in the choices of the place to intervene as well as the kinds of variables to be manipulated. (Author)

American Inst. for Research [Pittsburgh, Pa.]
TECHNIQUES FOR HUMAN FACTORS EVALUATION OF PROTOTYPE SPECIAL WEAPONS AND ASSOCIATED EQUIPMENT, SUPPLEMENT I, by James W. Shearer, Dan A. Peterson and Edward B. Slebodnick, Rept. on Contract AF 29(601)513. July 59, 81p. AIR-259-59-FR-198-Sup. I: AFSWC-TR-59-14, sup. I; AD-227 333.
Order from LC mi$4.80, ph$13.80 PB 146 598

This booklet is published as a supplement to AFSWC-TR-59-14, Techniques for Human Factors Evaluation of Prototype Special Weapons and Associated Equipment. The appendices to that report consisted of an Instructions Evaluation Guide (IEG) and an Equipment Evaluation Guide (EEG). The former is compiled of some 300 items for evaluating preliminary manuals of job instructions; the latter, of about 500 items for evaluating prototype equipment of various kinds. These supplements contain the cards for both guides. Supplement I contains the cards for the IEG. Supplement II contains the cards for the EEG. The Instructions section describes the order in which the cards should be used.

American Inst. for Research [Pittsburgh, Pa.]
TECHNIQUES FOR HUMAN FACTORS EVALUATION OF PROTOTYPE SPECIAL WEAPONS AND ASSOCIATED EQUIPMENT, SUPPLEMENT II, by James W. Shearer, Dan A. Peterson, and Edward B. Slebodnick. Rept. on Contract AF 29(601)513. July 59, 186p. AIR-259-59-FR-198-Sup. II; AFSWC-TR-59-14; sup. I; AD-227 331.
Order from LC mi$8.40, ph$28.80 PB 146 591

See also PB 146 598.

Dunlap and Associates, Inc., Stamford, Conn.
OPTIMUM SYMBOLS FOR RADAR DISPLAYS, by Hugh M. Bowen, John Andreassi and others. Rept. on Contract Nonr-2682(00). 1 Sep 59, 36p. 47 refs. AD-227 014.
Order from LC mi$3.00, ph$6.30 PB 148 898

Experiments were conducted to determine: (1) sets of geometric symbols each one of which is discriminated and recognized with high accuracy under a variety of display degradation conditions, and (2) the size and strokewidth to height ratio desirable for symbols to be used on complex displays. Recommendations including appropriate dimensions, are made concerning: (1) optimum geometric symbols; (2) size and strokewidth to height ratio; (3) compliance with the informational structure the symbols are representing; (4) the manner in which symbols are to be compounded to form symbol complexes; and (5) agreement with conventional and stereotyped meanings. (Author)

Dynamic Analysis and Control Lab., Mass. Inst. of Tech., Cambridge.
TIME-VARIABLE DYNAMICS OF HUMAN OPERATOR SYSTEMS, by Thomas B. Sheridan. Rept. for Sep 58-Sep 59 on Contract AF 19(604)4548. Mar 60, 125p. 37 refs. Rept. no. 124; AFCRC-TN-60-169.
Order from LC mi$6.30, ph$19.80 PB 147 732

The human operator of a control system is frequently modelled as a several parameter constant coefficient quasi-linear system, with coefficients dependent upon the process dynamics and the input spectrum. However, an important limitation to such a model occurs in precisely that situation where the human controller out performs his mechanical or electronic counterpart. An experimental technique is developed whereby the frequency characteristics of the human operator (or any physical system) are computed in a running fashion as he adapts to sudden changes in parameters of the reference input, the nature of the operator's display, the controlled process, or physiological conditions within himself. The method utilized a "random appearing" reference input which consists of a sum of non-harmonic sinusoids. Experimental results reveal the time-changes of the human operator's transfer characteristics to be quite consistent and almost instantaneous when the operator is experienced.

Personnel and Training

Human Factors Research, Inc., Los Angeles, Calif.
SUPERVISORY RATINGS AND PRACTICAL PERFORMANCE TESTS AS COMPLEMENTARY CRITERIA OF SHIPBOARD PERFORMANCE, by Robert R. Mackie and Wallace S. High. Technical rept. no. 9 on Research on the Development of Shipboard Performance Measures, Contract Nonr-1241(00). June 59, 59p. 15 refs. AD-220 172.
Order from LC mi$3.60, ph$9.30 PB 146 687

This report describes a shipboard follow-up study of the performance of Navy Machinery Repairmen whose aptitudes, skills, interests and achievements had been thoroughly studied two years earlier while they were in Class "A" MR training. Shipboard performance was assessed in two ways: (1) by administering a practical performance test requiring skill in the use of machinery repair equipment; (2) by securing ratings by supervising petty officers of each person's ability to perform the various aspects of the MR's shipboard job. The results strongly suggested that performance tests and supervisory ratings were best regarded as complementary criteria of shipboard performance. When the two shipboard measures were combined to form a simple composite criterion, it was estimated that over 50% of the true variance was accounted for by scores made two years earlier on a combination of scores made on: (1) mechanical knowledge tests; (2) training projects involving the use of lathe and milling machines; and (3) predictions by school instructors as to eventual suitability as an MR. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
A PERFORMANCE REQUIREMENT FOR BASIC LAND NAVIGATION, by Joseph F. Follette. Rept. on Contract DA 49-106-qm-1. Mar 60. 60p. 8 refs. Research rept. no. 4.
Order from LC mi$3.60, ph$9.30 PB 148 318

This report presents the rationale and supporting data that were the basis for establishing a performance requirement and a proficiency standard to be used in evaluating a program of instruction in basic land navigation. The combat reference situation in which navigation ability ultimately will be required was described, and the performance requirement and the means for accomplishing it were assessed. Generation of the requirement was based on characteristics of position defense by a ROCID division. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
THE REVISION OF NIKE PLATOON LEADER JOB DESCRIPTIONS: AJAX TO HERCULES, by Edgar M. Haverland and Walter J. Fightmaster. Rept. on Contract DA 49-106-qm-1. May 60, 26p. 5 refs. Technical rept. 62.
Order from LC mi$2.70, ph$4.80 PB 148 064

This report describes the sources of information and procedures used to revise the job descriptions of the Nike Ajax integrated fire control platoon leader and launching platoon leader positions to make them applicable to Nike Hercules platoon leader jobs. It outlines the methods found generally useful for revising and developing job descriptions to keep them up to data, and recommends their use by training agencies. The Hercules fire control and launching platoon leader job descriptions developed in this study are included. (Author)

Naval Personnel Research Field Activity, San Diego, Calif.
DEVELOPMENT OF A DOPPLER TEST, by Edward J. Pickering. Oct 59, 19p. 6 refs. BuPers Technical Bulletin 59-27; AD-233 002.
Order from LC mi$2.40, ph$3.30 PB 146 304

Sea-recorded materials were used to: (a) develop and evaluate a test to measure sonarmen's ability to determine Doppler; and (b) provide a set of Doppler items for drills in Doppler training. New test and drill materials were needed because many of the materials available at Fleet Sonar School, San Diego, (FSS/SD) were worn or obsolete. Administration of the experimental 60 item test to 6 classes, 99 students, at the FSS/SD indicated that the test can be expected to accurately discriminate individual differences in Doppler ability. The 50 item Doppler drill which was developed and the test are now in use at the FSS/SD. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
THE DEVELOPMENT OF MEASURES FOR THE EVALUATION OF FT PERFORMANCE, by Kalmer E. Stordahl and J. Howard Bryant. Mar 59, 64p. 8 refs. Technical Bulletin 59-8; AD-233 978.
Order from LC mi$3.90, ph$10.80 PB 147 229

The refinement of prototype procedures and instruments developed to provide economical and effective means for obtaining pertinent and current shipboard data to assess the influence upon personnel performance of policy and program changes is reported.

Naval Personnel Research Field Activity, San Diego, Calif.
AN EXPERIMENTAL INVESTIGATION OF DOPPLER TRAINING, by Edward J. Pickering. Nov 59, 52p. 15 refs. BuPers Technical Bulletin 59-29; AD-233 008.
Order from LC mi$3.60, ph$9.30 PB 146 303

Research and development in Doppler training during and since World War II is described. The effectiveness of Doppler training in improving the ability of sonar students to determine Doppler is evaluated, and planned modifications of Doppler training to increase the effectiveness of Doppler training are investigated. The results of this research indicate that: (1) the average ability of sonar students to judge Doppler is significantly improved through training; (2) the particular instructor who teaches Doppler greatly affects the results of training; (3) students who are poor judges of Doppler before training do not, even though they improve, reach a proficiency level adequate for fleet performance; (4) initially superior judges of Doppler improve through training and do maintain a proficiency level adequate for fleet performance; and (5) from an economics viewpoint more might be accomplished by selecting for Doppler ability than by training poor judges of Doppler. (Author) (See also PB 146 304)

Naval Personnel Research Field Activity, San Diego, Calif.
THE PROFICIENCY OF PACIFIC FLEET SONARMEN IN THE USE OF ELECTRONIC TEST EQUIPMENT, by Adolph V. Anderson and Edward J. Pickering. Nov 59, 30p. BuPers Technical Bulletin 59-30; AD-233 620.
Order from LC mi$2.70, ph$4.80 PB 147 274

A test designed to measure ability to use electronic test equipment was administered to 396 Pacific Fleet sonarmen as part of a general survey of sonar personnel. On the average, the ability of sonarmen to operate volt-ohm meters, vacuum tube volt meters, oscilloscopes, and signal generators was poorer than desirable. Sonarmen below the grade of chief petty officer who were assigned to helicopter squadrons performed at a lower level than sonarmen in other assignments. Possible remedial measures include the development of standard proficiency measures in the practical application of electronic test equipment; the development of one or more experimental training courses in the use of electronic test equipment; administrative action to cause closer agreement between practical factors requirements for sonarmen and performance on electronic test equipment; and the investigation of the feasibility of developing a training device to provide simulated experience in the use of electronic test equipment. (Author)

Naval Personnel Research Field Activity, San Diego, Calif.
A STUDY OF WEIGHTING FACTORS USED IN NROTC SELECTION, by Bernard Rimland. July 59, 28p. 11 refs. BuPers Technical bulletin 59-24; AD-231 132.
Order from LC mi$2.70, ph$4.80 PB 146 344

The weighting of the various selection factors in NROTC NROTC selection was explored. The findings indicate that weighting the Navy College Aptitude Test scores by a factor of 4 and weighting High School Grades by a factor of 6 resulted in the greatest assurance of academic success. In order to predict career motivation it was determined that equal weights should be assigned to the Career Motivation Questionnaire and to the career motivation item on the Interview Form. Though the interview (other than the career motivation item) has never been found to be very valid in the Navy setting, it has in the past been given approximately 50% of all the selection weight by the State Selection Committees. A new selection procedure has been developed

and promulgated by the Chief of Naval Personnel for use by the State Selection Committees. They should result in giving greater weight to the academic and career motivation factors and reducing the effective weight assigned to the interview. (Author)

Psychological Corp., New York
AN APPLICATION OF LEARNING THEORIES TO THE TRAINING OF RADIO CODE OPERATORS. by Albert K. Kurtz. Technical rept. no. 2 on Contract Nonr-2519(00). Sep 59, 19p. 8 refs. AD-226 228.
Order from LC mi$2.40, ph$3.30 PB 148 612

In order to determine the relative merits of two experimental methods and a control method of training radio code operators to receive International Morse Code at a high rate of speed, Navy recruits undergoing training in radio code were subjected to special instruction, some during the first two, and others during the first 4 weeks of their 24 week course. Some of the learning principles utilized in the experiment were: reinforcement, maintenance of interest, prevention of learning of erroneous responses, unidirectional confusion, overlearning, concentration on difficult material, development of ability to respond to stimulus within varied contexts, realism, and praise and encouragement. The four-week experimental method proved more effective than the two-week method. Although the results of tests with the control group were slightly higher than those with the experimental four-week group, it was felt that the experimental method may actually be superior to the control method. Apart from teaching effectiveness, the experimental method produced an intrinsically more interesting course than the control method, and it was suggested that some of the former's characteristics might be used in the later stages of the twenty-four week course to combat monotony. This should improve the present low morale of radio code students.

Psychological Corp., New York.
RECENT DEVELOPMENTS, PRACTICES, AND RESEARCH IN THE FIELD OF CODE LEARNING, by Albert K. Kurtz. Technical rept. no. 1 on Contract Nonr-2519(00). Sep 59, 54p. 45 refs. AD-227 063.
Order from LC mi$3.60, ph$9.30 PB 148 611

Contents:
Transmission speeds for code-reception practice
Tone speed
Order of presentation of signals
Rate of introduction and grouping of signals
Amount of practice per signal
Types of practice materials
Code-voice method
Learning theory, instructional techniques, and training aids
Arrangement of practice time
Typical progress in code learning
Code-reception errors
Accuracy standards
Variety and antimonotony procedures
Prediction of success after training has begun
Code sending
Code typing
Criteria of code receiving proficiency

School of Aviation Medicine [Brooks] AFB, Tex.
PROBABILITY AND STATISTICS IN ITEM ANALYSIS AND CLASSIFICATION PROBLEMS. SOME RESULTS ON THE DISTRIBUTION OF THE W-CLASSIFICATION STATISTIC, by Rosedith Sitgreaves (Teachers Coll., Columbia U.). Sep 57, 23p. 4 refs. Rept. 58-3: AD-157 697.
Order from LC mi$2.70, ph$4.80 PB 146 181

The classical problem of classification is concerned with classifying an individual as coming from one of two populations, on the basis of p measurements made on him. It is assumed that the p measurements have a multivariate normal distribution in each population with the same covariance matrix but with different mean values. The parameter values are unknown but can be estimated from samples of known population. The present paper gives a series representation for the sampling distribution of the classification statistic W, proposed for this problem by Anderson, in the case when the two samples of known population are of equal size. (Author)

Washington U., Seattle. [Div. of Counseling and Testing Services]
DIFFERENTIAL PREDICTION OF ACADEMIC SUCCESS, by Paul Horst. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). May 59, 37p. 33 refs.
Order from LC mi$3.00, ph$6.30 PB 146 468

The report is divided into the following parts: (A) Philosophy and principles of differential prediction: (B) Variables of differential prediction: (C) Methodological research: (D) Experimental research: (E) Application of the differential prediction program: (F) High speed electronic computer programs: (G) Special problems: and (H) Need for cooperative programs.

Washington U., Seattle. Div. of Counseling and Testing Services.
RELATIONSHIP BETWEEN PREADMISSION VARIABLES AND SUCCESS IN COLLEGE, by Paul Horst. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). June 59, 121p. AD-219 274.
Order from LC mi$6.30, ph$19.80 PB 146 691

The relationships between certain preadmission and college success variables, as determined by grade point averages, were studied. Three general types of admissions variables were analyzed: (a) high school grades, (b) number of high school units, and (c) test scores. The main part of the study was concentrated on the group of students entering the University of Washington in the fall of 1955, but data from the entering classes of 1953 and 1954 were also included for comparative purposes. In all, over 7,500 students were included. The results of the study indicate that: (1) the best preadmission predictors vary greatly from one college course area to another; (2) the best group of predictors are the high school grade point averages; (3) the next best group of predictors are test scores; (4) number of high school units are, in general, poor or very poor predictors of college success as measured by grade point averages; (5) the single best preadmission variable is the all academic high school grade point average; and (6) the grade predictions based on a number of different high school grade

averages and test scores are better predictors of college success than all academic high school grade point average. (Author)

Psychology

Applied Psychology Panel, Office of Scientific Research and Development.
THE USE AND DESIGN OF SYNTHETIC TRAINERS FOR MILITARY TRAINING, by Dael Wolfle. 6 July 45, declassified 8 Mar 55. 42p. 37 refs. OSRD rept. no. 5246; ATI-35 348.
Order from LC mi$3.30, ph$7.80 PB 146 809

A good trainer has three essential characteristics: (1) practice on the trainer leads to substantial improvement on the equipment the men are being trained to operate; (2) a good trainer provides reliable information on the quality of the men's performance; (3) mechanically and electrically it is as simple and rugged as possible. It is necessary to plan carefully an instructional program using a trainer. Instructions for the proper use of a trainer should be prepared as the trainer is being developed, and distributed with the trainer. Trainers possess some advantages over real equipment for practice. (1) They are generally safer, more economical, and more readily available. (2) On a trainer it is possible to break up a complex task into simpler elements. (3) It is usually easier to give men exact information about their errors and successes on a trainer than on real equipment. The steps to follow in developing a new trainer or in evaluating an existing one are outlined in this report.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
APPLICATION OF STIMULUS SAMPLING THEORY TO SITUATIONS INVOLVING SOCIAL PRESSURE, by Patrick Suppes and Franklin Krasne. Technical rept. no. 24 on Contract Nonr-225(17). 10 Sep 59, 39p. 12 refs. AD-226 681.
Order from LC mi$3.00, ph$6.30 PB 148 614

The hypothesis that ultimately group behavior can be explained entirely in terms of the behavior of the individuals who constitute the group is presented. The quantitative formulations of stimulus-response-reinforcement theory provide the conceptual tools for effecting this assumption. An interaction situation is conceived of as one in which each member of a group provides stimuli and reinforcements for every other member of the group with the behavior of each member entirely explicable on an individual basis, given the sequence of stimuli and reinforcements impinging on him. In the social situation objective stimuli and the behavior of other members of a group combine to form the relevant stimulus situations for each subject. It is felt that considerable analytic advantage is derived from the application of a quantitative theory of individual behavior. Through its use it is possible to make highly specific deductions about the extent of operation of certain events which are not directly observable but which may reasonably be postulated to exist; i. e., secondary self-reinforcement of responses well established in everyday experience. The magnitude of the effects of these secondary reinforcements is compared to that of the more directly controlled social support.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
STIMULUS SAMPLING THEORY FOR A CONTINUUM OF RESPONSES, by Patrick Suppes. Technical rept. no. 25 on Contract Nonr-225(17). 11 Sep 59, 38p. 4 refs. AD-226 640.
Order from LC mi$3.00, ph$6.30 PB 148 615

Stimulus sampling theory is extended to situations involving a continuum of possible responses. The experimental situation consists of a sequence of trials. On each trial the subject makes a response from a continuum of possible responses. His response is followed by a reinforcing event indicating the correct response for that trial. Stimulus sampling theory requires a complicated process which involves the conditioning and sampling of stimuli. The postulate is given that the conditioning of each stimulus is smeared over a certain interval of responses, possibly the whole continuum. Thus, the conditioning of any stimulus may be represented by a smearing distribution. Conditioning, sampling and response axioms are presented which state specific hypotheses about the assumed sequence of events on any trial. General theorems are given, and cases of noncontingent reinforcement are examined.

California U., Berkeley.
THE STABILITY OF PERSONALITY RATINGS OVER TWO DECADES, by Read D. Tuddenham. Technical rept. no. 3 on Adolescent Growth Study, Contract [Nonr-222(14)]. 1957, 39p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 148 822

The present report is concerned with the stability of a broad variety of personality ratings, an important class of variables often used in psychological research as criterion measures. The findings are offered despite certain methodological shortcomings--few cases and a lack of strict comparability in the "before" and "after" rating contexts--because of the extreme paucity of such reports, and because of the light the results throw upon the predictive validity of ratings explicitly intended to tap different levels of personality organization.

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. III. THE SEX COMPOSITION OF THE GROUP AS A DETERMINANT OF YIELDING TO A DISTORTED NORM, by Read D. Tuddenham, Philip D. Macbride, and Victor Zahn. Technical rept. no. 4 on Contract [Nonr-222(14)]. 1958, 8 refs.
Order from LC mi$2.40, ph$3.30 PB 148 823

This report describes an experiment intended to explore the influence upon yielding of the structure of the normative social situation and the qualities attributed to those who compose it.

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. IV. THE INFLUENCE UPON JUDGMENT OF AN AVOWEDLY DISTORTED NORM, by Read D. Tuddenham. Technical rept. no. 5 on Contract [Nonr-222(14)]. 1958, 29p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 148 824

A norm need not be believed to exert influence, and the effectiveness of palpably false propaganda may become somewhat more intelligible. To explore this matter further, an earlier experiment on yielding was repeated exactly, except for explaining to the subjects that the alleged norm was itself distorted and not always trustworthy. (See also PB 148 823)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. V. THE INFLUENCE UPON JUDGMENT OF A MODERATELY DISTORTED NORM, by Read D. Tuddenham. Technical rept. no. 6 on Contract [Nonr-222(14)]. 1958, 15p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 148 825

The present experiment attempts, under conditions of laboratory control, to investigate the more typical situation in which the discrepancy between self and others is moderate, and the group norm, if not veridical, is at least not grossly false. In this treatment, tension arising from awareness of discrepancy between self and others is much reduced, but the validity of the norm is not undermined. This paper describes the individual and group differences which result as compared with the other experimental variations. It is specifically concerned with whether reduced pressure produces a substantial number of nonyielders, or whether the relatively greater acceptability of the pseudonorm actually enhances its influence upon judgment. (See also PB 148 824)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. VI. THE INFLUENCE UPON JUDGMENT OF A GENUINE NORM, by Read D. Tuddenham. Technical rept. no. 7 on Contract [Nonr-222(14)]. 1958, 13p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 148 826

The present paper describes the limiting case when the norm itself is genuine and undistorted, but all other variables of the situation match those of the previous experiments. While formally related to the previous studies, the present variation is properly a study of conforming rather than of yielding, since the subjects need not surrender their own judgments to accept those of the group. The two hypotheses of this investigation were suggested by previous experiments, and may be stated as follows: first, a norm which does not conflict with individual experience induces convergence of judgment in the group; second, this convergence is more marked the greater the ambiguity of the stimulus situation, i.e., most marked on opinions, least marked on visual discriminations. (See also PB 148 825)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. VII. SOME CORRELATES OF YIELDING TO A DISTORTED GROUP NORM, by Read D. Tuddenham. Technical rept. no. 8 on Contract [Nonr-222(14)]. 1958, 16p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 148 827

The present report is concerned with the correlations between yielding score and a variety of other scores and ratings available on the experimental subjects. (See also PB 148 826)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. VIII. THE YIELDING EXPERIMENT FROM THE POINT OF VIEW OF THE SUBJECT, by Read D. Tuddenham and Philip D. Macbride. Technical rept. no. 9 on Contract [Nonr-222(14)]. 1958, 33p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 148 828

The present paper pursues the inquiry further by considering what experimental subjects had to say about their experience, and what relationships exist between the way a subject perceived the situation and his tendency to yield. (See also PB 148 827)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. IX. INFLUENCE OF CONFIDENCE UPON RESISTANCE OF PERCEPTUAL JUDGMENTS TO GROUP PRESSURE, by Philip D. Macbride. Doctoral thesis. Technical rept. no. 10 on Contract [Nonr-222(14)]. 1958, 40p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 148 829

The present research explored the relationship between confidence and yielding. It was hypothesized that yielding is an inverse function of confidence and that confidence in one's perceptual judgments is at least in part dependent on the accuracy with which one has made similar judgments in the past. Two principal questions were investigated: (1) do subjects who are "good" at a given perceptual task, that is, make few errors, yield less than subjects who are not? and (2) will subjects who are forced to make errors on a training series subsequently yield more than subjects who are not? (See also PB 148 828)

California U., Los Angeles.
A THEORY OF STIMULUS DISCRIMINATION LEARNING, by Richard C. Atkinson. Technical rept. no. 1 on Contract Nonr-233(58). 11 May 59, 38p. 20 refs.
Order from LC mi$3.00, ph$6.30 PB 146 602

This paper presents a theory of discrimination learning. For simplicity, the analysis will be restricted to situations where only one of two stimuli is presented on each trial; the subject's task is to learn to respond appropriately to them. However, the theory can be readily generalized to situations involving more than two stimuli. The experimental situation involves a series of discrete trials. On each trial one of two stimuli (S_1 or S_2) is presented. To the presentation of S_1, the subject makes one of two responses (A_1 or A_2); these responses are mutually exclusive and exhaustive.

Colorado U., Boulder.
SOME PERSONALITY CORRELATES OF CONCEPT CHANGE BY ENTERTAINMENT OF CONTRADICTORY PREMISES, by O. J. Harvey and Don Beverly (U. of Florida). Technical rept. no. 1 on Contracts Nonr-1147(07) and Nonr-2149(02). [1959] 22p. 19 refs. AD-225 586.
Order from LC mi$2.70, ph$4.80 PB 148 564

Under the assumption that concepts or opinions once formed channel an individual's cognitive functioning and blind him to alternatives not implied in the concept, 137 subjects (Ss) were exposed to treatments designed to render their conceptual schema less closed. Individuals higher in authoritarianism were assumed to be more disposed toward keeping their concepts intact. Subjects with a strong stand against the sale and drink of alcohol were exposed to a communication favoring sale of alcohol which was presented to them as having come from a source of either high or low authoritativeness. Following exposure to the communication, half of the Ss were retested on their attitudes toward alcohol (No Role condition) while the other half were retested after they had written arguments in favor of alcohol (Rode condition). Subjects were also tested on their accuracy of perception of the major arguments in the communication. The more authoritarian Ss showed less change in their opposition to alcohol following their presentation of arguments favorable to it. They also failed to perceive the main arguments of the pro-wet communication to an extent significantly greater than did Ss lower on this dimension. The authoritativeness of source did not significantly interact with authoritarianism and role playing was expected.

Educational Testing Service, Princeton, N. J.
DEVELOPMENT OF THE TEST "FORMULATING" HYPOTHESES", by Norman Frederiksen. Rept. on Contract Nonr-2338(00). June 59, 26p. AD-218 573.
Order from LC mi$2.70, ph$4.80 PB 146 407

The steps in the development of an experimental test called Formulating Hypotheses are described. The test is intended to measure ability to interpret data in the manner of a research scholar who is trying to make sense of research findings. Statistical results obtained in the course of development of the test are described. (Author)

Educational Testing Service, Princeton, N. J.
EXPERIMENTAL STUDIES OF HOMOGENEOUS GROUPING. A REVIEW OF THE LITERATURE, by Ruth B. Ekstrom. Rept. on Contract Nonr-2214(00). Apr 59, 30p. 44 refs.
Order from LC mi$2.70, ph$4.80 PB 146 461

The findings of this survey can be divided into three major groups: (a) thirteen studies which found differences, having or approaching significance, favoring homogeneous grouping, (b) fifteen studies which found no differences in achievement in homogeneous or heterogeneous groups, or which found homogeneous grouping detrimental, and (c) five studies which gave mixed results, partially favorable and partially unfavorable to homogeneous grouping. The studies covered grade levels from elementary school through college and dealt with a wide range of subject matter. No consistent pattern for the effectiveness of homogeneous grouping was found to be related to age, ability level, course content, or method of instruction.

Family Relations Center, San Francisco, Calif.
CHANGES IN NONCONFORMIST ATTITUDES INDUCED BY CLOSED LIVING GROUPS, by E. K. Gunderson, J. Douglas Grant, and Kelley B. Ballard. Technical rept. no. 12 on The Rehabilitation of Naval Disciplinary Offenders, Contract Nonr-1535(00). 28 July 59, 31p. 7 refs. AD-226 285.
Order from LC mi$3.00, ph$6.30 PB 147 187

The relationship of attitude-change of delinquency-prone subjects to the following factors in the closed living group design was studied: (1) subject's maturity level; (2) effectiveness of the supervisory team; (3) interaction of these variables; (4) the maturity level of the group; and (5) duration of the supervisor-group relationship. The findings indicated that delinquency-prone attitudes could be significantly reduced in high maturity confinees by utilizing a closed living group program with effective supervision over a period of 9 weeks. High maturity confinees have a potential for attitude-change, but, unless subjected to an appropriate retraining program, this potential is not realized.

Family Relations Center, San Francisco, Calif.
THE RELATIONSHIP OF DELINQUENCY POTENTIAL SCALE SCORES OF NAVAL RECRUITS TO LATER MILITARY PERFORMANCE, by E. K. Gunderson, Kelley B. Ballard, and P. S. Huge. Technical rept. no. 9 on The Rehabilitation of Naval Disciplinary Offenders, Contract Nonr-1535(00). 8 July 59, 27p. 6 refs. AD-226 283.
Order from LC mi$2.70, ph$4.80 PB 147 186

A 119-item scale for measuring delinquency-prone social attitudes was administered to a sample of 20,000 Navy recruits. A follow-up survey of the military records of these men was made 3 yr later. From this survey a sample of 1339 men who had shown serious nonconformity and 882 men with clear records high conduct marks was obtained. The following variables were studied to determine their relationship to later delinquent behavior: (1) age at enlistment; (2) school grade completed; (3) General Classification Test scores; (4) Armed Forces Qualification Test scores; and (5) scores on the Camp Elliott Delinquency Potential Scale (DP). Applying the criteria 17 years of age, tenth grade or less education, and DP score above 24 in recruit screening should reduce the number of serious disciplinary offenders in the fleet by almost 20% while eliminating only 8% of the total recruit population. The majority of the nonoffenders screened out would be of poor or marginal quality for the Naval service.

Family Relations Center, San Francisco, Calif.
RESTORATION PREDICTION SCALES, by Kelley B. Ballard, R. R. McHenry and J. Douglas Grant. Technical rept. no. 14 on Rehabilitation Research, Contract Nonr-1535(00). 28 July 59, 14p. 4 refs. AD-226 391.
Order from LC mi$2.40, ph$3.30 PB 147 188

Over the past four years, an attitude test consisting of true-false items has been administered to Navy and Marine court-martialed prisoners as they entered a Retraining Command. The items have been repeatedly analyzed against a success-upon-restoration-to-duty criterion. Resulting scales have low reliabilities and validities. However, poor as these scales are, they have norms which suggest that 50% of the confinees could be returned to duty with an 85% success rate. Present screening returns 50% with less than 60% succeeding. A separate report will cover efforts at restoration prediction based upon forced-choice responses at times of release from confinement. It may be that

several components such as these can be combined into a more powerful predictive instrument. (Author)

Laboratory of Social Relations, Harvard U., Cambridge, Mass.
PERCEPTUAL AND COGNITIVE PROCESSES IN INTERPERSONAL RELATIONS, by Renato Tagiuri. Final rept. on Contract N5ori-07670. 30 June 59, 33p. 17 refs. AD-218 783.
Order from LC mi$3.00, ph$6.30 PB 146 683

Contents:
Perception and cognition of persons as objects
Symposium on person perception
Perception of feelings of like and dislike among members of groups
Perceptual grouping as a basis for visibility of interpersonal choice
Mutuality and its statistical significance
Unit formation in the perception of interpersonal attitudes
Interpersonal choice as a stimulus
Perceptual failure
Sociometric status and the meaning of choice
Comparing perception of choice and rejection
Influence and liking as dimensions of dyadic relationships
Cognitive and perceptual processes in judging people
Operating characteristics of trait lists and scales
Sex differences in inferring personality traits
Movement as a source of information about a person
Miscellaneous projects
Role differentiation and estimates of group opinion
Sociometric procedure and its effect upon choice status

Maryland U., College Park.
ASSOCIATIVE STUDIES OF COMPLEX CLUSTERING EFFECTS, by Charles N. Cofer. Technical rept. no. 26 on Learning, Retention, and Recovery of Meaningful Material, Contract Nonr-595(04). June 59, 15p. 5 refs. AD-220 522.
Order from LC mi$2.40, ph$3.30 PB 146 689

Associative data are presented which seem to be consistent with the general notion that the complex clustering effects reported by Gonzales and Cofer (AD-209 896) are probably attributable to shifts in distributions of associated responses as a consequence of various arrangements of modifiers. The 6 complex clustering effects which were discussed are: (1) specificity effect; (2) inappropriate modification effects; (3) mediation effects; (4) mediated conflict effects; (5) mediated facilitation effects; and (6) adverb-verb effects.

Maryland U., College Park.
IMMEDIATE RECALL OF SENTENCES AND THE FACTORS OF MEANINGFUL AND ASSOCIATIVE RELATIONS AMONG SOME OF THEIR CONSTITUENT WORDS, by Charles N. Cofer and Jean C. Holroyd. Technical rept. no. 24 on Learning, Retention, and Recovery of Meaningful Materials, Contract Nonr-595(04). June 59, 15p. 6 refs. AD-220 230.
Order from LC mi$2.40, ph$3.30 PB 146 690

Experiment failed to find evidences in recall of sentences of effects of having nouns and/or adjectives categorized or not. Expectations based on an earlier report by Gonzalez and Cofer (1958) were thus not realized. However, evidence was obtained that associative connections among words, as measured in a free association test, may affect recall under some conditions. (Author)

Psychological Labs., Carnegie Inst. of Tech., Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS, by E. P. Hollander. Final rept. on Contract Nonr-1849(00). June 59, 4p. 17 refs. AD-233 055.
Order from LC mi$1.80, ph$1.80 PB 146 686

Psychological Labs., Carnegie Inst. of Tech., Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS, VII. AN EXPERIMENTAL STUDY OF IDIOSYNCRATIC BEHAVIOR AND STATUS, by E. P. Hollander. Technical rept. on Contract Nonr-1849(00). May 59, 12p. 2 refs. AD-233 054.
Order from LC mi$2.40, ph$3.30 PB 146 522

A study is presented to test the view that leadership status, measured in terms of influence acceptance, is affected by both the leader's task competence and his conformity or non-conformity over time. Data were gathered in a laboratory setting from 12 groups of 5 members each, one of whom was a confederate who had manifestly high task competence over the total of 15 trials and was used as a stimulus person. Nonconformity by him to the agreed upon procedural norms of the group was introduced experimentally at various times, e.g., early or late, by zones of 5 trials each. Influence was measured by the number of trials per zone of 5 in which the confederate's recommended solution was accepted as the group's choice. The overall increase in influence acceptance over the total of 15 trials was quite marked as a function of the accumulation of successive evidences of task competence by the confederate. But within this broad effect it was found that the absence of past non-conformity by the stimulus person was positively related to the group's acceptance of his influence. However, there was an interaction effect in the predicted direction such that non-conforming behavior after a zone of conforming behavior yielded high influence acceptance. (Author) (See also PB 145 214)

Psychological Labs., Harvard U., Cambridge, Mass.
INFORMATION AVAILABLE IN A BRIEF VISUAL PRESENTATION. by George Sperling (Bell Telephone Labs.). Appendix A included in Final rept. 29 May 57-31 Jan 59, on Contract AF 33(038)14343. 31 Dec 59, 56p. 85 refs. AFCRC TR-60-50.
Order from LC mi$3.60, ph$9.30 PB 148 784

An improved estimate of short-term memory for visual displays was obtained by giving a signal subsequent to the presentation that selects the element of the display on which the subject is to report. Papers prepared and brief summaries of each item on the contract are also listed.

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES IN SELECTION LEARNING. II. THE EFFECT OF INFORMATIVE AND UNINFORMATIVE CUES ON THE ACQUISITION AND RETENTION OF INTENTIONAL ITEMS, by Eugene Burnstein. Technical rept. no. 2 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. Oct 59, 12p. 7 refs. AFOSR-TN-60-263; AD-231 032.
Order from LC mi$2.40, ph$3.30 PB 146 311

The purpose of this study was to examine the effect of the informativeness of the selection cue on acquisition and retention under conditions of selection learning. In selection learning, unlike ordinary verbal rote learning, subjects learn a set of items which are interspersed among incidental items to be ignored. The selection cue differentiates between the intentional and incidental items. The findings indicate a significant effect in memory deriving from the informativeness of the selection cue. In the informative condition the intentional items consisted of two odd and one even digit numbers and the incidental items of three even digit numbers and subjects were instructed to learn only the former. In the uninformative condition both sets of items were the same but the intentional items were preceded by three taps and incidental by two taps, and subjects were instructed to learn only those preceded by three taps. No mention of the digital composition of the items was made. The findings show that when the cue is uninformative, performance in acquisition and retention is the same as in ordinary verbal rote learning. With informative cues, however, a significant gain in recall is obtained. (Author)(PB 145 101)

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES IN SELECTION LEARNING. III. FACILITATION AND INTERFERENCE EFFECTS IN SELECTION LEARNING, by Eugene Burnstein. Technical rept. no. 3 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. Oct 59, 19p. 2 refs. AFOSR-TN-60-264; AD-233 378.
Order from LC mi$2.40, ph$3.30 PB 146 310

Two experiments were conducted to demonstrate directly facilitation and interference effects in selection learning. The selection learning paradigm involves the simultaneous presentation of intentional and incidental items with the requirement that the subject learn only the intentional ones. In experiment 1 an attempt was made to improve the performance of selection learners in acquisition by reducing interference without simultaneously also reducing facilitation. Informative cue selection learners were compared for acquisition rates with uninformative cue selection learners, and the results demonstrated superior acquisition rate for the former. In experiment 2 an attempt was made to reduce acquisition rates of the selection learners by requiring short response latencies. The results showed clear superiority of rote learners over selection learners in acquisition. In retention test some evidence for the differential dissipation of interference effects was obtained. Most forgetting was obtained for rote learners, next for selection learners with uniformative cues, and least for selection learners with informative cues. (Author) (See also PB 146 311)

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES ON DRIVE AND INCENTIVE IN PERCEPTION. I. SOME EFFECTS OF DRIVE ON STIMULUS GENERALIZATION, by Donald Dorfman. Technical rept. no. 5 on Contract AF 49(638)367 and National Sciences Foundation Grant G-4951. Feb 60, 18p. 26 refs. AFOSR-TN-60-326; AD-233 777.
Order from LC mi$2.40, ph$3.30 PB 146 641

Some implications of the hypothesis that the effective or perceived intensity of a stimulus is an increasing function of drive level were tested. Implications were derived for stimulus-generalization data. The experimental results confirmed the hypothesis: (1) an increase in drive level from training to test resulted in a shift of the generalization gradient toward the lesser physical stimulus intensities; and (2) a decrease in drive level from training to test resulted in a shift of the generalization gradient toward the greater physical stimulus intensities.

Rutgers State U., New Brunswick, N. J.
THE SENSITIVITY OF EMPLOYEE ATTITUDE QUESTIONNAIRES, by F. K. Berrien and William H. Angoff. Technical rept. no. 5 on Contract Nonr-404(10). Sep 59, 47p. AD-226 671.
Order from LC mi$3.30, ph$7.80 PB 148 596

Two industrial plants, M and C, under the same management, doing identical work but separated by several hundred miles, were surveyed by an attitude questionnaire on two occasions separated by three and a half months. Just before the second survey in Plant C, employees were informed that the plant would be moved to a distant location in the near future. Interviews with employees, supplementing the questionnaires, confirmed the expectation that attitudes toward the company were adversely affected by the announced plans. However, the adverse attitudes, as expressed on the questionnaire, "scapegoated" supervisors whose behavior had not actually changed as evidenced by other questions. No similar changes occurred in the control plant. Because the majority of the questions did not show important changes in item values between Time 1 and 2, and because the observed changes appeared in far greater number in only one shift of Plant C, it is suggested that questionnaires of this type may be less sensitive than sometimes supposed. The usefulness of such questionnaires as research or management tools in assessing changes less drastic than the one described herein may be questioned. (Author)

Stanford U., Calif.
SOME ATTEMPTS TO MEASURE TOLERANCE FOR DISSONANCE, by Elliot Aronson and Leon Festinger. Technical rept. on Contract AF 41(657)140. Dec 58, 18p. WADC-TR-58-492; AD-207 337.
Order from LC mi$2.40, ph$3.30 PB 149 286

Individuals differ in their ability to tolerate cognitive dissonance introduced in laboratory experiments. The research reported in this paper was an attempt to develop a measure of tolerance for dissonance. Five tests were developed, four of which were administered to the predetermined criterion groups. None of these

effectively discriminated between subjects whose behavior indicated a high tolerance for dissonance from those whose behavior indicated low tolerance for dissonance. A different approach to a criterion was tried by identifying a group that had demonstrated high tolerance in a real-life situation. These were students who had changed majors in their junior year of college. A personality inventory was constructed and administered to ex-engineering majors and to a control group of engineering majors. Substantial differences in responses appeared in six areas. The general effectiveness of the questionnaire as a measure of tolerance for dissonance must be tested by administration to other groups that have recently made an important life decision, such as changing occupation or religion. (Author)

Virginia U., Charlottesville.
STUDIES IN PROBLEM SOLVING, by Frank W. Banghart, Arthur J. Bachrach, and Evan G. Pattishall. Technical rept. on Contract Nonr-474(08). Sep 59, 50p. 17 refs. AD-226 663.
Order from LC mi$3.30, ph$7.80 PB 148 606

Decision-making and problem solving; group structure, anxiety and problem solving efficiency; interaction of group structure and anxiety on problem solving efficiency; and GSR responses during problem solving.

[Washington U., St. Louis, Mo. School of Medicine]
THE EFFECT OF ELECTROCONVULSIVE SHOCK ON MALE ALBINO RATS WITH EXPERIMENTALLY INDUCED SENSORY DEFICITS, by David G. McDonald. Progress rept. on Contract Nonr-816(06). 30 June 59, 26p. AD-225 308.
Order from LC mi$2.70, ph$4.80 PB 146 688

A test was made of the hypothesis that a series of electroconvulsive shocks (ECS) produce an increase in reactivity to a variety of environmental stimuli in the male albino rat. Groups of blind, deaf, and anosmic animals were produced. After allowing sufficient time for recovery, one-half of the animals in each group received a series of 15 ECS, the other half 15 pseudo-ECS, one per day for 15 days. All animals were then trained in an enclosed alley straightaway, one trial per day for 20 days. Data indicated that a series of ECS results in significant differences in behavior, caused by a general increase in reactivity to environmental stimuli. (See also PB 144 182)

Washington U., St. Louis, Mo.
FACTOR ANALYSIS AND RELATED TECHNIQUES IN THE STUDY OF LEARNING. A REPORT OF A CONFERENCE HELD AT WASHINGTON UNIVERSITY, SAINT LOUIS, MISSOURI, 19-20 FEBRUARY 1959, ed. by Philip H. Dubois, Winton H. Manning, and Carl J. Spies. Technical rept. no. 7 on Contract Nonr-816(02). Aug 59, 194p. 96 refs. AD-226 739.
Order from LC mi$8.70, ph$30.30 PB 148 177

Contents:
An analytic approach to factor analysis, Philip H. DuBois
A bibliography of factor analytic studies of learning, Carl J. Spies
The triangular method of factor analysis in learning research, Winton H. Manning
The computation of the inverse of a matrix of correlations: an analytically meaningful approach, Philip H. DuBois and Winton H. Manning
Learning, prediction and the simplex, Lloyd G. Humphreys
Simplex theory in learning and training, Marshall B. Jones
Abilities and the learning of psychomotor skills, Edwin A. Fleishman
Determination of generalized learning curves by factor analysis, Ledyard R. Tucker
Learning and human ability: a theoretical approach, George A. Ferguson

Washington U., Seattle.
DIMENSIONAL ANALYSIS, LATENT STRUCTURE, AND THE PROBLEM OF PATTERNS, by Clifford E. Lunneborg, Jr. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). Sep 59, 89p. 31 refs. AD-226 073.
Order from LC mi$4.80, ph$13.80 PB 148 593

A development study is presented of a technique of analysis dependent upon the configural dimensionality of a set of psychological measures. The problem of patterns arises from the criticism of traditional test scoring procedures that linearly combining item or test responses results in a loss of information inherent in the patterning or configuration of the responses. If pattern information is present for a set of measures over a sample of respondents, then, in terms of the general polynomial formulation, the higher order power and product terms should provide sources of variation independent of the variation possessed by the original measures. This proposition was recast in a form suitable to test by techniques conventionally associated with factor analysis. This new proposition was that the rank of a matrix of observations on a set of psychological measures augmented by higher order power and product terms should be greater than the rank of the matrix of observations on the original variables considered by themselves if any pattern information is present in those observations. The present technique and the problem of pattern analysis is compared with the technique of latent class analysis. The latter is shown to be a form of pattern analysis restricted to somewhat homogeneous sets of measures. (Author)

Washington U., Seattle. Div. of Counseling and Testing Services.
A PROCEDURE FOR STANDARDIZING AND IPSATIZING USING THE IBM TYPE 650, by Calvin E. Wright. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). June 59, 8p. 7 refs. AD-219 273
Order from LC mi$1.80, ph$1.80 PB 146 412

BIOLOGICAL SCIENCES

Arctic Aeromedical Lab., Ladd AFB, Alaska.
COLD TESTING OF SELECTED COMPONENTS OF ECL-20-92-28-36-BED AIR TRANSPORTABLE INFIRMARY, by Charles L. Lecker. Jan 58, 20p. Technical note AAL-TN-58-31; AD-221 552.
Order from LC mi$2.40, ph$3.30 PB 146 628

Cold testing of selected components from a 36-bed air transportable infirmary was conducted at Ladd Air Force Base, Alaska to determine serviceability and operational capability at sub-zero temperatures. The tests were conducted in a squad tent which was a component of the 36-bed assemblage. During a typical 8 hr test period the tent interior displayed floor temperatures between -22°F. to +24°F. in areas remote from the heat source and temperatures between -12°F. to +62°F. in an area near the heat source. Pre-and post-exposure control tests were conducted indoors at a temperature of approximately 70°F. During the cold testing of items other than the tent, the outside temperatures ranged from -28°F. to 35°F. The tent was erected at a temperature of 10°F. with approximately 8 inches of snow cover. The wind velocity ranged from zero to 2 miles per hour. All components were given a rough treatment test as well. (Author)

Anatomy and Physiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
HUMAN DECELERATION TESTS, by Eli L. Beeding, Jr. and John D. Mosely. Jan 60, 15p. 2 refs. AFMDC-TN-60-2; AD-234 148.
Order from LC mi$2.40, ph$3.30 PB 146 634

A series of deceleration tests were conducted to determine human tolerance to impact forces with the subject seated in the backward facing position. For healthy males seated in the backward facing position, restrained with shoulder straps, lap belt and inverted "V" strap, the tolerance limit to G forces of .04 second duration seems to be in the area of 83 G at 3800 G/second.

Army Chemical Warfare Labs., Army Chemical Center, Md.
BREATHING IN BRIEF EXERCISE, by F. N. Craig and E. G. Cummings. Apr 60, 22p. 13 refs. CWLR-2364.
Order from LC mi$2.70, ph$4.80 PB 148 265

Ventilation of the lungs before, during, and after running on the treadmill for periods of 20 and 60 seconds has been observed in two men. Speed and grade were varied and mixtures of air, oxygen, and carbon dioxide were inhaled. Oxygen consumption, carbon dioxide output, and the concentration of carbon dioxide in respired air were also observed. In the first 20 seconds of the run, the ventilation varied with speed but was not necessarily proportional to the ultimate metabolic cost of the run. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
ESTIMATION OF PULMONARY RESISTANCE BY REPETITIVE INTERRUPTION OF AIR FLOW, by John A. Clements, John T. Sharp and others. Oct 59, 31p. 13 refs. CWL Special pub. 2-24.
Order from LC mi$3.00, ph$6.30 PB 146 345

A simple technique for estimation of lung and airway resistance has been developed, using repetitive interruption of air flow and non-linear flowmetering. The method is satisfactory with respect to reproducibility of values and is a valid method for measuring resistance, as judged by comparison with standard methods. The theory of the method has been briefly explored, with special attention to the influence of the thorax and effect of upper airway properties. The physical properties of the thorax cause slight overestimation of resistance and this effect is increased at the extremes of lung volume. The effect of upper airway properties is to cause underestimation of resistance; this effect is accentuated by increased distensibility of upper airways, especially when pulmonary resistance is high. It is concluded from resistance measurements on human subjects and from studies on respiratory analogs that the inherent error of the method ranges from about +0.2 cm H_2O/1/sec in the normal to about -1.5 cm H_2O/1/sec at 15 cm H_2O/1/sec. It is pointed out that the method may develop larger errors in inhomogeneous obstructive pulmonary disease.

Army Medical Research Lab., Fort Knox, Ky.
SOME BEHAVIORAL AND PHYSIOLOGICAL STUDIES IN VIBRATION, by Vernon H. Schaefer, Robert G. Ulmer, and Harry J. Link. 12 June 59, 31p. 23 refs. Rept. no. 389; AD-218 075.
Order from LC mi$3.00, ph$6.30 PB 146 314

Male albino rats subjected to whole body vibration exhibited significant but generally transient decrements in a number of behavioral and physiological measures. Important pathological changes were also found. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
HIGH G PROTECTION, by R. F. Gray and M. G. Webb. Rept. on Proj. TED ADC AE 1411. 12 Feb 60, 22p. 10 refs. Rept. no. 7 on Task MR005.12-0007.2; NADC MA-5910; AD-235 338.
Order from LC mi$2.70, ph$4.80 PB 146 960

The advantages, problems, and limits of older types of G protective systems are discussed in this report. Theories are presented for methods of using liquid or form-fitting external supports for the body along with respiratory pressurization to counteract the distorting forces. Actual devices which were worked out to apply these theories are shown. These devices include: (a) the Mayo Tank first used in 1942 to test G protection by submersion in water; (b) the G-Capsule and associated equipment; and (c) the Moulded Couch incorporating several devices or procedures such as partial supination to avoid chest pain. Through the use of these various devices during the past year, several new records of tolerance to centrifugal acceleration have been established, indications have been gained for improvements on these devices, and it is expected that higher levels of G tolerance will be attained. (Author)

California U., Los Angeles.
A COMPARISON OF THE RECEIVER OPERATING CHARACTERISTICS FOR MESSAGES RECEIVED BY EAR AND BY EYE, by Edward C. Carterette and Michael Cole. Technical rept. no. 2 on Contract Nonr-233(58). 18 June 59, 24p. 15 refs. AD-225 060.
Order from LC mi$2.70, ph$4.80 PB 146 695

The following questions were investigated: (1) are the auditory and visual receiver operating characteristic curves different; and (2) does the assumption of a constant probability of correct recognition over successive presentations hold up as a good engineering approximation for vision? Visual and auditory experiments indicated a remarkable similarity in the form of the response whether the messages were spoken over a noisy communication channel or presented for a brief duration in a tachistoscope.

Copenhagen U. (Denmark).
AN INVESTIGATION OF THE EFFECTS OF CAUDATE PROJECTIONS TO CEREBRAL CORTEX, by A. Mosfeldt Laursen. Final technical rept. for 1 1 Nov 58-31 Oct 59 on Contract DA 91-591-EUC-943. 30 Nov 59, 20p. 20 refs. AD-231 380.
Order from LC mi$2.70, ph$4.80 PB 146 307

The influence on cortical electrical activity exerted by the caudate nucleus was tested and a search was conducted for electrical responses in this nucleus when the cerebral cortex was stimulated electrically. Strong single pulses delivered to the caudate evoked a potential whose source was found to be the caudate nucleus itself, and which could be recorded on the cortical surface. There was no evidence of potentials generated in the cortex when the caudate nucleus was stimulated. The dorsolateral surface of the hemispheres was explored with a stimulating electrode using a wide range of stimulus parameters, while attempts were made to detect an electrical response in the caudate. It was found that the caudate could not be considered a relay for the unspecific thalamic projections to the cortex, and there is consequently no evidence to indicate that the function of the caudate is directly connected with that of the reticular activating system of Moruzzi and Magoun.

Lamont Geological Observatory, Palisades, N. Y.
THE RELATIONSHIP OF REPRODUCTIVE TEMPERATURE AND THE GEOGRAPHICAL RANGE OF THE MARINE WOODBORER LIMNORIA TRIPUNCTATA, by Carolyn Beckman and Robert Menzies. Technical rept. no. 2 on Contract Nonr-266(41). Sep 59, 20p. 8 refs. CU-3-59-Nonr 266(41); AD-228 561.
Order from LC mi$2.70, ph$4.80 PB 148 598

Experimental results show that Limnoria tripunctata will feed at temperatures ranging from approximately 10°C to 30°C. The reproductive temperature range appears to be from about 15°C to 30°C and the greatest population increase is in the neighborhood of 25°C. Excessive mortality results at 30°C. Gravidity and hence number of young produced depends upon the season and does not appear to be immediately modified by the presence of favorable reproductive temperatures. The experimental results agree well with the known geographic range of the species. (Author)

Lovelace Foundation, Albuquerque, N. Mex.
THE ELUCIDATION OF THE ROLE PLAYED BY THE CENTRAL AND PERIPHERAL TEMPERATURES AT THE INITIATION OF SHIVERING, by Thomas P. K. Lim. Rept. on Contract AF 41(657)200. Aug 58, 14p. 19 refs. Technical note AAL-TN-58-26.
Order from LC mi$2.40, ph$3.30 PB 146 629

The purpose of this study was to elucidate the controlling mechanisms of central (brain) and peripheral (subcutaneous) temperatures at the onset of shivering in anesthetized dogs during induced hypothermia. The related problems concerning the effect of shivering activities on metabolic and respiratory functions will also be investigated at a later date. (Author)

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D. C.
THE DEVELOPMENT OF A TEST TO DETERMINE THE ADEQUACY OF DECOMPRESSION FOLLOWING A DIVE, by R. J. Kiessling and G. J. Duffner. 15 Feb 60, 23p. 16 refs. Research rept. 2-60; AD-234 889.
Order from LC mi$2.70, ph$4.80 PB 146 958

An attempt was made to develop a test of decompression adequacy which can be used both as a research technique and to evaluate new decompression procedures and devices for diver and underwater swimmer. Eighteen subjects made 30-min air dives of 90, 110, and 125 ft. After a surface interval of 45 min the divers were further decompressed to 18,000 ft of altitude for 1 hr. Times of occurrence of decompression sickness symptoms were utilized as measurements of decompression adequacy. The test devised proved to predict decompression adequacy following no-decompression dives. (Author)

North Dakota U., Grand Forks.
CHANGES IN BODY TEMPERATURE AND RENAL FUNCTION IN DOGS EXPOSED TO COLD, by W. C. Nungesser and H. E. Ederstrom. Rept. on Contract AF 18(600)1136. Nov 57, 35p. 8 refs. Technical note AAL-TN-57-38; AD-221 548.
Order from LC mi$3.00, ph$6.30 PB 146 619

Methods for the study of renal function in the dog in cold, and to correlate any observed changes with other physiological variables known to occur in cold were investigated. Methods employed are described. Subsequent experiments duplicating the coldroom experiments but without cold were run on the same animals. Changes in renal functions studied were variable in the unanesthetized dog in the cold. No changes were seen which were different in magnitude or direction than might occur with time alone. Changes in skin temperatures, shivering, and other variables in these and previous experiments are discussed.

Technische Hochschule, Munich (West Germany).
INVESTIGATION OF THE POSSIBLE INFLUENCE OF ATMOSPHERIC IONS ON HUMAN REACTION TIME, by Joseph Eichmeier and John Rheinstein. Final technical rept. for 1 Jan-31 Dec 59 on Contract DA 91-591-EUC-1035. [1959] 52p. 173 refs. AD-232 720.
Order from LC mi$3.60, ph$9.30 PB 146 309

Ions must be breathed in through the mouth in order to affect human push button reaction time. Different concentrations of atmospheric ions have different effects upon reaction time. Concentrations within an order of magnitude of those found in nature are found to have an effect on the reaction time. It is improbable that the electric field of an ion generator has any large effect on reaction time. The possibilities of the elimination of atmospheric small ions in a sealed room are examined. The most appropriate electrical means of making a sealed room free of ions is by using 2 opposite walls of the room as electrodes of a condenser. The applied field should be of the order of 30 V/cm. Ion densities as low as 50 positive and 100 negative ions/cm^3 have been obtained in a wire cage. Methods are discussed for reducing the influence of the undesirable part of the electric field of the measuring condenser.

Tufts U. School of Medicine, Boston, Mass.
METABOLISM OF FATTY ACIDS AND RELATED SUBSTANCES IN ANIMALS EXPOSED TO COLD, by David Rapport. Rept. for 1 Nov 58-31 Jan 59 on Contract AF 41(657)145. June 59, 17p. 2 refs. Technical note AAL-TN-59-16; AD-233 846.
Order from LC mi$2.40, ph$3.30 PB 146 660

Contents:
Methods
- Mitochondrial dry weight
- Liver perfusion method
- Protein content of liver homogenate
- Isolation of fatty acids from liver homogenates

Results
- Further studies on cold exposure and oxidative phosphorylation
- The adrenal medulla and oxidative phosphorylation
- Oxidative phosphorylation in mitochondria of the cold-fasted rat
- Acetate oxidation by mitochondria from control and cold-fasted liver
- Fatty acid synthesis in the cell-free liver system

Virginia U. Medical School, Charlottesville.
GROSS BODY COMPOSITION IN ALASKAN AND TEMPERATE ZONE MAMMALS, by Grover C. Pitts. Progress rept. for 1 Mar-31 May 58, on Contract AF 41(657)186. June 58, 9p. 2 refs. Technical note AAL-TN-58-8; AD-230 838.
Order from LC mi$1.80, ph$1.80 PB 146 467

Approximately 140 mammals of 31 species, 25 genera, and 13 families, including forms indigenous to both Alaska and Virginia, were collected, dissected into 11 gross components, and the fresh weight, fraction of fat, and fraction of water determined on each component. The difference between fatness of Alaskan and Virginia specimens was significant. Fatness was correlated with specific gravity of the carcass and presented in graphic form.

Biochemistry

Florida State U., Tallahassee.
SPECIFIC ANTAGONISTS OF BIOLOGICALLY ACTIVE COMPOUNDS, by Karl Dittmer. Final rept. for 15 May 55-30 Sep 58 on Contract Nonr-1753(00). [1958] 15p. 31 refs. AD-225 278.
Order from LC mi$2.40, ph$3.30 PB 148 574

Contents:
The toxicity of β-2-furylalanine in the growint rat.
The toxicity of γ-chloro- and γ-bromallylglycine in the rat.
Microbiological properties of proparoyl-S-cysteine
Microbiological properties of some derivatives of amino acid anhydrides
Present status of studies regarding the mechanism of amino acid antagonism.
Synthesis and properties of trifluoroacetamidomalonate.
Synthesis and properties of α-keto and α-hydroxy derivatives of some amino acid antagonists.
Synthesis and microbiological properties of α-keto and α-hydroxy derivatives of some amino acid antagonists.

Milan U. (Italy).
CELLULAR DAMAGE PRODUCED BY HYPOXIA, by Enrico Ciaranfi. Technical final rept. on Contract AF 61(514)1026. 30 Oct 59, 9p. 9 refs. AFOSR-TR-60-42. AD-234 214.
Order from LC mi$1.80, ph$1.80 PB 146 622

The consequences of hypoxia have been studied on rat liver cells, by the aid of electron microscopy and by different biochemical techniques, and were extended to the influence of hypoxia on the metabolism of brain cortex.

School of Aviation Medicine, Brooks AFB, Tex.
THE AUTOMATIC DETERMINATION OF CALCIUM, INORGANIC PHOSPHATE, UREA NITROGEN, AND GLUCOSE IN PAROTID FLUID, by Ira L. Shannon and John R. Prigmore. Apr 60, 17p. 49 refs. Rept. 60-49.
Order from LC mi$2.40, ph$3.30 PB 148 084

Automatic methods of chemical analysis have been adapted to parotid fluid analysis and the performance of these procedures has been evaluated in the determination of calcium, inorganic phosphate, urea nitrogen, and glucose.

School of Aviation Medicine, Brooks AFB, Tex.
PAROTID GLAND FLOW RATE AND PAROTID FLUID UREA CONCENTRATION, by Ira L. Shannon and John R. Prigmore. June 60, 7p. 7 refs. Rept. no. 60-59.
Order from LC mi$1.80, ph$1.80 PB 148 498

In a series of three experiments the relationship between parotid gland flow rate and parotid fluid urea concentration was determined. In each instance a significant ($P < .01$) negative correlation was found between these two variables. The data were all combined and an average within-subjects correlation coefficient of - 83 ($P < .01$) was calculated. The average between-subjects correlation coefficient of .05 was not significantly different from zero. In a fourth experiment parotid flow was elicited continuously for three hours in 11 subjects. The effect of time on flow rate and urea concentration was insignificant; that is, there was no apparent gland fatigue effect on either variable during the three-hour period. (Author)

Tufts U. School of Medicine, Boston, Mass.
OXIDATIVE PHOSPHORYLATION IN LIVER MITOCHONDRIA PREPARED FROM COLD-EXPOSED RATS, by Sylvia Panagos, Robert E. Beyer, and Edward J. Masoro. Rept. on Contract AF 41(657)145. June 58, 5p. 4 refs. Technical note AAL-TN-58-32; AD-221 553.
Order from LC mi$1.80, ph$1.80 PB 146 627

The mechanism of increased heat production in animals exposed to cold for 2 or more wk was explained in the following manner: On a decrease in the formation of ATP coupled to electron transport, a larger proportion of the available energy derived directly from this system would be evolved as heat. This increased heat production may in part contribute to the maintenance of body temperature in the cold environment. The necessity of the thyroid and adrenal secretions for continued survival in the cold may indicate an hormonal influence on these energy-producing reactions of the body.
(Biological Sciences--Biochemistry, 14 Oct 60)

Pathology

Institut Pasteur, Paris (France).
BIOPHYSICAL AND BIOCHEMICAL STUDIES ON VIRUS INFECTED CELLS, by Pierre Lepine. Final technical rept. no. 1, 1 Mar 59-29 Feb 60, on Contract DA 91-591-EUC-1069. 29 Feb 60, 15p. 7 refs. AD-234 913.
Order from LC mi$2.40, ph$3.30 PB 146 955

Preliminary infection of a given mammalian cell system, by a virus whose virulence is maintained at such a low grade that it will not destroy the infected cells but simply cause a chronic infection, is capable of completely suppressing the multiplication of another virus, though highly virulent, when added as a secondary infecting agent in the given cell system, notwithstanding the fact that there is no antigen relation or cross-immunity between the two viruses involved in the process. This inhibition phenomenon bears on the phase of multiplication of the second infecting virus, this virus being fixed by the preliminary infected cells in the same amount and in the same conditions as it is fixed on normal control cells. This inhibitory phenomenon is governed by the production of a substance of a protein nature in the infected cells which is capable of inhibiting the growth of the virus and which can be transferred from an infected system to a non infected one, thus inducing in normal non infected cells an acquired resistance to virus infection. The study of syncytial formations under the influence of a Myxovirus in chronically infected cell systems lead to the conclusion that such formations are governed by the presence of a cell secreted substance which was named syncytin and which induces the formation of such syncytia by dissolving the limiting membrane in infected cell aggregates. (Author)

Institute of Neurology [National Hospital, London (Gt. Brit.)]
SUBCORTICAL PARTICIPATION IN THE DEVELOPMENT OF MIRROR FOCI. Final technical status rept. no. 4, 1 Oct-30 Dec 59, on Contract DA 91-591-EUC-1021. 21 Dec 59, 6p. 3 refs. AD-232 722.
Order from LC mi$1.80, ph$1.80 PB 146 308

The effect of the synchronous discharge of a large population of cortico-thalamic neurones on activity within the thalamic somato-sensory relay nuclei has been studied. Thalamic responses to peripheral nerve stimulation are depressed by activity within cortico-thalamic neurones. A subconvulsive dose of strychnine given intravenously changes this depression to enchancement. (Author)

Johns Hopkins U. School of Hygiene and Public Health, Baltimore, Md.
VIRULENCE OF ROCKY MOUNTAIN SPOTTED FEVER, by Winston H. Price. Final progress rept. on Contract Nonr-248(44). 30 June 58, 41p. 8 refs.
Order from LC mi$3.30, ph$7.80 PB 148 928

Three virulent types of R. rickettsii exist in the United States, which can be differentiated by the symptoms they produce in guinea pigs. In their arthropod vector, D andersoni, each type may assume an intermediate virulent phase, lower in virulence than the virulent type from which it arose. All three virulent types can pass into an avirulent phase, which is of much lower virulence than the intermediate virulent phase. The two low virulent phases are not genotypic changes, but are only changes in phenotype. A substance can be shown to be present in appropriately prepared tick suspensions which lowers the virulence of the virulent phase when incubated with such rickettsiae in vitro. The virulence of both phases can be increased by diphosphopyridine nucleotide (DPN) or by appropriately prepared tick extracts. The avirulent phase is characterized by being virulent for chick embryos but not for guinea pigs; it immunizes guinea pigs against the virulent phase of any one of the three types, but not against boutonneuse fever, and can not be recovered from guinea pigs. In vitro reactivation experiments indicate that the increase in virulence from the avirulent phase to the virulent phase occurs in two and possibly 3 steps, although the same compounds appear to be involved in each reactivation step. All data indicate that the changes of R. rickettsii from high to low virulence phases to avirulent phases and back to high virulence are not due to selection, mutation, or a combination of these phenomena but to actual changes in the majority of the rickettsiae. The low virulent phases have so far only been produced in arthropod vectors or in vitro by the addition of tick extracts. Two very low virulent types of R. rickettsii, U_1 and U_2, exist in the United States. All data fits with the theory that the arthropod can control the virulence of R. Rickettsiae by controlling the synthesis of specific compounds. Although the avirulent phase of all virulent types can be readily isolated in nature, there is no evidence that these changes in virulence play a role in selecting new types of virulent strains in nature.

[Vienna U. (Austria)].
INVESTIGATIONS ON SPRING-SUMMER-MENINGO-ENCEPHALITIS IN THE EASTERN PART OF AUSTRIA, by Richard Bieling. Final technical rept. for 1 Feb 59-31 Jan 60 on Contract DA 91-591-EUC-1061. [1960] 15p. AD-234 397.
Order from LC mi$2.40, ph$3.30 PB 146 956

Systematic virological-serological examinations with patients of the hospital at Neunkirchen resulted in the finding that there is a certain causal connexion

to FSME-virus with 5 cases, while with 7 cases this result was uncertain. The results show that Enteroviruses are of less importance, as in most of the cases FSME was proved. It is not possible to conclude on the mode of infection out of these few numbers.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
CONTINUOUS EXPOSURE OF LABORATORY ANIMALS TO A LOW CONCENTRATION OF CARBON MONOXIDE, by Nelson P. Musselman, William A. Groff and others. Jan 60, 11p. 23 refs. CWLR-2337; AD-232 115.
Order from LC mi$2.40, ph$3.30 PB 146 302

The effects on dogs, rabbits, and rats of continuous exposure (24 hr a day, 7 days a wk) to a low concentration (50 ppm) of carbon monoxide (CO) was studied. Three weeks after initial exposure, the hemoglobin, hematocrit, and red blood cell (RBC) counts of the dogs showed slight increases, which persisted throughout the remainder of the tests. The average per cent saturation of hemoglobin by CO was 7.3 for dogs 3.2 for rabbits, and 1.8 for rats. Except for a small increase in the eosinophil count of the rats, no other blood changes were found. All tissues examined microscopically and macroscopically appeared similar to those of the controls. The exposed animals showed no significant differences as compared with the control animals in voluntary activity, behavior, body weight, ratio of heart weight to body weight, and electrocardiograms (EKG). The absence of toxic signs and only slight blood changes in the dogs, rabbits, and rats used in the experiments indicate that no harmful effects result fron continuous exposure of these animals to a concentration of 50 ppm of CO. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
STAFF CONFERENCE REPORT: HEALTH HAZARDS OF MILITARY CHEMICALS, by Keith H. Jacobson. Oct 59, 30p. 5 refs. CWL Special pub. 2-25; AD-228 583.
Order from LC mi$2.70, ph$4.80 PB 146 460

Contents:
Pharmacological studies on borane fuels
Biochemical studies on borane fuels
Acute and subacute toxicity of HEF-2 vapor
Acute and subacute toxicity of HEF-3
Skin decontamination of borane fuels
Toxicity of boron oxide aerosols
Perchloryl fluoride toxicity
Blood chemistry studies and fluoride metabolsim of animals exposed to perchloryl fluoride
Histo-pathologic changes produced by single and repeated exposures of dogs and rodents to perchloryl fluoride (See also PB 135 244)

Columbia U. Coll. of Physicians and Surgeons, New York.
CHEMICAL FACTORS AFFECTING THE PHYSIOLOGY AND PATHOLOGY OF NERVOUS FUNCTION, by David Nachmansohn. Final rept. Aug 54-Aug 58, on Contract DA 49-007-MD-740. Apr 58, 10p. 24 refs. AD-218 028.
Order from LC mi$1.80, ph$1.80 PB 148 383

Development of an antidote against nerve gas poisoning: Experiments are described in which 2-pyridine aldoxime methiodide (2-PAM) was successfully used on mice to prevent paraoxan poisoning and on human beings to treat patients poisoned with parathion, an insecticide. 2-PAM was considered a really efficient antidote. Atropine combined with PAM protected animals against 15- to 20-fold lethal doses (and more) of alkylphosphate. The combination proved even sucessful against poisoning with sarin. 2-PAM was found to exert the extraordinary power of reactivation only in the case of phosphorylated acetylcholinesterase.
Lipid soluble quaternary ammonium ions: The action of lipid soluble quaternary ammonium ions in the conducting membrane is discussed. Many possibilities for the study of the chemical mechanism underlying nerve activity are offered by modifying molecules in such a way that they produce predictable and desired effects.

Sperling Labs., Arlington, Va.
DIPROPARGYL ETHER: LD_{50} - DOGS; LD_{50} - RABBITS; 1,6 HEPTADIYNE: LD_{50} - DOGS, LD_{50} - RABBITS. Rept. on Contract Nonr-2727(00). [1959] 24p. AD-227 813.
Order from LC mi$2.70, ph$4.80 PB 148 587

Tabulated results

Radiobiology

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A COMPUTER SOLUTION FOR DETERMINATION OF THERMAL TISSUE DAMAGE INTEGRALS FROM EXPERIMENTAL DATA, by Alice M. Stoll. 9 Mar 60, 16p. 5 refs. Rept. no. 17 on Task MR 005.15-2002.1; NADC MA-6004; AD-234 709.
Order from LC mi$2.40, ph$3.30 PB 146 959

A computer method utilizing the IBM 650 and the Bell Telephone programming system was developed for the evaluation of tissue damage due to thermal irradiation. It is presented as an illustration of the possibilities computers offer the biological investigator unversed in their use. It was possible to obtain a complete analysis, yielding separate values of damage during heating, damage during cooling, and total damage, within 45 sec or less, of machine time for each set of data. In contrast, graphical integration by a skilled operator required at least a half-hour for each set. Since hundreds of such analyses may be required in this type of study, the advantages of computer use are obvious. Furthermore, the relative simplicity of the programming system is such that very little training or mathematical skill is required for the biological investigator to be able to prepare his own computer programs and thereby eliminate many tedious and time-consuming graphical procedures. (Author)

California U., Berkeley.
PROCEEDINGS OF ANNUAL TRI-SERVICE CONFERENCE [NO. 3] ON BIOLOGICAL EFFECTS OF MICROWAVE RADIATING EQUIPMENTS, 25-27 25-27 AUGUST, 1959. Aug 59, 342p. 63 refs. RADC-TR-59-140; AD-234 788.
Order from LC mi$11.10, ph$53.10 PB 146 531

See also PB 140 093

Chicago U., Ill.
EFFECT OF X-IRRADIATION ON SPLEEN NUCLEOTIDE LEVELS, by Edwin M. Uyeki. Apr 60, 11p. 10 refs. AFSAM rept. 60-28.
Order from LC mi$2.40, ph$3.30 PB 148 083

A study was made of the effects of whole-body x-irradiation on the adenosine nucleotide levels of the spleens of rats, mice, and guinea pigs. At various intervals after the animals were exposed to 400 and 800 r of x-ray, they were sacrificed and measurements taken of the adenosine triphosphate, adenosine diphosphate, and adenylic acid levels. A lethal dose of x-ray (800 r) caused a decrease in the ATP levels of rat spleen to 63 percent below normal and a reduction in the total nucleotide content of the spleen. A 50 percent decrease in the adenosine triphosphate levels of the spleens of mice was observed with 400 r of x-ray and after 800 r a progressive and continuous decline in this nucleotide occurred during the survival period. The adenosine triphosphate levels of guinea pig spleens decreased more slowly and to a lesser extent than such levels in the spleens of rats and mice. The radiation-induced decreases in adenosine triphosphate content of the spleens of these three species may be explainable on the basis of an increased adenosine triphosphatase activity which was previously observed in this laboratory to be caused by ionizing radiations. The nature of the biologic test system (viz, growing cells) restricts a causal association between the nucleotide titers and phosphatase activity. (Author)

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
MOLECULAR RESPONSE CHARACTERISTICS TO ULTRA-HIGH FREQUENCY FIELDS, by Herman P. Schwan. Technical rept. no. 24 on [Contract Nonr-551(05)] [1959] 26p.
Order from LC mi$2.70, ph$4.80 PB 148 160

It is concluded from available information that effects of orientation may definitely exist at levels of organization down to about one micron, and breakage of molecular bonds may occur under pulsed conditions involving high field values and at the lower end of the radar frequency range.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
SURVEY OF MICROWAVE ABSORPTION CHARACTERISTICS OF BODY TISSUES, by Herman P. Schwan. Technical rept. no. 25 on Contract [Nonr-551(05)]. [1959] 33p
Order from LC mi$3.00, ph$6.30 PB 148 161

The absorption data reviewed cover a total range of about 1 to 10 at any particular frequency. The determination of absorption characteristics is a prerequisite to much experimental work. For most tissues frequencies substantially higher than 3,000 Mc cause mere surface heating, i.e. they act like infrared or sunlight. At lower frequencies, particularly below 1,000 Mc, much larger penetration is achieved. From the complexity of reflectance and energy distribution it is concluded that no dose meter can be constructed which can be carried on or near the body surface and give sensible data. Standing wave pattern in the body makes it senseless to talk about energy flux in the body and to use it as a measure of dosage.

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 3. Monthly rept. June 60, 32p. 53 refs.
Order from OTS $0.50, $3.00/6 mos. PB 161 371-3

Contents:
Milk
Air
Water
Other data: external gamma activity measurements.
(See also PB 161 371-2)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 4. Quarterly rept. July 60, 112p. 5 refs.
Order from OTS $0.50; $3.00/6 mos. PB 161 371-4

Contents:
Radiation protection criteria
Milk
Air
Water
Other data: human bone; food; fish; soils; external gamma; atomic power station
(See also PB 161 371-3)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 5. Aug 60, 50p. 5 refs.
Order from OTS $0.50, $3.00/6 mos PB 161 371-5

Contents:
Sect. 1. Milk
Sect. 2. Air
Sect. 3. Water
Sect. 4. Other data: external gamma; medicine; soils; food; state activities; short lived isotopes
(See also PB 161 371-4)

Radiobiological Lab., U. of Texas, Austin.
RADIOPROTECTION OF FEMALE RATS WITH AET, by George S. Melville, Jr. and Thomas P. Leffingwell. May 60, 14p. 19 refs. AFSAM rept. no. 60-40.
Order from LC mi$2.40, ph$3.30 PB 148 497

The protective effect of S, 2-aminoethylisothiuronium dibromide (AET) against the injury caused by gamma rays has been studied in the female rat. Significant protection has been achieved using either intraperitoneal injection or gavage. The drug was somewhat more effective when given by the parenteral rather than by the oral route. It was also noted that as the dose rate was decreased from approximately 1,000 to 500 to 100 r per minute, the protective effect of oral treatment with AET was also decreased. Further evidence suggests that larger animals are more susceptible to the toxic effects of the protective drug itself. (Author)

School of Aviation Medicine, Brooks AFB, Tex.
NEUTRON ACTIVATION OF BIOLOGIC MATERIALS: NEUTRON EXPOSURE FACILITY, by David R. Rovner. Feb 60, 9p. 10 refs. Rept. 60-18.
Order from LC mi$1.80, ph$1.80 PB 148 082

A facility for exposing biologic materials to neutrons of varying energies is described. The primary source is a linear accelerator which utilizes: (1) a 100 kv. potential to accelerate deuterium ions; and (2) targets consisting of both deuterium and tritium types. Calibration of the monitoring equipment and operating controls is discussed. The dosimetry of the neutron field is explained and doses at various points are calculated. The maximum flux available is 1.0×10^9 neutrons per second, representing a dose of 93 rep per hour at 4.5 cm. from the target. Measures for radiation safety are briefly described: these are in accord with the recommendations of the National Committee on Radiation Protection. (Author)

Sloan-Kettering Inst. for Cancer Research, New New York.
STUDY OF THE POST-IRRADIATION SYNDROME IN HUMANS, by James J. Nickson. Final rept. for 1 Nov 57-31 Oct 58 on Contract DA 49-007-MD-910. [1958] 26p. AD-211 306.
Order from LC mi$2.70, ph$4.80 PB 146 593

Four patients with nearly normal physiologic condition received five courses of total-body irradiation of calculated absorbed doses from 50 to 150 r at midplane, and one of the patients also received internal irradiation from sodium-24. Physiological alterations resulting from irradiation were studied. Alterations in the formed elements of the circulating blood were found to be the most consistent index of radiation effect. Data are included on changes in creatin-creatinine excretion ratios, pentose excretion rate, and properdin levels.

Southwest Research Inst., San Antonio, Tex.
A PRELIMINARY INVESTIGATION OF THE APPLICATIONS OF MAGNETIC RESONANCE ABSORPTION SPECTROSCOPY TO THE STUDY OF THE EFFECTS OF MICROWAVES ON BIOLOGICAL MATERIALS, by George Pish, William H. Storey, Jr. and others. Rept. no. 12 (Final) for 9 May 58-1 May 59 on Contract AF 30(602)1843. 1 May 59, 95p. 9 refs. RADC-TR-59-81; AD-216 431.
Order from LC mi$5.40, ph$15.30 PB 147 024

Electron spin resonance (EPR) methods were found applicable to show changes induced by microwave radiation upon the eyes of rabbits. The EPR signals obtained from ionizing radiation induced free electrons in the posterior cortex tissue of the lens show a simple singlet structure with the differences between normal and opaque lenses giving a doublet structure. Also, observation of dilute solutions of lens tissue shows the effects of microwave damage. The free radicals induced in lenses exposed to microwave radiation have a longer life than those from normal lenses. Differences in protein structure between normal rabbit eye lenses and rabbit eye lenses in which cataracts have been induced by microwave irradiation were investigated by high resolution nuclear spin resonance (NSR). NSR spectra from the proteins in rabbit eye lenses are shown and are grossly interpreted. Differences in the NSR spectra between some of the cataract-bearing lenses and their non-cataract controls are pointed out, and the meanings of the differences are suggested. The effects of the presence of moisture on the action of trifluoroacetic acid on proteins is considered as a possible explanation for the time dependence of the data. In addition, a table is given showing the dry weights of the samples, together with weight loss upon drying.

Stockholm U. (Sweden).
RESEARCH ON "LOCALIZED RADIO-LESIONS". PART IV. LABORATORY OBSERVATIONS ON THE REPRODUCTIVE BEHAVIOR OF THE PIGEON (COLUMBA LIVIA) DURING THE PRE-INCUBATORY PHASE OF THE BREEDING CYCLE, by Eric Fabricius and Ann-Mari Jansson. Technical rept. no. 1, Appendix 2, on Contract AF 61(514)1247. 1 Mar 59, 33p. 16 refs. AFOSR-TN-60-253; AD-233 373.
Order from LC mi$3.00, ph$6.30 PB 146 313

Contents:
Description of the actions belonging to the reproductive behavior which occur during the pre-incubatory phase
The main reproductive behavior patterns and their frequency during the successive subperiods of the pre-incubatory phase
Bowing, attacking, and driving
Behavior associated with the nest site and the nest
Behavior associated with copulation
The mutual relations of the different actions, and the sequence of their occurrence during the individual 34 min periods
The relations of some behavior items to copulation
The sequence of the behavior items during the individual 34 min tests
The order of the activities
(See also PB 146 305)

Stockholm U. (Sweden).
RESEARCH ON LOCALIZED RADIO-LESIONS. PART V. OBSERVATIONS ON PIGEONS DECEREBRATED WITH HIGH ENERGY PROTONS, by Eric Fabricius and Börje Larsson (U. of Uppsala). Technical rept. no. 1, Appendix 3, on Contract AF 61(514)1247. 26p. 35 refs. AFOSR-TN-60-254; AD-233 374.
Order from LC mi$2.70, ph$4.80 PB 146 312

Four pigeons were decerebrated by radiolesions produced by 185 Mev protons from a synchrocyclotron. The cerebral preduncles were cut off at the level of the anterior commissure and the bending point of the

tractus septo-mesencephalicus. Escape response and spontaneous feeding and drinking disappeared in all the birds, as well as all social behavior, including calling, but the ability of walking, standing in a normal position, and maintaining the equilibrium remained. All birds lost the ability of passing food from the crop into the stomach. The method of producing lesions by a proton beam proved promising for functional studies on the bird brain. The lesions were distinctly restricted. No damage to surroundings structures, and no conditions of shock were observed. (Author) (See also PB 146 313)

Zoology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SIGNIFICANCE OF ECHINOCOCCUS MULTILOCULARIS TO MILITARY PERSONNEL AT REMOTE STATIONS IN ALASKA, by Jack D. Douglas. June 59, 10p. 10 refs. Technical note AAL-TN-59-3; AD-233 844.
Order from LC mi$1.80, ph$1.80 PB 146 626

Results of this project and other studies which have been conducted in recent years indicate that no medical or surgical problem exists relative to hydatid disease in military personnel stationed on St. Lawrence Island and the coast of Alaska. The problem of prime importance, insofar as military personnel are concerned, is of a psychological nature. Early exploratory work and findings in the native population have given rise to considerable local concern which is transmitted to new arrivals, usually in a manner which is completely out of proportion to the true picture. This laboratory is presently compiling a resume of the recent findings on hydatid disease in Alaska, which will be disseminated to site personnel to help alleviate the psychological problem. Although a true medical or surgical problem does not exist at present, it remains a potential threat, and studies must be continued to clarify further the various aspects of hydatid disease in order that more concrete information relative to control, early detection, and treatment will be available should the problem arise. (Author)

Florida U., Gainesville.
CHAETOGNATHA FROM THE COASTAL WATERS OF THE SOUTHEASTERN ATLANTIC STATES AND THEIR VALUE AS INDICATOR ORGANISMS, by E. Lowe Pierce and Marvin L. Wass. Final rept. on Contract Nonr-580(05). June 59, 63p. 26 refs.
Order from LC mi$3.90, ph$10.80 PB 147 447

The Chaetognatha were studied in plankton samples collected during nine cruises of the Fish and Wildlife Service M/V T. N. Gill in the waters off the coast of the southeastern Atlantic States. Three genera and 12 species were identified in a total of 590 samples examined. Two kinds of water were present in the area, Carolinian Coastal water and Florida Current water. Although most species showed a gradation from one kind of water to the other it was possible to select a species (S. hispida) which had a high percentage of incidence in Carolinian type water. Its presence in the Florida Current would indicate mixing with inshore water. S. hexaptera, S. lyra and K. subtilis showed more than a 90% occurrence in Florida Current water. Their presence in Carolinian type water could be attributed to recent mixing with Florida Current water. Constant selection for the ability to withstand mixed water in this area undoubtedly accounts for the widespread distribution of several of the species collected.

Kansas U., Lawrence.
STUDIES IN GENE-ENVIRONMENT INTERACTIONS IN DDT-RESISTANCE AND RELATED CHARACTERS. II. A CONTRIBUTION TO THE STUDY AND CONTROL OF ENVIRONMENTALLY CAUSED FLUCTUATIONS OF SOME QUANTITATIVE CHARACTERS IN DROSOPHILA MELANGASTER, MEIGEN, by Robert R. Sokal and Heinz W. Neunes. Final rept. on Gene-Environment Interactions in DDT-Resistance and Related Characters, Contract Nonr-583(08). 30 Sep 59, 30p. 13 refs. AD-233 100.
Order from LC mi$2.70, ph$4.80 PB 148 571

Environmentally caused fluctuations in the length of the larval period from generation to generation, as have been observed by several authors in selection experiments with Drosophila melanogaster, were shown to be mainly an effect of uncontrollable difference among separate batches of medium. The length of the pupal period is not subject to these fluctuations. The original hypothesis that the fluctuations in larval period are due to variations of the microflora in the medium vials, could not be verified: rearing the flies aseptically did not reduce the fluctuations. Instead, changes in the chemical composition of Karo-syrup and molasses in our medium were demonstrated to be largely responsible for the fluctuations. By means of replacing these two components with sugar and salts, the fluctuations were satisfactorily reduced. (Author)

Kansas U., Lawrence.
A SURVEY OF THE MOSQUITOES OF THE VICINITY OF KOTZEBUE, ALASKA, by A. Ralph Barr and P. R. Ehrlich. Rept. on Contract AF 41(651)92. May 57, 16p. Technical note AAL-TN-57-9.
Order from LC mi$2.40, ph$3.30 PB 146 620

This report gives the results of a brief survey carried out at Kotzebue and a number of other localities on the shores of the Chukchi Sea during the summer of 1956.

CHEMISTRY

Analytical Chemistry

Army Chemical Warfare Labs., Army Chemical Center, Md.
METHODS OF MICROANALYSIS. III. GRAVIMETRIC DETERMINATIONS OF SULFUR, PHOSPHORUS, BROMINE AND CHLORINE IN ORGANIC COMPOUNDS, by John M. Corliss, Cecil A. Rush and others. Apr 60, 25p. 13 refs. CWLR 2369.
Order from OTS $0.75 PB 161 860

Elementary microgravimetric methods are presented and discussed. Results of their application to the chemical analysis of a variety of standard compounds and products produced in Chemical Corps research projects are tabulated. Some factors concerning the use of the microbalance in obtaining accurate precipitate weights are considered. (Author)

Inorganic Chemistry

Pennsalt Chemicals Corp., Wyndmoor, Pa.
PROPERTIES AND THERMAL STABILITY OF POLYMERIC MONOAMMINEDICHLOROZINC (II), by Joseph Simkin and B. P. Block. Technical rept. no. 2 on Contract Nonr-2687(00). 1 Aug 59, 6p. 10 refs. AD-225 086.
Order from LC mi$1.80, ph$1.80 PB 148 132

Monoamminedichlorozinc (I) was prepared by heating $[Zn(NH_3)_2Cl_2]$ at 200°C to release NH_3. The NH_3 loss was rapid at first but gradually decreased to a constant rate, corresponding to a loss of 1 mole NH_3 per $ZnCl_2$. Analysis of the residue confirmed the empirical formula as $An(NH_3)Cl_2$. The product was an amber-colored, transparent, glassy solid at room temperature. It had no sharp melting point, but softened at 80° to 90°C and was transformed into syrup which remained viscous up to 110°C, and became very mobile at 200°C. I was insoluble in common organic solvents but formed clear solutions in dimethylformamide, aqueous NH_3, and mineral acids. Infrared spectra indicated the presence of absorption bands in the region of 1600 and 1300 cm^{-1}. X-ray examination showed the product to be amorphous. These properties indicated the polymeric molecular structure $(-Zn(NH_3)(Cl)Cl-)_x$, with x large in value. I was stored at 200° ± 5°C for 200 hr in air. There was an approximate weight loss of 0.3% per hr for the first 30 hr followed by a significant leveling off to about 0.03 wt -% per hr. Analysis of the residue showed that 0.1% NH_3 remained; the Zn content was unchanged; and there was a substantial drop in total chloride. These results showed that contrary to the literature (R. J. Kane, Ann. chim. et phys [2] 72:29, 1839), I is decomposed upon heating, the dominant reaction being: $2n(NH_3)Cl_2 \triangle 2nCl_2 + NH_3$. The NH_3 which was coordinated with $ZnCl_2$ in I exhibited only moderate resistance toward thermal removal.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
THE REACTION OF HEXAMMINECOBALT (III) CHLORIDE WITH SODIUM CYANIDE, by B. P. Block. Technical rept. no. 4 on Contract Nonr-2687(00). 1 Aug 59, 4p. 3 refs. AD-225 088.
Order from LC mi$1.80, ph$1.80 PB 148 134

Hexamminecobalt (III) chloride was allowed to react with NaCN at 80°C to produce a precipitate of $[Co(NH_3)_6]$ $[Co(CN)_6]$ rather than $[Co(NH_3)(CN)_3]$. It was concluded that partially substituted cyanocobalt (III) ammines are more reactive toward substitution than $Co(NH_3)_6^{3+}$, and that substitution which starts on a given cobalt atom goes to completion. The reaction is more facile at higher temperatures.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
THE THERMAL STABILITY OF METAL AMMINES. II. COBALT (II) AND COBALT(III) COMPOUNDS, by L. R. Ocone, J. R. Soulen, and B. P. Block. Technical rept. no. 6 on Contract Nonr-2687(00). 1 Aug 59, 14p. 11 refs. AD-225 419.
Order from LC mi$2.40, ph$3.30 PB 148 136

The thermogravimetric behavior of seven cobalt ammines has been examined in a nitrogen atmosphere. Chelation increases thermal stability with six-membered rings showing greater stability than five-membered rings in chelates of tetrahedral cobalt (II). In all cases examined the ammines of cobalt (III) began to lose weight well under 200°C. No significant difference was detected in the thermal response of the cis and trans forms of $[Co(NH_3)_4Cl_2]Cl$. (Author) (See also PB 148 133)

Pennsylvania U., Philadelphia.
RESEARCH ON A NEW CLASS OF INORGANIC MOLECULES CONSISTING BASICALLY OF SULFUR AND NITROGEN, by M. E. Cohen, R. A. Kent and others. Rept. on Contract AF 33(616)5444. Apr 60, 22p. 13 refs. WADD Technical rept. 60-169.
Order from OTS $0.75 PB 161 883

The silicon amines, $(C_6H_5)_3SiNH_2$, $(C_2H_5)_3SiNH_2$ and $[(CH_3)_3Si]_2NH$ have been found to react with either S_2Cl_2 or SCl_2. No pure silicon derivatives of tetrasulfur tetranitride, S_4N_4, of the type $(R_3Si)_4S_4N_4$, $(R_3Si)_3S_5N_2$, $(R_3SiNS)_x$ etc. analogous to those formed by carbon amines, could be isolated from the reaction products. NH_2CN, $CO(NH_2)_2$ and $CO(NHCH_3)_2$ were found to react with S_2Cl_2 to give complex polymeric materials. S_4N_4 was found to react violently with $C_6H_5PCl_2$ at room temperature to give high yields of the linear phenyl phosphonitrilic chloride oligomer, $(C_6H_5PNCl)_4 \cdot C_6H_5PCl_4$. S_4N_4 was found to react with anhydrous HBr and HF at room temperature, to produce, in the former case, a mixture of S_4N_3Br and NH_4Br. S_4N_3Cl has been found to react with a number of amines to give semi-solid viscous materials.

Richmond Research Lab., Stauffer Chemical Co., Calif.
INORGANIC POLYMERS PROGRAM, by A. J. Leffler and F. W. Breuer. Semi-annual technical rept. for 1 July 58-1 Jan 59 on Contract Nonr-2259(00). 18 Sep 59, 61p. 29 refs. AD-227 693.
Order from LC mi$3.90, ph$10.80 PB 148 594

The reactions of tris-trimethylsilylphosphine were further investigated, and their thermal decompositions yielded hexamethyldisilane plus an unknown liquid. Reaction with diphenyldichlorosilane yielded low-molecular-weight polymers. The reaction of halogenated nitriles and diborane yielded stable borazenes; the reaction with difunctional materials is under investigation. An attempt to prepare $[H(CF_2)_4CH_2]_3P$ by the reaction of $H(CF_2)_4CH_2I$ and $NaPH_2$ in liquid ammonia yielded $H(CF_2)_3CF = CH_2$. The reaction of perfluoroadipodinitrile with ammonia yielded a mixture of cyclic imidine and diamidine. Homopolymerization of cyclic perfluoroglutaroimidine was investigated. Special reaction conditions were studied which consistently produced a polymer different from the known highly cross linked species. The cross-linked homopolymer was attacked by amidines and ammonia giving rise to side reactions which may also occur with the copolymers. Mechanisms for both the homopolymerization of the cyclic glutaroimidine and its copolymerization with amidines was proposed. A modified polymerization method consisting of the reaction of perfluorobutyroamidine and perfluoroglutarodinitrile gave a more uniform polymer, but the properties were not satisfactory. This reaction will be studied by the preparation of low-molecular-weight analogs.

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
THE HYDRATES OF THE TETRA n-BUTYL AND TETRA i-AMYL QUATERNARY AMMONIUM SALTS, by Richard McMullan and G. A. Jeffrey. Technical note on Contract AF 49(638)456. June 59, 13p. 10 refs AFOSR-TN-59-475; AD-215 718.
Order from LC mi$2.40, ph$3.30 PB 146 527

The several prepared compounds are believed to be of the clathrate type, similar in general character to the gas hydrates. Actually, as shown, the compounds form several series.

Washington U., Seattle.
HALOGEN FLUOROSULFONATES $BrSO_3F$, $Br(SO_3F)$ AND $I(SO_3F)_3$; PREPARATION OF MERCURY(II), NITROSYL AND NITROSONIUM FLUOROSULFONATES FROM PEROXYDISULFURYL DIFLUORIDE [AND] SOME REACTIONS OF FLUORINE FLUOROSULFONATE: IODINE TRIFLUORIDE BISFLUOROSULFONATE, by George H. Cady and John E. Roberts (U. of Massachusetts). Technical rept. nos. 23-25 on Contract Nonr-477(16). 1959, 17p. 22 refs. AD-219 821.
Order from LC mi$2.40, ph$3.30 PB 148 138

Bromine (I) fluorosulfonate, bromine (III) fluorosulfonate and iodine (III) fluorosulfonate have been prepared by reacting peroxydisulfuryl difluoride with the appropriate halogen. These compounds have been characterized. Chlorine does not react with peroxydisulfuryl difluoride. Attempts to prepare lower fluorosulfonates of iodine have given inconsistent results. Peroxydisulfuryl difluoride reacts with nitric oxide to give nitrosyl fluorosulfonate and with mercury to give mercury (II) fluorosulfonate. With nitrogen dioxide an equimolar mixture of nitrosyl and nitronium fluorosulfonates is produced. The reaction products have been characterized. Fluorine fluorosulfonate reacts with sulfur dioxide to give pyrosulfuryl fluoride and with thionyl fluoride to give peroxydisulfuryl difluoride and thioryl tetrafluoride. With iodine, fluorine fluorosulfonate reacts to from iodine trifluoride bisfluorosulfonate, $IF_3(SO_3F)_2$. This new compound has been characterized. Chlorine does not react with fluorine fluorosulfonate. (Author)

Organic Chemistry

Callery Chemical Co., Pa.
THE PREPARATION, UNIT CELLS, AND SPACE GROUPS OF TWO ETHERATES OF SODIUM TRIDECAHYDRODECABORATE(1-) by H. G. Norment, Jr. Rept. on Project Zip, Contract NOa(s) 58-454-d. 25 May 59, 8p. 1 ref. CCC-454-TR-312; AD-220 682.
Order from LC mi$1.80, ph$1.80 PB 148 373

The mono-ethyl etherate of sodium tridecahydrodecaborate(1-), $NaB_{10}H_{13}(C_2H_5)_2O$, and the bismethyl etherate of sodium tridecahydrodecaborate(1-), $NaB_{10}H_{13}\cdot 2(CH_3)_2O$, have been prepared. Unit cell dimensions and space groups were determined for both materials by single-crystal x-ray diffraction techniques. (Author)

Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
INVESTIGATION OF INTERMEDIATES OF CERTAIN SELECTED K AGENTS, by Max M. Boudakian. Final research rept. for 16 Aug 57-31 Mar 58 on Proj. Kreole, Contract DA 18-108-405-cml-29. 1 Aug 58, 118p. 95 refs. OMCC-9031-KFRR-1; AD-213 543.
Order from LC mi$6.00, ph$18.30 PB 148 483

The specific compound of major interest to the U. S. Army Chemical Corps in the synthesis of K-agents is 5-(1,2-dimethylheptyl) resorcinol. Since the classical synthesis route to this compound involves numerous steps with a low overall yield, a program was designed to develop a shorter and improved process for the synthesis of 5-(1,2-dimethylheptyl) resorcinol and certain key intermediates, such as 3,5-dihydroxyacetophenone and 3,5-dimethoxyacetophenone.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
SULFUR-NITROGEN SYSTEMS. I. POLYMERS FROM SULFAMIDE, by F. L. Scott and H. Q. Smith. Technical rept. no. 5 on Contract Nonr-2687(00). 1 Aug 59, 24p. 13 refs. AD-225 089.
Order from LC mi$2.70, ph$4.80 PB 148 135

Formaldehyde, sulfamide, and melamine were allowed to react under condensation conditions at a pH of 10 to yield white solids which were resistant to most solvents and had melting points ranging from 220° to 260°C. The IR spectra indicated a structure which resembled polymethylene polysulfamide. The polymers could be pressed into films on a Carver press at about 210°C and 11,000 lb. Polymerizations run at pH 7 yielded the same product as at pH 10, except in smaller yield. This suggested that the active moiety in the facile cross-linking prowess of sulfamide was the sulfamide ion. Further experiments revealed the condensation of sulfamide with formaldehyde, even in the presence of stoichiometric quantities of base was much more rapid than the rearrangement of sulfamide to imidodisulfamide. Variations in the quantities of the reactants which were used to produce the sulfamide-based polymers caused no pronounced effects on the thermal properties of the polymers.

Roosevelt U., Chicago [Ill.]
THE CHEMISTRY OF PROXIMATE AZIDO- AND THIO- GROUPS, by Eugene Lieber. Final technical rept. for 1 Sep 59-15 Feb 60 on Contract DA 11-022-ORD-3221. Feb 60, 86p. 56 refs. OOR rept. 2497.1-C; AD-235 469.
Order from LC mi$4.80, ph$13.80 PB 148 532

The present investigation concerns the synthesis of 5 (carbon-carbon substituted)-1, 2, 3, 4-thiatriazoles, and the physical properties of these systems. The infrared absorption spectra of the initial diazothization products of a series of 4-substituted thiobenzhydrazides clearly show that these compounds are not open chain azides, and confirms some recent investigations showing that these products are 5(para-substituted)-phenyl-1, 2, 3, 4-thiatriazoles. The reaction of sodium thiobenzoylthioglycolates with sodium azide in aqueous solution has been investigated and is found to give good yields of 5(para-substituted)phenyl-1, 2, 3, 4-thiatriazoles, identical with those formed by the diazotization

of 4-substituted thiobenzhydrazides. A study of the infrared absorption spectra of 4-substituted thiobenzhydrazides and aliphatic thiohydrazides shows that there exists no thione-thio tautomerism in their solid state. The 5(para-substituted)phenyl-1, 2, 3, 4-thiatriazoles exhibit aromatic type absorption in the ultraviolet region. The 1, 2, 3, 4-thiatriazole nucleus is electron-withdrawing in nature. All of the 5(para-substituted)phenyl-1, 2, 3, 4-thiatriazolea decompose at their melting points with the formation of 4-substituted phenyl nitriles, sulfur and nitrogen gas. The 5-aliphatic-1, 2, 3, 4-thiatriazoles are unstable and decompose upon formation, even at zero degrees centigrade. (Author)

Sterling Chemistry Lab., Yale U., New Haven, Conn.
THE EPOXIDATION OF SOME ALLYLIC ALCOHOLS, by James English and M. L. Sassiver. (Doctoral thesis). Rept. on Contract AF 49(638)37. [1960] 23p. 30 refs. AFOSR TN-60-247; AD-233 601.
Order from LC mi$2.70, ph$4.80 PB 147 228

The composition of the mixtures of stereoisomers produced on epoxidation of a series of allylic alcohols ($RCHOHCH=CH_2$) has been determined.

Yale U., New Haven, Conn.
INVESTIGATION OF INITIAL FREE RADICAL YIELDS IN ORGANIC COMPOUNDS SUBJECTED TO GAMMA RADIATION, by Randolph H. Bretton and Imre Zwiebel. Rept. for 1 July 57-30 June 59 on Contract AF 33(616)5239. Apr 60, 46p. 32 refs. WADD Technical rept. 60-127.
Order from OTS $1.25 PB 161 849

Satisfactory analytical and operational procedures for the use of DPPH (diphenylpicrylhydrazyl) as a scavenger in free radical yield determinations have been developed. These procedures are used to determine the free radical yields resulting from the irradiation of organic compounds in a Cobalt-60 gamma source. This report includes a summary and discussion of the radiochemical theory relating to the problem, followed by a literature survey on the specific project of the irradiation of alcohols. The theory underlying the use of scavengers is presented and the results of a detailed study of the specific scavenger DPPH, are given. Preliminary results for the irradiation of ethyl alcohol and acrylonitrile are presented. (Author)

Physical Chemistry

Arizona State U., Tempe.
THERMOELECTRIC MATERIALS AND DEVICE RESEARCH, by B. R. Gossick and H. B. Whitehurst. Quarterly progress rept. no. 1, 18 Sep-17 Dec 59, on Contract DA 36-039-sc-85249. [1960] 17p. 6 refs. AD-232 816.
Order from LC mi$2.40, ph$3.30 PB 148 342

Previous knowledge concerning the thermal and electrical properties of rutile which would make it useful as a thermoelectric material is briefly discussed. A modification of the material which might improve the thermoelectric figure of merit is proposed. Experimental efforts to produce rutile in a suitable form by the treatment of colloidal precipitates is described. (Author)

Avco-[Everett] Research Lab., Mass.
RATES OF SELECTED REACTIONS INVOLVING NITROGEN AND OXYGEN, by Norman Davidson. Rept. on Contract AF 04(645)18. June 58, 16p. 24 refs. Research rept. 32; AD-205 514.
Order from LC mi$2.40, ph$3.30 PB 147 397

This report summarizes the results of kinetic studies of reactions other than dissociation involving compounds of nitrogen and oxygen. Not all of the extensive literature in the field is reviewed here. Attention is focused on those papers which, so far as the author knows, provide the best data. Kinetic studies with the single pulse shock tube are described in detail, because this new method is of particular interest for high temperature gas dynamics.

Avco-Everett Research Lab., Mass.
VARIATIONAL THEORY OF CHEMICAL REACTION RATES APPLIED TO THREE-BODY RECOMBINATION, by James Keck. Rept. on Contract DA 19-020-ORD-4862. Sep 59, 67p. 19 refs. Research rept. 66; AD-227 520.
Order from LC mi$3.90, ph$10.80 PB 147 208

A variational theory which gives a least upper bound to the rate of a chemical reaction is presented. Explicit calculations of the recombination rate of attracting atoms in the presence of repulsive third bodies are made for a simple trial surface having one adjustable parameter. At low temperatures, the experimental rate constants are quite close to the theoretical bounds; at high temperatures, the experimental data fall away.

Baylor U., Waco, Tex.
THE MECHANISM OF THE ACTION OF ORGANIC BRIGHTENING AGENTS IN ELECTROPLATING PROCESSES, by Thomas C. Franklin and Jack R. Goodwyn. (Doctoral thesis). Technical rept. no. 1 for 10 Sep 56-10 Apr 60 on Contract DA 23-072-ORD-1056. [1960] 139p. 100 refs. OOR rept. 1747.2-M.
Order from LC mi$6.90, ph$21.30 PB 148 444

The causes of the maxima observed in the current-voltage curves for the oxidation of hydrogen at a black nickel electrode in basic solution and at a gray palladium electrode in basic and acidic solutions have been investigated and found to be due to the oxidation of two forms of hydrogen adsorbed on the surface of the electrode and hydrogen absorbed in the bulk of the electrode. The one maximum in the current-voltage curve for a nickel electrode plated in a Watts type bath is due to the oxidation of absorbed hydrogen. When certain organic compounds are added to a Watts bath, the concentration which produces the brightest deposit also produces the deposit containing the minimum amount of absorbed hydrogen. Curves relating the current efficiency of hydrogen ion discharge and the hydrogen

content of electrodeposits to the concentration of organic compound in the plating bath are similar in shape. The fact that the organic compounds affect the hydrogen polarization and nickel polarization differently explains the variation in the current efficiency and hydrogen content of the deposits when such compounds are added to the plating bath. (Author)

Bureau of Mines, Bartlesville, Okla.
COMBUSTION CALORIMETRY I. ORGANIC FLUORINE COMPOUNDS, by W. D. Good and D. W. Scott. Technical note on Contract RPSN 88-801A, ARPA Order no. 24-59, Task 3. 3 Aug 59, 37p. 17 refs. AFOSR-TN-59-698; AD-219 968
Order from LC mi$3.00, ph$6.30 PB 146 580

The contents of this Technical Note are to appear as a chapter in the book "Experimental Thermochemistry, Vol. II," being prepared under auspices of the Sub-Commission on Experimental Thermochemistry of the International Union of Pure and Applied Chemistry. The combustion calorimetry of organic fluorine compounds is discussed, and experimental procedures are recommended. A computation form is given for reducing the experimental results to standard states. Also discussed are factors influencing accuracy, choice of reference substances, and publication of results. (Author)

Bureau of Mines, Bartlesville, Okla.
COMBUSTION CALORIMETRY II, ORGANOMETALLIC COMPOUNDS, by W. D. Good and D. W. Scott. Technical note on Contract RPSN 88-801A. 3 Aug 59, 33p. 47 refs. ARPA Order no. 24-59, Task 3; AFOSR TN-59-699; AD-219 970.
Order from LC mi$3.00, ph$6.30 PB 146 601

The contents of this note are to appear as a chapter in the book "Experimental Thermochemistry, Vol. II," being prepared under auspices of the Sub-Commission on Experimental Thermochemistry of the International Union of Pure and Applied Chemistry. The combustion calorimetry of organometallic compounds and other carbon compounds of metals is discussed. References are given to past work in the field. Limitations of static-bomb methods and advantages of rotating-bomb methods are pointed out. Other topics treated are: Corrections to standard states; comparison experiments; materials for the bomb, fittings, and crucible; containers for samples; problem of complete combustion; and publication of results. (Author) (See also PB 146 580)

California U., Berkeley.
THE CHEMILUMINESCENCE OF ETHYLENE FORMED PROBABLY FROM METHYLENE IN AN INERT MATRIX, by Theodore D. Goldfarb and George C. Pimentel. Rept. on Contract AF 49(638)1. 10 Feb 60, 13p. 10 refs. AFOSR-TN-60-182; AD-233 368.
Order from LC mi$2.40, ph$3.30 PB 146 718

An orange-red luminescence occurs when diazomethane suspended in solid nitrogen or solid argon is photolyzed and then warmed to permit diffusion. Spectrographic and visual studies of this thermoluminescence are reported. Conditions favorable for the production of the luminescence also result in relatively high yields of ethylene as a final product. Furthermore, a deuteration effect is observed.

Callery Chemical Co., Pa.
PHYSICAL PROPERTIES OF BORON TRIBROMIDE, by W. F. Barber, C. F. Boynton, and P. E. Gallagher. Rept. on Project Zip, Contract NOa(s) 58-454-d. 25 Mar 59, 18p. 10 refs. CCC-454-TR-306; AD-220 681.
Order from LC mi$2.40, ph$3.30 PB 148 374

The triple point of a sample of 99.96 mole percent boron tribromide has been found to be -46.482°C. Over the temperature range -20 to 90°C, the density values have been found to fit the equation $d(g/ml) = 2.6954 - [2.962 \times 10^{-3} t_{(°C)}]$. Over the temperature range 0° to 90°C, the viscosity values have been found to fit the equation $\log \eta$ (millipoises) = 331/t - 0.250. Over the temperature range 22° to 84°C, the surface tension values have been found to fit the equation γ (dynes/cm) = 31.9 - 0.128 t (°C). Over the temperature range 0 to 90°C, the vapor pressure values have been found to fit the equation $\log P(mm) = 6.9795 - 1311/[t_{(°C)} + 230]$. (Author)

Carnegie Inst. of Tech., Pittsburgh, Pa.
CATALYTIC PYROLYSIS OF DIBORANE, by R. B. Beckman (Carnegie Inst. of Tech.). Rept. on Project Zip, Contract NOas-52-1024-c. 9 Dec 57, 21p. 4 refs. CCC-1024-TR-272.
Order from LC mi$2.70, ph$4.80 PB 149 191

The feasibility of catalyzing a directed pyrolysis of diborane to higher boron hydrides, by means of commercially available catalysts, was investigated. In general, the results indicate that the usual metal catalysts such as nickel, activated alumina, and platinum have some catalyzing properties. The data, unfortunately, are too meager to demonstrate whether or not this catalysis is directional for the desired liquid products. With the solid catalysts tested it was always found that solid degradation products eventually stopped the reaction.

Columbia U., New York.
ANOMALOUS RELAXATION OF HYPERFINE COMPONENTS IN ELECTRON SPIN RESONANCE, by Jan W. H. Schreurs, George E. Blomgren, and George K. Fraenkel. Technical note rept. no. 3 on Contract AF 49(638)520. 1 Jan 60, 27p. 20 refs. CU-3-60-AF-520-Chem.; AFOSR-TN-59-1326; AD-233 724.
Order from LC mi$2.70, ph$4.80 PB 146 749

Different hyperfine components in the electron resonance spectra of free radicals exhibiting proton hyperfine splitting were found to saturate at different rates, and it is pointed out that different sets of relaxation times must be used to describe the behavior of each component. An analysis is given of the experimental parameters which affect saturation measurements. An appendix is included on the work of Jen, et al. [Phys. Rev. 112:1169, 1958], on deuterium atoms trapped at liquid helium temperatures; this work shows that the anomalous intensities obtained as a function of r-f power is not the same as the phenomenon observed

for free radicals in solution, and cannot be adequately interpreted in terms of any currently proposed mechanisms. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
METHYLENE DERIVATIVES AS INTERMEDIATES IN POLAR REACTIONS. XIX. THE REACTION OF POTASSIUM ISOPROPOXIDE WITH CHLOROFORM, BROMOFORM AND DICHLOROFLUOROMETHANE, by Jack Hine, Arthur D. Ketley and Kozo Tanabe. Technical rept. no. 5 on Contract Nonr-991(03). 13 May 59, 22p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 148 795

On reaction with potassium isopropoxide in isopropl alcohol, dichlorofluoromethane gives triisopropyl orthoformate as the only product detected, while chloroform and bromoform give, in addition, propylene diisopropyl ether, acetone, carbon monoxide, a methylene halide, and under some conditions dark-colored products of higher molecular weight. Mechanistic interpretations are given for some of these and related observations. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
METHYLENE RADICALS IN SOLUTION, by Jack Hine, Arthur D. Ketley and others. Final rept. on Contract Nonr-991(03). 16 June 59, 4p. AD-218 179.
Order from LC mi$1.80, ph$1.80 PB 147 263

Studies were made of the reactions of alcohols and alkoxy and aryloxy anions with dihalomethylenes generated from haloforms and bases. The Riemer-Tiemann reaction proceeded via a dihalomethylene intermediate, but dibromomethylene, dichloromethylene, and chlorofluoromethylene reacted with potassium isopropoxide in isopropyl alcohol in a different manner. Isopropyl difluoromethyl ether, prepared by the action of potassium isopropoxide in isopropyl alcohol on chlorodifluoromethane, was inert to potassium isopropoxide at 0° and 50°C. A new method for drying and determining the water content of isopropyl alcohol was developed, and from this data the true second-order rate constants for the hydrolysis of an ester by hydroxide ion in alcoholic solution were calculated. Potassium isopropoxide reacted with dichlorofluoromethane to give high yields of triisopropyl orthoformate and with chloroform and bromoform to give methylene halides, carbon monoxide, propylene, diisopropyl ether, and acetone.

Grace, W. R., and Co., Clarksville, Md.
INVESTIGATION OF THIN SHEETS OF HIGH-QUALITY, SINGLE-CRYSTAL SILICON, by F. T. Fitch. Technical summary rept. no. 1, 1 Sep 59-29 Feb 60, on Contract DA 36-039-sc-85242. 10 Mar 60, 30p. AD-234 238.
Order from LC mi$2.70, ph$4.80 PB 148 551

Due to its high surface tension, molten silicon forms a liquid lens of about 4 mm equilibrium depth on a lead surface. The saturation concentration of lead slightly above the silicon melting point is about 17% Pb. Lead is definitely volative at these temperatures and difficulties are encountered in controlling the lead vapors and losses from the system. Lead does not form a solid solution with silicon. When detected at definite levels in the samples, the lead was present as a finely dispersed metal phase. Silicon single crystals have been pulled with lead additions up to 5% in the melt. Their lead content was very low (<0.01%). Polycrystalline material was obtained at a lead concentration >10% in the melt. This appeared to reflect a need for improved pulling techniques as much as the possibility of a limiting lead concentration at which a single crystal may be obtained. A high-temperature furnace suitable for the study of the Si-Pb system has been assembled and checked through initial operation

Harvard U., Cambridge, Mass.
NUCLEAR MAGNETIC RESONANCE AND INFRARED ABSORPTION SPECTRA STUDIES OF ORGANOSILANES AND RELATED COMPOUNDS, by David David E. Webster. Technical rept. on Contract Nonr-1866(13). Aug 59, 42p. 34 refs. AD-228 133.
Order from LC mi$3.30, ph$7.80 PB 148 174

Contents:
The nuclear magnetic resonance spectra of some trisubstituted silanes; the electronegativity of substituents, by David E. Webster
Nuclear magnetic resonance studies of some methyl derivatives of the group IVB elements, by M. P. Brown and D. E. Webster
The nuclear magnetic resonance spectra of some methylhydropolysiloxanes, by D. E. Webster and R. Okawara
The infrared spectra of the methylacetoxysilanes and some methyltin carboxylates, and the configuration of the trimethyltin and the dimethyltin cations, by Rokuro Okawara, D. E. Webster, and Eugene G. Rochow

Instituto di Chimica Generale dell? Universita, Palermo (Italy).
THERMODYNAMICS OF THE EQUILIBRIA BETWEEN Ni(DBH) AND A SERIES OF NITROGEN BASES IN BENZENE, by Luigi Sacconi. Final technical rept. no. 2, 1 Apr 59-31 Mar 60, on Contract DA 91-591-EUC-1105. [1960] 19p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 148 360

The equilibria in benzene between NiDBH and 20 nitrogen bases has been studied. From the spectrophotometric data the values of log K at different temperatures have been obtained. From the temperature dependence of the formation constants, the heats of reaction and free energy and entropy changes were calculated. The data are discussed in terms of structural and electronic factors. In the equilibria with cyclic polymethylenimines the existance of a competition between front- and internal strain is revealed. The double bond of unsaturated amines (mono- and diallylamine) causes lowering of the donor affinity of these bases. The introduction of a phenyl group in the alpha position into alkylamines results in -I effect and steric hindrance. The donor affinity of NH_2-, CN- and $COOCH_3$-substituted pyridines roughly parallels the polarity ($-\Sigma\sigma^*$) of these bases.

Little, Arthur D., Inc., Cambridge, Mass.
IONIC-MODEL CALCULATIONS: I. THE LITHIUM HALIDES, by Alfred Büchler. Interim technical rept. no. 2 on Study of High-Temperature Thermodynamics of Light-Metal Compounds, Contract DA 19-020-ORD-4829. 20 Apr 60, 11p. 17 refs. OOR rept. 006. 2-C.
Order from LC mi$2. 40, ph$3. 30 PB 148 430

The effect of the introduction of the higher multipole polarizabilities of ions on ionic-model calculations has been investigated. In the case of the lithium halides, the agreement between the observed and calculated vibration-rotation constants that is obtained when only dipole polarizabilities are used is destroyed when higher polarizabilities are introduced. The agreement between the observed and calculated dissociation energies is not affected. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
IONIC-MODEL CALCULATIONS: II. THE BENDING FORCE CONSTANTS OF THE GROUP II HALIDES, by Alfred Büchler. Interim technical rept. no. 3 on Study of High-Temperature Thermodynamics of Light-Metal Compounds, Contract DA 19-020-ORD-4829. 15 Apr 60, 19p. 14 refs. OOR rept. 006. 3-C.
Order from LC mi$2. 40, ph$3. 30 PB 148 431

The bending force constants of the Group II halides have been calculated for three versions of an ionic model of these molecules. The first version treats the ions as point charges; the second includes their dipole polarizabilities; the third is based on a multipole expansion that includes all terms up to the charge-(induced octupole) term. The calculations show that the ionic model cannot account for the observed magnitude of the bending force constants. (Author) (See also PB 148 430)

Louisiana State U., Baton Rouge.
FARADAIC RECTIFICATION WITH CONTROL OF ALTERNATING POTENTIAL VARIATIONS. APPLICATION OF ELECTRODE KINETICS FOR FAST PROCESSES, by Hiroaki Matsuda and Paul Delahay. Technical rept. no. 38 on Contract Nonr-300(00). Sep 59, 17p. 9 refs. AD-233 311.
Order from LC mi$2. 40, ph$3. 30 PB 148 575

The potential of an electrode at which a fast charge transfer process occurs is varied about the equilibrium potential according to a sinusoidal function of time. The resulting alternating current includes a rectification component because of the asymmetry of the current-potential curve. An equation is derived for the faradaic rectification current and is compared with a previous result obtained on the assumption of current control for $t \to \infty$. A correction for the double layer structure in the solution of the boundary value problem is also derived. (Author)

Louvain U. (Belgium).
KINETICAL PARAMETERS IN PREMIXED LAMINAR FLAMES, by A. Van Tiggelen, R. Corbeels, and H. Vandenabeele. Technical note no. 2 on Contract AF 61(514)1245. Feb 60, 41p. 17 refs. AFOSR-TN-59-1149; AD-234 580.
Order from LC mi$3. 30, ph$7. 80 PB 146 640

Activation energy and reaction order in CH_4-O flames: Experimental burning velocities, obtained at different fuel-to-O ratios, dilutions with N, and initial temperatures of the fresh gases, are almost perfectly represented by a formula where the classical kinetic parameters of a chemical reaction are present (activation energy (38 kcal) and reaction order with respect to O (1. 4), and to CH_4(-0. 4)). The empirical formula corresponds exactly to the theory with a chain-mechanism including the formation of a peroxide radical (CH_3O_2). Reaction order in acetylene -O flames: The activation energy obtained was 31 kcal. The reaction order with respect to O varies between 2 and 0. 8 and between -1 and 0. 2 with respect to acetylene; the sum of both orders was always equal to unity and the negative value with respect to acetylene was valid at the rich side. A chain reaction with the formation of a peroxide must also occur in acetylene-O flames. Flame propagation velocity: CH_4-H-O mixtures: Burning velocities and flame temperatures in stoichiometric ternary CH_4-H-O mixtures at different dilutions with N were measured. These mixtures seem to correspond to a case of weak interaction between the 2 separate reactions. The activation energy is about equal to the value given by a linear interpolation between the 2 extreme values (18 kcal for pure H and 38 for pure CH_4).

Massachusetts Inst. of Tech., Cambridge.
TWO-DIMENSIONAL GASEOUS DETONATIONS I. THE VELOCITY DEFICIT, by James A. Fay. Rept. on Contract Nonr-1858(25). Mar 59, 24p. 15 refs. Proj. Squid Technical rept. MIT-21-P.
Order from LC mi$2. 70, ph$4. 80 PB 146 596

The measured velocity of gaseous detonation waves is less than that predicted by the Chapman-Jouguet plane wave theory. The velocity deficit (difference between theoretical and measured velocities) has been found to vary inversely with the tube diameter and initial pressure. A quantitative explanation of this effect is advanced by determining the growth of the viscous boundary layer on the tube wall and its effect upon the flow in the reaction zone of the detonation front.

Massachusetts U., Amherst.
SOME LIGHT SCATTERING STUDIES OF THE TEXTURE OF CRYSTALLINE POLYMERS, by Richard S. Stein. Technical rept. no. 12 on Contract Nonr-2151(00). 24 July 59, 39p. 25 refs. AD-225 701.
Order from LC mi$3. 30, ph$6. 30 PB 147 264

Contents:
Angular variation of scattering
Changes on heating and cooling
Density and orientation fluctuations
The resolution of orientation and density contributions
The effect of swelling
The variation of polarization during crystallization
The effect of ringed spherulites
The effect of stretching
The polarization of light scattered from stretched samples

Minnesota U., Minneapolis.
NUCLEAR AND ELECTRON SPIN RESONANCE, by John E. Wertz. Final rept. on Contract AF 18(600)479. 29 Feb 60, 86p. 63 refs. AFOSR-TR-60-69.
Order from LC mi$4. 80, ph$13. 80 PB 147 917

It is shown that for magnesium oxide electron spin resonance spectra may be used to detect and to give detailed descriptions of many of the known types of defect centers. It has been possible to make numerous correlations with other physical properties.

Noyes Chemical Lab., U. of Illinois, Urbana:
A CRITERION FOR ORBITAL HYBRIDIZATION AND CHARGE DISTRIBUTION IN CHEMICAL BONDS, by Martin Karplus and D. M. Grant. Technical rept. no. 21 on Contract Nonr-1834(13). 29 June 59, 11p. 21 refs. AD-220 346.
Order from LC mi$2. 40, ph$3. 30 PB 147 259

A theory is advanced which suggests that electron-coupled nuclear spin interactions, when interpreted in terms of the theory of localized electron pairs, can serve to measure the extent of orbital hybridization and bond polarization. Applications of the theory were made to systems of high symmetry in which hybridization and/or bond polarities are known, including BH_4^-, CH_4, and NH_4^+. Some non-tetrahedral systems were also studied whose nuclear magnetic resonance spectra were analyzed and whose X-H coupling constants were determined. The results obtained with the localized electron pair theory indicated that the coupling constant, $A_{NN'}$, was a useful criterion for the study of bond properties, since it is sensitive to the amount of hybridization and covalency in the wave function.

Ohio State U. Research Foundation, Columbus.
THERMAL FUNCTIONS AND HEATS OF FORMATION OF SOME OF THE MAJOR VAPOR SPECIES IN THE BORON-OXYGEN-HYDROGEN SYSTEM AT ELEVATED TEMPERATURES, by David White, Patrick N. Walsh and others. Technical rept. 4 on Contract Nonr-495(12). July 59, 25p. 10 refs; AD-225 417.
Order from LC mi$2. 70, ph$4. 80 PB 147 086

The thermodynamic properties of the gaseous molecules B_2O_3, B_2O_2, HBO_2 and $(HBO_2)_3$ are discussed in the light of the results of a spectroscopic investigation of the B-O-H- system. Extensive tables of thermal functions for these molecules are given. The heats of formation of these species, as well as others in the B-O-H system, are summarized, and the uncertainties discussed. These thermodynamic properties have been used to compute phase equilibria and partial pressures of the vapor species in the oxidation of boranes at various temperatures and stoichiometric ratios. (Author)

Pennsalt Chemicals Corp., Wyndmoor, Pa.
POLYMERS CONTAINING COORDINATED BORON, by C. R. Bertsch and H. C. Miller. Technical rept. no. 9 on Contract Nonr-2687(00). 10 Sep 59, 16p. 24 refs. AD-227 931.
Order from LC mi$2. 40, ph$3. 30 PB 148 569

Attempts were made to form linear polymers with tetracoordinated boron as the backbone element and using oxygen or CN groups to link the boron atoms. Inorganic bidentate ligands were used to block the two other coordination positions of the boron atom. No stable polymers were formed when sulfamate, aminomethanesulfonate, methanedisulfonate, or carbonate were used as the ligands. (Author)

Pennsylvania State U. Coll. of Mineral Industries, University Park.
ON THE BURNING RATE OF AN H-ATOM PROPELLANT, by Howard B. Palmer. Rept. on Contract Nonr-1858(25). Mar 59, 8p. 8 refs. Proj. Squid Technical rept. PSU-4-P.
Order from LC mi$1. 80, ph$1. 80 PB 146 595

The recent success of Windsor (Chem. and Eng. News, Jan. 12 (1959)) in trapping pure H atoms as a solid prompts added interest in the possibility of using H atom recombination for propulsion. For this reason, an attempt to calculate a priori the one-dimensional burning rate of an H-atom propellant seems worthwhile.

Princeton U., N. J.
ABSOLUTE INFRARED INTENSITIES OF THE AMMONIUM ION IN CRYSTALS, by C. C. Ferriso (Doctoral thesis) and D. F. Hornig. Technical rept. no. 2 on Contract Nonr-1858(27). 15 June 59, 18p. 20 refs. AD-220 137.
Order from LC mi$2. 40, ph$3. 30 PB 146 408

The absolute intensities of the 2 IR active fundamentals of the ammonium ion ν_3 and ν_4, were studied in several environments. Dilute solid solutions of NH_4^+ ions in KCl, KI, CsCl and CsI were studied and compared with pure NH_4I. After separating the effect of the net charge, the apparent bond moments ranged from 0. 63d to 0. 80d (ave. 0. 71) and the bond dipole derivatives, $/\partial \mu / \partial r$, from 2. 06d/A to 3. 59d/A (ave. 2. 80d/A). The bond moment is substantially the same as in NH_3. (Author)

Quantum, Inc., Wallingford, Conn.
FUNDAMENTAL STUDIES OF THE CHEMISTRY AND PHYSICS OF ORGANIC MATERIALS ADSORBED ON METAL SUBSTRATES, by Hilton A. Roth, Ralph F. Lumb, and C. M. Doede. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)3882. Apr 60, 149p. 22 refs. WADD Technical rept. 59-23.
Order from OTS $2. 75 PB 161 840

This research was an experimental exploration into the nature of the overall chemical and/or physical forces active at the interface between a continuous solid surface and an adsorbed thin film. In Part I disubstituted siloxane oriented polymeric films were synthesized lineally and normally on the surface of steel. Tensile strengths of these films were measured. Efforts were made to synthesize semi-inorganic and organic phosphorus containing polymers on this surface. The efforts demonstrated that the reactivity of phosphorus containing monomers with the

surface is uncontrollable. The work involved an experimental study of the film forming properties of the surfaces of saturated aqueous selections of omega hydroxyundecanoic acid.. It also included an exploratory attempt to synthesize a thin film of oriented polyamide. In Part II a photochemical method was adapted to evaluate the energy required to break interfacial adsorption bonds. Radiotracer techniques were used. The adsorption systems consisted of stearic acid and octadecanol on steel. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
OXYGEN OVERPOTENTIAL IN MOLTEN CARBONATES, by George J. Janz and Francisco Colom. Technical rept. no. 4 on Contract Nonr-591(10). Sep 59, 25p. 8 refs. AD-226 419.
Order from LC mi$2.70, ph$4.80 PB 148 566

The overvoltage of the oxygen evolution reaction on Pt electrodes in a ternary mixture of molten Na_2CO_3-Li_2CO_3-K_2CO_3 has been studied from 420°C to 1000°C. The overvoltage—log current density relations exhibit two well distinguished regions over the entire temperature range. At high c.d. (greater than 10^{-3} amp/cm^2) the slope of the Tafel line is maintained in accord with the overall process; $CO_3^{=} \rightarrow CO_2 + O + 2\bar{e}$ with the value of 10.4±1.1 kcal mol^{-1} for the heat of activation for oxygen evolution. At low c.d. the overpotential appears to be a more complex problem with marked temperature dependence. A portion of the relation in this region of c.d. in the high temperature range (above 600°C) may be understood with reference to the properties of the Pt electrode as a reversible CO_2-oxygen electrode in such melts. (Author)

Rochester U., N. Y.
ENERGY TRANSFERAL IN POLYATOMIC MOLECULES AND PHOTOCHEMISTRY IN THE LIQUID AND SOLID PHASES, by W. Albert Noyes, Jr. Final rept. on Contract AF 18(600)1528. 1 Mar 60, 13p. 30 refs. AFOSR-TR-60-38.
Order from LC mi$2.40, ph$3.30 PB 148 090

A study of several years has shown that light and radiation produce free radicals in some instances and rearrangements to complete molecules in others. The reactions proceed mainly through two states, one of which is short lived and one of which lasts much longer. The rearrangements to complete molecules seem to come mainly from the short lived state and reactions which arise from reactive intermediates such as radicals start mainly from long lived states. Finally the powerful radiations from radioactive substances produce effects which in many cases resemble those formed by visible or ultraviolet light. (Author)

Rutgers State U., New Brunswick, N. J.
A STUDY OF THE PROPERTIES OF MATTER BY MEANS OF NUCLEAR MAGNETIC RESONANCE TECHNIQUES. Technical rept. for 1 Dec 55-31 Dec 31 Dec 59 on Contract AF 18(603)6. 26 Jan 60, 22p. 7 refs. AFOSR [TR]-60-17; AD-232 674.
Order from LC mi$2.70, ph$4.80 PB 146 334

Absorbtion of energy from radiofrequency fields was measured by nuclear magnetic moments at resonance; the effects were studied on such absorption signals of the internal motions of atoms in simple systems, especially in such systems as metal hydrides, liquid water, and gaseous and liquid Xeon. In other experiments enhancements of normal nuclear spin polarizations were induced by exciting resonances electron spins coupled to the nuclear spins by dipolar interactions in several liquids and solids. The shapes and intensities were studied of continuous steady-state nuclear resonance signals as affected by application of pulsed radio-frequency power. Under some circumstances considerable improvement in sensitivity results from proper combinations of such sources. Under other circumstances it may be possible to obtain very narrow band filtering. (Author)

South Carolina U., Columbia.
INTRAMOLECULAR FREE RADICAL ARYLATION AND RELATED REACTIONS, by DeLos F. DeTar and Chin-Chiun Chu (Doctoral thesis). Rept. on Contract AF 49(638)88. [1960] 24p. 27 refs. AFOSR-TN-60-157; AD-231 250.
Order from LC mi$2.70, ph$4.80 PB 147 346

A study has been made of the reactions of the 2-o-terphenyl free radical. Cyclization to triphenylene (IX) occurs to the exclusion of the intermolecular reaction with benzene or with carbon tetrachloride. However, bromine abstraction from bromotrichloromethane does compete with cyclization. The peroxide of o-(1-naphthyl)-benzoic acid (VI) was also investigated, but the acyloxy radical failed to decarboxylate. The main product found was the lactone (VIII) of o-(2-hydroxy-1-naphthyl)-benzoic acid. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE MEASUREMENT OF THE VAPOR PRESSURE OF ATOMIC SPECIES FROM SPECTROPHOTOMETRIC MEASUREMENTS OF THE ABSORPTION OF RESONANCE LINES. I. TEST OF THE METHOD ON THE VAPOR PRESSURE OF SODIUM, by Guido L. Vidale. Rept. on Contract AF 04(647)269. May 60, 49p. 20 refs. Technical Information Series R60SD330.
Order from LC mi$3.30, ph$7.80 PB 148 206

A method has been developed for studying the equilibrium vapor pressure of atomic species over refractory ceramics. It consists of measuring the absorption coefficient of the hot equilibrium vapor at the center of an atomic resonance line. A resonance line of known oscillator strength for the atomic species under examination is generated in a liquid nitrogen cooled, hollow cathode discharge tube, and the absorption of this line by a known length of equilibrium vapor present in an isothermal cell is measured using spectrophotometric techniques. After correcting for the various causes of line broadening of the resonance line, the measured absorption is used to calculate the density of the atomic species. The experimental and theoretical techniques are described, and the results of a reinvestigation of the vapor pressure of sodium metal at 400°K are given. It is shown that the individual vapor pressure measurements have a root mean square deviation of 12%, and that their average differs from

the best literature values by less than 3%. The various sources of error are discussed quantitatively, and it is shown that pressure of 10^{-8} to 10^{-9} atmospheres of atomic species can be generally measured with an accuracy of ± 20%. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE MEASUREMENT OF THE VAPOR PRESSURE OF ATOMIC SPECIES FROM SPECTROPHOTOMETRIC MEASUREMENTS OF THE ABSORPTION OF RESONANCE LINES. II. THE OSCILLATOR STRENGTH OF THE Cu_{3247} LINE, by G. L. Vidale. Rept. on Contract AF 04(647)269. May 60, 32p. 10 refs. Technical Information Series R60SD331.
Order from LC mi$3.00, ph$6.30 PB 148 207

The oscillator strength of the Cu_{3247} resonance line has been obtained from the experimentally determined absorption coefficient at its center. This resonance line was generated in a hollow cathode discharge tube operated at liquid nitrogen temperature and its absorption by an amount of copper vapor of known length and density was measured spectrophotometrically. The value of f was calculated from this measured absorption by taking into account the effect of Doppler and pressure broadening and of the hyperfine structure of the line. The copper vapor consisted of the equilibrium vapor over copper in an isothermal cell, in the presence of a sufficient density of inert gas to diffusion limit the effective cell length. The reported result f = 0.32 is compared with literature values, and its probable error is estimated. (Author) (See also PB 148 206)

Stanford Research Inst., Menlo Park, Calif.
THE DIFFUSION OF ATOMIC HYDROGEN THROUGH MULTICOMPONENT MIXTURES, by Henry Wise. Rept. on Project Squid, Contract Nonr-1858(25). Sep 59, 7p. 7 refs. Technical rept. SRI-4-P; AD-225 795.
Order from LC mi$1.80, ph$1.80 PB 148 588

The diffusion coefficient of atomic H through a mixture of Ar and H was determined at 30 x 10^{-3} mm Hg. The atomic H concentration along the center of the reaction tube was measured with a microcalorimeter consisting of a pyrex probe coated with a thin layer of vacuum-evaporated Pt. With increasing mole fraction of Ar, a marked reduction occurred in the ratio D_{123}/D_{12}. D_{13} had an average value of (2.88 ± 0.11) x 10^4 sq cm/sec at 30 x 10^{-3} mm Hg, which corresponds to an effective momentum-loss collision diameter $\sigma_{H, Ar} = 2.92 \times 10^{-8}$ cm as compared to $\sigma_{H, H_2} = 2.55 \times 10^{-8}$ based on a model of rigid elastic spheres.

Technische Hochschule, Munich (West Germany).
RESEARCHES ON HYDROGEN EVOLUTION, by C. A. Knorr. Rept. on The Structure and Properties on Interfaces, Contract AF 61(052)142. Apr 60, 50p. 60 refs. WADC Technical rept. 59-687.
Order from OTS $1.25 PB 161 880

Pt. I. Investigation of adsorption phenomena on platinum, rhodium, iridium, palladium and gold, by means of the potentiostatic method of applying a triangular voltage. Formation and decomposition of hydrogen and oxygen coverages as a function of the retardation of charge transfers. Pt. II. Inveatigation of the reaction of hydrogen occluded in Pd-wires with H-acceptors like chromic acid, potassium ferricyanide, and hydrogen peroxide, by the measurement of the longitudinal resistance. Study of the oxide surface with regard to the H^+ permeability and the influence of poisoning on the decomposition reaction. (Author)

Uppsala U. (Sweden).
HETEROPOLAR AND HOMOPOLAR BOND ENERGY, by Ingvar Lindqvist. Technical note no. 8 on Contract AF 61(052)43. 1 Mar 60, 10p. 3 refs. AFOSR-TN-60-127; AD-234 583.
Order from LC mi$1.80, ph$1.80 PB 146 742

A concept, heteropolarity, has been defined which permits the division of the bond energy of a localized electron pair bond into a heteropolar and a homopolar part. The variations of these two energy parts with respect to shifts of the heteropolarities of the bonds in binary molecules are discussed. It is suggested that the description of the bond energy proposed is well suited for discussions of inductive effects. (Author)

Uppsala U. (Sweden).
INDUCTIVE EFFECTS ON CHEMICAL BONDS, by Ingvar Lindqvist. Technical note no. 9 on Contract AF 61(052)43. 1 Mar 60, 37p. 24 refs. AFOSR-TN-60-126; AD-234 582.
Order from LC mi$3.00, ph$6.30 PB 146 743

Inductive effects on a given chemical bond, caused by substitution or addition reactions, have been discussed using an approach which divides the bond energy into a heteropolar and a homopolar part. It has been possible to give a unified treatment of experimentally established effects of the order of 0.01 Å. The nature of the donor-acceptor interaction has been discussed with consideration of the inductive effects on all the bonds in the donor and acceptor molecules. The consequences in halogen bridged compounds and in complex ions have also been treated briefly. (Author)

Uppsala U. (Sweden).
OXIDE CHLORIDES AND ORGANOMETALLOID OXIDES AS DONOR MOLECULES, by Ingvar Lindqvist. Technical note no. 10 on Contract AF 61(052)43. 1 Mar 60, 12p. 9 refs. AFOSR-TN-60-125; AD-234 581.
Order from LC mi$2.40, ph$3.30 PB 146 744

A model of an idealized structure has been suggested, which can be used for the discussion of adducts of oxide chlorides and organometalloid oxides. No safe distinction between single and double bond structures can be made with the experimental data available at present. The results show, however, the importance of inductive effects in donor-acceptor reactions, and some predictions can be made about other adducts than those studied. (Author) (See also AD-234 582)

Warner and Swasey Co., New York.
INFRARED SPECTRAL EMISSIVITIES AND INTERNAL DISTRIBUTIONS OF CARBON DIOXIDE AND WATER VAPOR AT HIGH TEMPERATURES, by Richard H. Tourin and Paul M. Henry. Final rept. on Contract AF 19(604)2223. Dec 59, 109p. 42 refs. AFCRC-TR-60-203; AD-238 493.
Order from LC mi$5.70, ph$16.80 PB 146 636

Infrared spectral emissivities of hot carbon dioxide and water vapor were determined by measurement of the infrared absorption spectra of gas samples heated under controlled conditions. The measurements are described and are discussed in relation to molecular energy distributions, theoretically calculated emissivities, and flame radiation. (Author)

Washington State U., Pullman.
THE INTERACTION OF ACTIVATED ATMOSPHERIC GASES WITH SOLID SURFACES, by Daniel G. Bills. Rept. no. 15 (Final) on Contract AF 19(604)1897. 31 Dec 59, 35p. 22 refs. AFCRC-TR-60-255.
Order from LC mi$3.00, ph$6.30 PB 148 742

This paper reports experimental investigations of several new effects connected with the adsorption on solids of nitrogen and hydrogen molecules which are not in their normal energy state. The new work reported here primarily concerns: (1) studies of the thermal decomposition of glass and its relation to 2 below; (2) studies of the chemical sputtering produced by activated molecules impinging on glass surfaces; (3) studies of means of reducing ionization gauge pumping; and (4) identification of the activated species in molecular nitrogen as non-ionic.

Washington State U., Pullman.
INTRODUCTION TO TABLES ON PYROLYSIS OF ESTERS. PYROLYSIS OF CARBOXYLATES, by Grant Gill Smith and Frank D. Bagley. Rept. on Contract AF 49(638)615. June 60, 87p. 320 refs. AFOSR-TN-60-590; AD-238 726.
Order from OTS $2.25 PB 161 866

This is the first table of a series summarizing the temperatures, yields and references for the pyrolysis of esters of organic and inorganic acids and closely related nitrogen and sulfur analogues. Only esters which contain a β-hydrogen on the alkyl group and could possibly pyrolyze to olefins are included. Some of the esters, e.g. unsaturated esters, do not pyrolyze to give olefins even though they have a β-hydrogen and might be expected to produce olefin, but produce other substances such as rearranged products; esters of this type are also included. No distinction is made between studies primarily interested in the products of pyrolysis and those studies for theoretical interest.

Wayne State U., Detroit, Mich.
THE DETERMINATION OF SIZE DISTRIBUTION CURVES BY LIGHT SCATTERING AND RELATED INVESTIGATIONS, by Morton L. Wallach. Doctoral thesis. Technical rept. no. 34 on Contract [Nonr]-736(00). 1 Aug 59, 82p. 70 refs. AD-226 072.
Order from LC mi$4.80, ph$13.80 PB 148 184

An investigation was undertaken in an effort to develop a method of determining particle size distribution curves in emulsions. Most of the conventional, well established methods of determining size distribution curves are not particularly suited to the analysis of emulsions. In contradistinction, light scattering should, in principle, be well adapted to the study of size distributions in emulsions. In general, a measurable contribution is made to the total observed effect even for very small colloidal particles. Five per cent differences in size can be detected for particles as small as 100 mμ in diameter. Experimental techniques established for monodispersed systems should serve equally as well in the case of heterodispersions. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRICAL CLEANUP OF GASES, by R. E. Fox and J. S. Knoll. Final rept. 15 Mar 59-14 May 60, on Contract AF 49(638)591. 14 May 60, 23p. 10 refs. Research rept. 403FD428-R5; AFOSR-TR-60-72.
Order from LC mi$2.70, ph$4.80 PB 148 404

The short term re-emission studies have been extended down to times approaching 1 sec. These studies indicate that even at these short times, re-emission follows a 1/T dependence. Further studies are needed with a modified tube to carry the times to shorter intervals. Temperature dependence of the re-emission rate, as well as the pumpdown rate, has been carried out over a temperature range from room temperature down to liquid nitrogen (-200°C) temperature. This effect is significant and should be accurately controlled for re-emission studies. The studies of the dependence of ion energies on the re-emission rate were inconclusive due to the nature of the tube construction. The results indicate that the effect of ion pumping at the filament and/or its supports is more important for a tube of this geometry than had previously been suspected. (Author) (See also PB 136 138)

EARTH SCIENCES

American Geographical Society, New York.
RESEARCH ON LATE-PLEISTOCENE ENVIRONMENTS OF SOUTHERN CHILE, by Calvin J. Heusser. Semi-annual status rept. on Contract Nonr-641(04). 11 May 59, 11p. AD-218 165.
Order from LC mi$2.40, ph$3.30 PB 147 448

A reconnaissance study was made to determine southern Chilean late-Pleistocene environmental changes, particularly climatic fluctuations, and to construct chronology of these changes for comparison with chronologies from the northern hemisphere. Five methods were applied to gather data: (1) the palynology (pollen analysis) of the deposits formed in the lakes and bogs on and beyond the prominent Laguna de San Rafael moraine; (2) limnology of the water bodies associated with the above deposits and the geochemistry of those sediments; (3) glacial geology, since glacier variations, as indicated by moraine sequences, are governed primarily by climate; (4) glacier variations of the last several

centuries are measured and dated from the ages and growth patterns of woody plants established on recessional moraines and outwash, as well as along the trimlines of the glaciers; and (5) by means of radiocarbon dating, additional dates ranging from hundreds to thousands of years of the Late Pleistocene are obtained from organic remains associated with past events. The foundation for most of the chronology is based on ages determined by radiocarbon analysis. (Author)

Naval Ordnance Test Station, China Lake, Calif.
ATMOSPHERIC REFRACTION IN THE VISIBLE SPECTRUM, by R. J. Stirton. 1 Dec 59, 23p. 12 refs. NOTS TP-2357; NAVORD rept. 6614; AD-234 066.
Order from LC mi$2.70, ph$4.80 PB 146 995

The refraction of the atmosphere causes the apparent position of an object to be higher than its true position. The correction for this angular position is obtained in the form of an explicit integral. A computing program for the IBM 704 was written to handle the numerical work. A wide range of observer and object positions and some generality in the atmospheric properties are indicated. In particular, consideration is given to including local temperature and pressure observations in the functions representing the atmosphere. (Author)

Texas A. and M. Coll., College Station.
OCEANOGRAPHY AND METEOROLOGY OF THE GULF OF MEXICO, by Hugh J. McLellan. Annual rept. for 1 May 58-30 Apr 59 on Contract N7onr-48702. 1 May 59, 36p. 12 refs. Reference 59-16A, AD-220 441.
Order from LC mi$3.00, ph$6.30 PB 146 534

The project is now being oriented towards the problem of predicting oceanographic conditions. There are several aspects to these studies including sea state prediction and water mass characteristics. The placing of a telemetering weather buoy in the central Gulf during the summer of 1958, is the major item in these studies. A thermistor array is now being constructed for use in the buoy to report temperatures from 18 depths down to 300 m. Negotiations were made for the fabrication of an instrumented chain to make under-way measurements of thermal microstructure from the research vessel, and experimental measurements of radiation balance from the ship were carried out. (Author)

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
AN INDEX OF IONOSPHERIC STORMINESS, by H. S. Marsh, W. H. Cameron, and R. A. Swirbalus. Dec 59, 22p. 3 refs. AFCRC-TR-59-365; AD-233 816.
Order from LC mi$2.70, ph$4.80 PB 146 358

An index of ionospheric storminess is needed to describe objectively the conditions of the ionosphere accompanying magnetic disturbances. Quiet-day recordings of the standard frequency transmissions from WWV and CHU are used to derive average monthly MUF (maximum usable frequency) and LUF (lowest usable frequency) contours. An index of storminess for a given day may be derived from the degree to which elevation of the LUF and depression of the MUF cause shrinkage of the average useful frequency spectrum for the day. Charts show the use of deviations from the average hours-in value for a given frequency to extrapolate equivalent percentage changes in MUF or LUF contours. Correlation with magnetic data is illustrated. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
MILITARY APPLICATIONS OF SUPERCOOLED CLOUD AND FOG DISSIPATION, by Currie S. Downie and Bernard A. Silverman. Dec 59, 51p. 117 refs. Air Force Surveys in Geophysics no. 118; AFCRC-TN-59-635; AD-234 550.
Order from LC mi$3.60, ph$9.30 PB 146 673

The physics of the dissipation of supercooled fog and stratiform clouds is examined briefly. The results of the Geophysics Research Directorate dry-ice seeding investigations are presented. Four seeding missions are discussed in detail as examples of the meteorological conditions to which the technique is applicable and the results which can be anticipated. On one mission the below-minimum weather conditions at destination were modified to allow a safe and routine VFR landing. Military and civilian applications include the clearing of weather at airfields for landings and takeoffs. (Author)

Air Force [Command and Control Development Div.] Bedford, Mass.
A NUMERICAL MODEL FOR THE PREDICTION OF HURRICANE FORMATION, by Louis Berkofsky. Mar 60, 100p. 102 refs. Geophysical Research Papers no. 67; AFCRC-TR-60-220.
Order from OTS $2.25 PB 161 889

A nongeostrophic flow model, in which the latent heat of condensation released through pseudo-adiabatic processes is the only heat source, is devised. An attempt is made to formulate initial conditions which resemble, as nearly as is known, the conditions existing prior to the formation of a hurricane. Using these initial conditions, the equations are solved on the IBM 704 electronic computer. Solutions are obtained with and without the latent heat of condensation in order to assess the importance of the heating for the development process. Solutions are obtained for three time steps (21 minutes). Even during this short period there are clear indications of the importance of latent heat. The vertical motions are about an order of magnitude larger, the horizontal temperature gradient is about one and one-half times as intense, and horizontal convergence is increasing much more rapidly, than when no heat is added. The pressure changes about the same amount in the case when heat is added as when no heat is added. This indicates a lag in the reaction of the pressure field to the addition of energy. It is estimated that the pressure field will react in 15 or 20 time steps. (Author)

Allied Research Associates, Inc., [Cambridge, Mass].
AN ESTIMATE OF THE POTENTIAL TRANSMISSION LOAD OF WEATHER RADAR DATA ON THE WEATHER SYSTEM 433L, by Robert C. Copeland. Scientific rept. no. 4 on Contract AF 19(604)5204. 14 Oct 59, 21p. 2 refs. AFCRC-TN-59-616; AD-233 825.
Order from LC mi$2.70, ph$4.80 PB 146 330

To evaluate the potential transmission load on the weather radar data handling portion of the weather system 433L without initiating an extensive radar climatology study, the average and maximum number of the weather radar network installations which would see precipitation at a given time was estimated from a consideration of the precipitation analyses of surface weather maps. Fifteen maps for each month from May 1958 to May 1959 were considered, and allowances were made for the typically lower altitudes and reflectivities of snow than of summer convective storms. Also, for 8 dates, the percentage of the area of each radar PPI scope that would be covered by precipitation echoes was estimated. The results suggest that 37% of the radar installations would be detecting precipitation at the given map time, on the average; however, it appears that as many as 75% of the radars would simultaneously detect precipitation of a few occasions. Although the echo coverage indicated on individual radar PPI scopes varied from zero to 100%, 20% or less coverage was dominant. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A DESCRIPTION OF THE WINTER WEATHER AT THULE AIR BASE, GREENLAND, by David H. Slade. 15 May 59, 19p. USASRDL Technical rept. 2034; AD-216 880.
Order from LC mi$2.40, ph$3.30 PB 146 550

Most of the winter storms affecting Thule, an air base on the northwest coast of Greenland, originate as disturbances in the mid-latitudes. During their trip into the Arctic, their nature changes greatly. The effect of these storms at any particular location on the Greenland coast depends, to a great extent, on the local topography at that point and on the relationship between the position and path of the storm and the Greenland icecap. An investigation of surface stability and lapse conditions at Thule during the 1957-1958 winter shows some of the relationships between such structures and weather. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
HIGH ALTITUDE NIGHTTIME BALLOON ML-537()/UM, by Moses Sharenow and Ruth M. Welt. 15 May 59, 12p. USASRDL Technical rept. 2031.
Order from LC mi$2.40, ph$3.30 PB 147 996

A high-altitude ballon, ML-537( )/UM, suitable for nighttime use has been developed and tested in temperate, tropic, and arctic latitudes. Results of the tests indicate that the balloon is capable of attaining a bursting altitude in excess of 100,000 feet with slightly more hydrogen than that required by existing night balloons now used to attain an altitude of 80,000 feet. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A LIGHTNING COUNTER FOR POSITIVE AND NEGATIVE STROKES, by Lothar H. Ruhnke. 15 Apr 60, 24p. 4 refs. USASRDL Technical rept. 2111.
Order from LC mi$2.70, ph$4.80 PB 148 543

An electronic instrument is described which records on a strip chart recorder the rate of occurrence of lightning strokes, differentiating between positive and negative strokes. Two channels, one for the negative and one for the positive lightnings, are provided. The electrostatic component of a lightning is formed into an impulse of constant amplitude and length by means of a filter network and a monostable multivibrator. The pulses are integrated in a relay network and the result is recorded on paper. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A MANUAL METHOD FOR SOLUTION OF THE HYDROSTATIC EQUATION, by Abraham Golden. 15 Jan 59, 13p. 3 refs. USASRDL technical rept. 2006; AD-226 687.
Order from LC mi$2.40, ph$3.30 PB 146 347

The development of an atmospheric sounding system, Rawin set AN/GMD-2, created a need for a manual method of computation for the hydrostatic equation of the atmosphere. A graphical and tabular method is presented when (1) the data are correlated values of geometric height, temperature, and humidity; and when (2) it is necessary to find the geopotential heights of standard-pressure surfaces and the pressure at a given geometric height. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE RECORDING OF ACOUSTIC WAVES FROM HIGH-ALTITUDE EXPLOSIONS IN THE ROCKET-GRENADE EXPERIMENT AND CERTAIN OTHER RELATED TOPICS, by William R. Bandeen. 1 July 59, 69p. 13 refs. USASRDL technical rept. 2056; AD-231 943.
Order from LC mi$3.90, ph$10.80 PB 147 997

The instrumentation and operation of the sound-ranging installation for the rocket-grenade experiment at Fort Churchill are discussed. Schrodinger's equation for the transmissivity of sound in the atmosphere is applied to empirical data illustrating the upper altitude limit of the experiment. A modified method of correcting for the finite-amplitude-propagation effect in the grenade experiment is discussed. An analysis is made of the specific problem of measuring angles of arrival of sound waves in the grenade experiment. The effect of the re-entry ballistic wave on grenade sound arrivals is discussed, and a method of determining the times of such obscured arrivals and also of weak sound arrivals is presented. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
RF FREQUENCY DRIFT OF RADIOSONDE TRANSMITTER T-435/AMT-4B, by A. A. Coppola. 15 May 59, 17p. USASRDL Technical rept. 2035.
Order from LC mi$2.40, ph$3.30 PB 146 549

This report illustrates the RF drift characteristics of Radiosonde Transmitter T-435/AMT-4B during a balloon flight and discusses the factors contributing to the general drift pattern. During a routine flight the radiosonde transmitter can be expected to drift in frequency by as much as 4.5 mc, the variation being from about 1 mc below to as much as 3.5 mc above the initial frequency. The RF drift can be attributed to two causes: temperature effects on the RF cavity, and a sharp decrease in battery filament voltage near the end of a flight, the latter having the greater effect. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THEORY AND PERFORMANCE OF STREAMLINE NEOPRENE BALLOONS, by M. Sharenow. 15 Apr 59, 46p. 7 refs. USASRDL Technical rept. 2026; AD-220 785.
Order from LC mi$3.30, ph$7.80 PB 146 654

The theory of the motion of streamline balloons is developed in a manner analogous to that of spherical balloons. Ideally, expansible streamline balloons will accelerate continuously to burst if they do not reach the critical Reynolds number. In the case of the balloons investigated, this was reached near 50,000 feet where a sharp drop in ascent rate occurred. The ascent rate up to this altitude falls short of the theoretically computed rate because of balloon deformation and deviation from ideal shape. Comparison is made between two types of balloons. The newer one, fabricated by a new method known as the gel-adhered process, is lighter in weight and simpler to inflate and handle than the older type which is assembled by a cementing process. The two types provide approximately equivalent performance (75,000 feet at 1,800 feet per minute) when inflated with the same volume of gas. In practice, a smaller volume of gas is used to inflate the newer type, with an accompanying increase in bursting altitude and decrease in ascent rate. Methods of obtaining increased ascensional rates by roughening balloon surfaces in accordance with aerodynamic flow separation theory are suggested. (Author)

California U., Los Angeles.
TRANSOSONDE PROJECT, by M. G. Wurtele. Final rept. on Contract Nonr-233(21). 30 Sep 59, 19p. 14 refs. AD-228 833.
Order from LC mi$2.40, ph$3.30 PB 148 592

A study of the relation of the fields of pressure and wind are shown by an analysis of trajectories of transosonde balloons. The research included: (1) a complete synoptic study of the days of trajectory flights to be analyzed; (2) a theoretical study of the relation of the flight trajectory to the observed pressure field, and (3) an evaluation of the analytical and forecasting value of transosonde flight data in the absence of data from radio sonde and wind sonde networks. (Author)

Chicago U., Ill.
NAVY IMPROVEMENT IN FORECASTING, by H. Riehl. Final rept. for 1 Oct 51-30 Sep 59 on Contract N6ori-02036. [1959] 4p. 22 refs.
Order from LC mi$1.80, ph$1.80 PB 148 223

The main areas of interest were: (1) tropical circulations, especially hurricanes and typhoons; (2) general circulation of the tropics and coupling between low and high latitudes; and (3) jet streams, especially in the subtropics. The report lists 22 journal articles completed on this project.

Chicago, U., Ill.
SOME COMPUTATIONS OF THE INFLOW ANGLE IN HURRICANES NEAR THE OCEAN SURFACE, by Miriam Ausman. Rept. on Contract N6ori-02036. Sep 59, 22p. 3 refs. AD-228 931.
Order from LC mi$2.70, ph$4.80 PB 148 582

Ship wind reports around 6 hurricanes in 1954 and 1955 were used to obtain the inflow angle in these storms as a function of distance from the storm center and the angular distance from the direction of storm motion. The mean inflow angle averaged around radius circles seemed to be unrelated to the radius of the circle used or to storm maturity. The size and location of the areas of outflow, however, were well-defined at constant values. Outflow took place in an area about 140 angular degrees wide and approximately centered on the direction of storm motion. (Author)

Chicago U., Ill.
SYNOPTIC COMPARISONS OF JET STREAM AND GULF STREAM SYSTEMS, by Chester W. Newton. Technical rept. no. 1 on Contract Nonr-2121(10). Feb 59, 36p. 47 refs.
Order from LC mi$3.00, ph$6.30 PB 146 355

Comparisons are made between typical examples of oceanic and atmospheric current structures. These indicate that the lateral dimensions of the Gulf Stream are about 1/25 those of the jet stream; the shapes of the current profiles are almost identical, with equivalent lateral shears. In the vertical, the dimensions are nearly in the ratio 1:10, which also characterizes meander sizes. Striking similarities are found between thermal structures in the two systems. In both, variations from pronounced frontal concentrations to more gentle and broad barocline structures are observed over short distances or time intervals. Frontal slopes are equal, as are the vertical shears observed within frontal layers. Marked axial variations of speed, and of lateral and vertical gradients of current speed and temperature, are present in both systems. Ageostrophic motions are prominent. Some comments are made on possible interpretations of these variations, in regard to transverse circulations and to inertia oscillations in the current systems. (Author)

Laboratory of Climatology, Centerton, N. J.
INVESTIGATION OF THE HEAT AND WATER BALANCE AT CENTERTON, NEW JERSEY, MAY-JULY, 1959, by J. R. Mather and H. Hacia. Final rept. on Contract Nonr-1617(00). 1959, 52p. Publications in Climatology, v. 12, no. 1; AD-226 846.
Order from LC mi$3.60, ph$9.30 PB 147 182

Little, Arthur D., Inc., Cambridge, Mass.
WARM FOG AND STRATUS CLOUD DISSIPATION.
Final rept. on Contract DA 36-039-sc-64569.
4 June 56, declassified 28 May 57, 91p. 19 refs.
Order from LC mi$5.40, ph$15.30 PB 149 401

The investigations, both theoretical and experimental, have been directed toward the development of methods for dissipating warm fog and stratus clouds. Most of the work has been concerned with various possible electrical techniques for causing electrostatic precipitation of cloud particles and for promoting the formation of precipitation. Dissipation systems based on the evaporation of droplets have also been considered.

MacDonald Physics Lab., McGill U. (Canada).
THE MOTION AND EROSION OF CONVECTIVE STORMS IN SEVERE VERTICAL WIND SHEAR, by Walter Hitschfeld. Rept. on Contract AF 19(604)2065. July 59, 50p. 15 refs. Stormy Weather Research Group Scientific rept. MW-29; AFCRC-TN-59-447; AD-225 398.
Order from LC mi$3.30, ph$7.80 PB 146 536

Radar data displayed in the form of precipitation maps at constant altitude above ground were used to portray the structure of storms and their anvils. Well developed storms even in the presence of severe wind shear, were observed to remain essentially vertical through their active phase. Instead of being strongly bent by the shear, parts of the storm appeared to be carried off by the wind, forming extensive plume patterns or anvils which trailed down to levels as low as 10,000 ft while evaporating. Size and shape of the plume suggested that its particles had fall speeds ranging 0.75 to about 5 m sec^{-1}, and were of precipitation size. A statistical analysis of the precipitation patterns of two of the days analyzed is presented. This work includes a statistical measure of echo distribution as a function of height, and the derivation of a correlation index (probability of finding echo at a specified horizontal range and bearing from a point with echo). (Author)

Massachusetts Inst. of Tech., Cambridge.
ON THE PROBLEM OF INITIAL DATA FOR THE PRIMITIVE EQUATIONS, by Norman A. Phillips. Technical rept. on Numerical Weather Prediction Project, Contract Nonr-1841(18). Sep 59, 20p. 11 refs. AD-225 878.
Order from LC mi$2.40, ph$3.30 PB 148 578

An analysis is presented demonstrating that in a forecast with the primitive equations, pure geostrophic or purely non-divergent initial wind fields results in noticeable meteorological noise, especially in a baroclinic atmosphere. In a linear example this noise is shown to be suppressed if the divergence of the initial wind field is set equal to the divergence implied by the usual geostrophic theory of numerical weather prediction. The absence of noise in Charney's 1955 test computation with non-divergent balanced initial data is explained. The quasi-geostrophic expansion is used to define initial data for a non-linear forecast with the primitive equations. Two cases are considered; that where only the geopotential is known from observations, and that where only the non-divergent part of the wind is known from observation. The initial tendencies computed from initial data of this kind is shown to preserve the assumed geostrophic character of the flow, and making possible to get more accurate forecasts with the primitive equations. (Author)

Massachusetts Inst. of Tech., Cambridge.
QUESTIONS CONCERNING THE ENERGY OF STRATOSPHERIC MOTIONS, by Victor P. Starr. Scientific rept. no. 1 on Planetary Circulation Project, Contract AF 19(604)5223. Dec 59, 13p. 5 refs. AFCRC-TN-59-665; AD-233 568.
Order from LC mi$2.40, ph$3.30 PB 146 567

The theoretical conclusion is reached that the vertical transport of kinetic energy in the atmosphere from one horizontal layer to another is effected solely by an area integral multiplied by the vertical velocity. Speculations are made as to whether the kinetic energy in stratospheric levels is maintained against friction through such a vertical transport from other levels, or whether the needed supply is derived from convective sources in situ. (Author)

Massachusetts Inst. of Tech., Cambridge.
SOME RADAR OBSERVATIONS OF TROPOSPHERIC CELLULAR CONVECTION, by Reginald E. Newell. Research rept. no. 33 on Weather Radar Research, Contract AF 19(604)2291. Nov 59, 57p. 66 refs. AFCRC-TN-60-205; AD-233 832.
Order from LC mi$3.60, ph$9.30 PB 146 320

Small-scale cellular convection is a mode of motion whose role in the vertical transport processes in the troposphere is not established. The dimensions of cellular convective motions are obtained from a range-height display of a 3-cm AN/CPS-9 radar together with estimates of the frequency of cellular vs non-cellular echoes. The observation of cell spacing and depth, for cells which do not exceed about 6 km in depth, vary in a manner which is similar to that predicted from the Bénard cell theory of Lord Rayleigh. The motions may be transporting heat upwards. Other properties are doubtless simultaneously transported vertically; as an example, some estimates are made of the vertical flux of horizontal momentum at the radar site (42°N). (Author)

McGill U. (Canada).
TEMPERATURE AND WIND FREQUENCY TABLES FOR EURASIA. VOL. 1. JANUARY-MARCH, by J. N. Rayner. Rept. on Contract DA 19-129-qm-1447. Feb 60, 212p. Arctic Meteorology Research Group Pub. in Meteorology no. 18.
Order from LC mi$9.60, ph$33.30 PB 148 324

Naval Ordnance Test Station, China Lake, Calif.
CHARTS FOR DETERMINING ATMOSPHERIC DENSITY BETWEEN ALTITUDES OF 24,000 and 100,000 FEET, by Paul H. Miller. 18 Feb 59, 13p. NOTS TP 2184; NAVORD rept. 6464; AD-216 098.
Order from LC mi$2.40, ph$3.30 PB 146 681

Charts have been developed at the Naval Ordnance Test Station for the rapid and accurate determination of atmospheric densities between the pressure-altitude levels of 400- and 5-millibars in units of slugs per cubic foot. From these charts the density is determined as a function of pressure (in millibars) and temperature (in degrees Centigrade), with the assumption that the relative humidity is 0% at all levels under consideration. The range of densities considered is from 115 slugs/$foot^3$ x 10^{-5} to 40 slugs/$foot^3$ x 10^{-6}. These charts eliminate the necessity of mathematically computing atmospheric densities aloft for any combination of pressure and temperature typically encountered at the latitude of NOTS. (Author)

Naval Ordnance Test Station, China Lake, Calif.
HORIZONTAL-DISTANCE CALCULATOR FOR MAKING EARTH-CURVATURE CORRECTIONS IN RAWIN-DETERMINED UPPER-WIND MEASUREMENTS, by Paul H. Miller. Dec 59, 22p. 4 refs. NOTS TP-2387; NAVORD rept. 7021; AD-233 347.
Order from LC mi$2.70, ph$4.80 PB 146 729

A calculator, which incorporates earth-curvature features, has been developed and constructed for the determination of horizontal distances of a target at known altitude and elevation angle. The accuracy of the calculator is compared with other methods of obtaining the same information. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
FREQUENCIES AND DURATIONS OF HOURLY TEMPERATURES, FORT GREELY, BIG DELTA, ALASKA, by Fernand De Percin and Owen S. Parmele. Jan 60, 25p. 11 refs. Technical rept. EP-122; AD-234 283.
Order from LC mi$2.70, ph$4.80 PB 147 237

Naval Ordnance Test Station, China Lake, Calif.
TIME-VARIABILITY STUDY OF WINDS ALOFT AT THE NAVAL ORDNANCE TEST STATION, CHINA LAKE, CALIFORNIA, by Paul H. Miller. 1 Oct 55, 69p. 7 refs. NOTS-1274; NAVORD Rept. 4952.
Order from LC mi$3.90, ph$10.80 PB 148 045

The results of this study form a useful tool for the weather forecaster and for use in scheduling tests requiring certain upper wind parameters. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
THE MEASUREMENT AND SIGNIFICANCE OF DEW, by William C. Robison. Sep 59, 20p. 30 refs. Research Study rept. RER-28; AD-230 370.
Order from LC mi$2.40, ph$3.30 PB 146 468

Dew is a micrometeorological phenomenon that was studied sporadically in many countries. Methods of measuring amounts of dew at observing stations are not standardized on a world basis or within the U. S. For laboratory study, drosometers, based on the difference in weight of a receptor before and after exposure, are most suitable, and are often used in conjunction with a recording cylinder. For observations at field stations, an optical method has considerable advantages. (Author)

Frost Science

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
DETERMINATION OF THE MODULUS OF ELASTICITY OF ARTIFICIAL SNOW-ICE IN FLEXURE, by Leif K. Halvorsen. Master's thesis. Feb 59, 27p. 5 refs. Research rept. 31; AD-216 681.
Order from LC mi$2.70, ph$4.80 PB 148 474

This study was initiated to determine the modulus of elasticity for artifical snow-ice, and to arrive at some method of making flexural tests on snow and ice. The testing was done at the Keweenaw Field Station, Houghton, Michigan. Fifty-eight snow-ice beams were tested with variation in density and loading rate. Results show that both loading rate and density influence the value of the modulus of elasticity (E). A variation in density from 0.621 to 0.719 g/cm^3 gave a variation of E from 1.35 x 10^4 to 2.22 x 10^4 kg/cm^2. A variation in the relative time of deflection from 42 sec/0.0200 to 23 sec/0.0200 cm gave a variation of E from 1.22 x 10^4 to 1.45 x 10^4 kg/cm^2. The modulus of rupture was found for different conditions and the effect of the density variation computed. For the density range studied, the modulus of rupture varied from 7.79 to 11.54 kg/cm^2. The failure appeared to be a combination of shear and flexure. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
RECOMMENDED STANDARDS FOR SMALL-SCALE ICE STRENGTH TESTS, by T. R. Butkovich. Nov 58, 9p. 4 refs. Technical rept. 57, AD-211 569.
Order from LC mi$1.80, ph$1.80 PB 146 560

The effects of specimen size and shape on the strength values obtained with small-scale unconfined compressive tests are shown. Results are given that show that a loading rate of 0.5 kg/cm^2-sec is required for all small-scale strength tests to minimize plastic effects which accompany slow loading of ice. The ring test, which is a useful new type of test to measure the tensile strength of ice, is described. Recommended standards for specimen size, shape, and configuration along with loading rates and equipment are discussed. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
SOME PHYSICAL PROPERTIES OF ICE FROM THE TUTO TUNNEL AND RAMP, THULE, GREENLAND, by T. R. Butkovich. May 59, 21p. 7 refs. Research rept. 47; AD-225 569.
Order from LC mi$2.70, ph$4.80 PB 148 475

Strength, density, elasticity, crystal size, bubble size, and fabric of the ramp ice and 5 types of tunnel ice were studied, and ice temperatures and ceiling deformation in the tunnel were measured. Crushing and ring tensile strength tests were made in a tunnel room at -5C on cylindrical cores (3 in. diam and 9 in. long) taken horizontally and vertically in the tunnel and vertically in the ramp, and flexural strength was

measured on horizontal and vertical beams from both the tunnel and the ramp. The crushing strength of tunnel ice showed slight differences among ice types, but not between horizontal and vertical samples: and fitted the empirical equation relating crushing strength to density. The equation did not hold for ramp ice of average density, probably because of layering. The results of ring tensile tests were similar to those of crushing tests, except that the equation relating ring tensile strength to the density of high-density snow gave values about 20% higher than for tunnel ice. The flexural strength of ramp ice was about half that for tunnel ice and comparable to. but consistently lower than, ring tensile values. The static modulus of elasticity was about 1/5 the average dynamic modulus, and increased with increasing rate of load application, approaching the value of the dynamic modulus as a limit. Lower values of the static modulus were observed for ramp ice. Deformation studies in a tunnel room (100 x 30 ft) indicated that the room is closing primarily by a block action. (Author)

Denver U., Colo.
GLACIOLOGICAL INVESTIGATIONS IN THE TUTO AREA OF GREENLAND, by T. M. Griffiths. Final rept. on Ramp Studies in Thule Area, Contract DA 11-190-ENG-20. Apr 60, 72p. 7 refs. Technical rept. 47.
Order from LC mi$4.50, ph$12.30 PB 149 123

This report is primarily concerned with work accomplished during the 1956 field season, but observations and data obtained in 1954 and 1955 are included in many cases.

Naval Civil Engineering Lab., Port Hueneme, Calif.
STRAIN GAGE TECHNIQUE FOR DYNAMIC MEASUREMENT OF ICE, by Don B. Clark. Interim rept. 18 Feb 60, 21p. Technical rept. 060; AD-235 057.
Order from LC mi$2.70, ph$4.80 PB 146 971

The Laboratory is undertaking a study of the properties of sea ice. A technique for applying resistance wire strain gages to ice samples for dynamic measurement of strain has been developed to facilitate this study. A coating was found which would maintain the high electrical impedance necessary between the strain gage and sea ice samples. Strain gages were applied to various samples of fresh water and sea water ice. These were compression-loaded dynamically to failure while the strain was recorded with an oscillograph and bridge amplifier. Sufficient strain data was recorded to indicate the validity of the new technique. Under rapid compression loading to a point near failure of the ice, a strain gaged ice sample can be cycled without permanent deformation or flow of the ice, and without slippage of the gage. Gages properly coated are shown to hold their high electric impedance against sea water ice for a period of time exceeding three weeks. Resistance wire strain gages, with proper preparation and application, can be used advantageously to measure the dynamic strains in fresh water ice or sea ice, and thus determine their structural characteristics. (Author)

Geography

Arctic Inst. of North America, Washington, D. C.
NORTHERN ELLESMERE ISLAND: CAPE ALDRICH TO CAPE COLGATE, NORTHWEST TERRITORIES, CANADA, by James R. Lotz. Scientific rept. no. 1 on Contract AF 19(604)3073. Apr 59, 101p. 54 refs. Publication no. 1; AFCRC-TN-60-274.
Order from LC mi$5.70, ph$16.80 PB 148 221

This report deals with location and extent; exploration; topography of Cape Aldrich, Cape Columbia, Cape Columbia to Disraeli Bay, Disraeli Fiord and Ward Hunt Island, Cape Discovery, M'Clintock Fiord, Cape Richards, Ayles Bay, Yelverton Fiord, Phillips Bay to Yelverton Fiord, Phillips Bay, and Phillips Bay to Cape Colgate; ice features along the coast; traveling conditions along the coast of Northwest Ellesmere Island, including weather, climate, and scientific work determined by Aldrich, Peary, Marvin, the 1953, and the 1954 expeditions; times of beginning and ending of the melt; regional and structural geology; geomorphology and glaciation; vegetation; and wild life.

California U., Los Angeles.
TRANSPORTATION AND PHYSICAL GEOGRAPHY IN WEST AFRICA, by Benjamin E. Thomas. Technical rept. no. 2 on Human Environments in Central Africa Projec., Contract DA 19-129-qm-1309. 1960, 58p. 23 refs.
Order from LC mi$3.60, ph$9.30 PB 147 939

This report includes a set of 12 original maps showing the monthly changes in usable roads and waterways in French West Africa. Because data have already been collected on roads and inland waterways, these routes receive special attention, and items for which material is not at hand, such as ports, seaways, and airways, are omitted. French West Africa was selected as the focus of the study because it reaches from the heart of the Sahara to the Guinea Coast and extends over all the major types of physical areas that are found in West Africa.

National Research Council, Washington, D. C.
THE KABUL, KUNDUZ, AND HELMAND VALLEYS AND THE NATIONAL ECONOMY OF AFGANISTAN. A STUDY OF REGIONAL RESOURCES AND THE COMPARATIVE ADVANTAGES OF DEVELOPMENT, by Aloys Arthur Michel. Rept. no. 5 on Foreign Field Research Program, Contract Nonr-2300(09). 1959, 460p. 67 refs. AD-225 909.
Order from LC mi$11.10, ph$69.60 PB 148 602

Contents:
Regional studies
- The Kabul Valley
- The Kunduz Valley and related areas
- The Helmand Valley: geographical and historical setting
- The Helmand Valley: the project areas along the Helmand
- The Helmand Valley: the project areas along the Arghandab
- Hydroelectric, industrial and commercial features of the Helmand Valley project
- Evaluation of the Helmand Valley project within its own region

Interregional analysis
- The direction of Afghan economic development
- The location of Afghan economic development
- Power resources and requirements of industrial development
- Transportation resources and requirements of development
- The three regions and the national economy of Afghanistan

Oceanography

Marine Lab., U. of Miami, Coral Gables, Fla.
A DATA REPORT OF FLORIDA GULF COAST CRUISES, by Frank Chew, S. J. Bein and J. H. G. Stimson. Rept. on Contract Nonr-840(01). June 59, 121p. Rept. 59-1; AD-220 751.
Order from LC mi$6.30, ph$19.80 PB 146 704

This DATA REPORT contains hydrographic and chemical data collected during the 8 major cruises sponsored by the Florida State Board of Conservation during the two-year period beginning July 1955. The data for each station are reported in two parts. The first part, entitled BATHYTHERMOGRAPH OBSERVATIONS, give the date, hour, location and depth of station, sea surface temperature, wind, and air temperature; the bathythermograph instrument number is given for some cruises, in others, the surface salinity (or the sample number for surface salinity) is given. The second part contains the salinity, phosphorus, nitrate and nitrite at the indicated depths. Where pertinent, surface water movements as determined by the GEOMAGNETIC ELECTROKINETOGRAPH (GEK Current), von Arx, W. S. 1950, (An electromagnetic method for measuring the velocities of ocean currents from a ship under way, Pap. Phys. Oceanogr. Meteor. 11(3); 1-62), are also included. Serial numbers of drift tubes are included for one cruise to show the method of recording.

Marine Lab., U. of Miami, Coral Gables, Fla.
RECONNAISSANCE SURVEY OF THE BATHYMETRY OF THE STRAITS OF FLORIDA, by Violet B. Siegler. Technical rept. on Contract Nonr-840(01). June 59, 18p. 15 refs. Rept. 59-3; AD-227 264.
Order from LC mi$2.40, ph$3.30 PB 146 702

The area of the Straits of Florida surveyed in this report extends from approximately 27°15' N (St. Lucie Inlet) along the Florida coast to 24°30' N (the area of Key West) and from 81°50' W to the Grand Bahama Bank. This swath of water extends roughly 250 miles from the above-mentioned north and south points and varies from 40 to 90 miles in width.

Naval Ordnance Test Station, China Lake, Calif.
DEEP-SEA TEMPERATURE METER, by Hugh B. Martin, III and George R. Lewis. 8 Sep 59, 20p. NOTS TP-2321; NAVORD rept. 6589; AD-234 963.
Order from LC mi$2.40, ph$3.30 PB 146 986

An electronic, frequency-modulated instrument for the continuous measurement of ocean temperature was designed. Pressure, velocity of sound propagation, and other parameters can be measured and recorded simultaneously. This transistorized meter is small and easy to handle, covers a temperature range of 0 to 30°C with a sensitivity of 0.01°C and an accuracy of 0.03°C, and operates in the frequency range of 5,000 to 8,000 cps. (Author)

New York U. Coll. of Engineering, N. Y.
A STUDY OF WAVE FORECASTING METHODS AND OF THE HEIGHT OF A FULLY DEVELOPED SEA ON THE BASIS OF SOME WAVE RECORDS OBTAINED BY THE O. W. S. WEATHER EXPLORER DURING A STORM AT SEA, by Willard J. Pierson, Jr. Technical rept. on Contract Nonr-285(03). June 59, 34p. 18 refs. AD-220 419.
Order from LC mi$3.00, ph$6.30 PB 146 694

The growth of the waves in a storm in which the wind speed increased from 25 kn to 62 kn and in which the significant waves grew 6 ft to 42 ft as recorded by the O. W. S. Weather Explorer is studied. Spectra computed from the records are compared with results of Darbyshire and Neumann. The spectral forms given by Neumann for partially developed seas do not agree with the observed spectra, although the height forecasts are good. The results indicate that the height of a fully developed sea as a function of wind speed as given by Neumann is an overestimate. They also suggest that the data studied by Darbyshire do not correspond to fully developed seas for the higher wind speeds and that the height of a fully developed sea as given by Darbyshire is an underestimate. (Author)

Scripps Institution of Oceanography, U. of California, La Jolla.
IMPULSIVELY GENERATED WAVES, by William G. Van Dorn. Rept. no. 2 on Contract Nonr-233(35). 12 Aug 59, 80p. 28 refs. AD-225 953.
Order from LC mi$4.50, ph$12.30 PB 148 181

The prediction of the local effects from long period water waves incident upon an arbitrary coastline is approached on a dimensional basis for lack of an adequate hydrodynamic theory. A model for wave runup and shoreline height on a sloping beach is constructed by extrapolating the results of laboratory experiments. The model leads to predictions in satisfactory agreement with field observations of local effects from two large tsunamis. Curves are provided for predicting local offshore wave height and length from an arbitrary source of known energy, as well as local effects in terms of the offshore height. The predictions are considered to be accurate within a factor of 1.8 (70% probability). An attempt is made to construct prediction curves for tsunamis based on wholly seismic evidence by analogy to waves from explosions, but the results are indeterminate, since they depend upon a knowledge of the focal depth of earthquakes. It is concluded that a chain of long-wave stations on selected small islands could give ocean-wide advance warning of dangerous tsunamis, and quantitative predictions of local effects in critical areas. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
DESIGN WIND PROFILES FROM JAPANESE RELAY SOUNDING DATA, by Norman Sissenwine, Matthew T. Mulkern (Wolf Research and Development Corp.) and Henry A. Salmela. Dec 59, 37p. 14 refs. Air Force Surveys in Geophysics no. 117; AFCRC-TR-59-292; AD-234 551.
Order from LC mi$3.00, ph$6.30 PB 147 444

The best balloon-measured upper winds over Japan are the Tateno relay soundings, a special series of observations especially developed to provide an accurate sounding capability for this area. From these soundings (which are corrected for the curvature of the earth), only those in which a wind speed at either 3, 6, 9, 12, or 15 km exceeds the values achieved 99 and 95% of the time were selected. Profiles, both synthetic and typical, exhibiting general characteristics common to these high-speed cases, are presented. Directional changes accompanying the wind shears are found to be small in the majority of the soundings. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
ATMOSPHERIC NET-RADIATION FLUX DURING WINTER IN THE THULE AREA, GREENLAND, by Robert W. Fenn and Helmut K. Weickmann, 4 Jan 60, 13p. 4 refs. USASRDL technical rept. 2090; AD-230 757.
Order from LC mi$2.40, ph$3.30 PB 148 001

A brief description of an airborne IR net-radiation receiver (developed in Germany) is given. The results of 2 radiosonde flights made with this element at Thule Greenland, on 14 and 15 Feb 1959 are shown. The outgoing net-radiation flux increases with altitude from 0.05 cal cm^{-2} min^{-1} at the surface to about 0.2 cal cm cm^{-2} min^{-1} between 10,000 and 20,000 m. Above 25,000 m the outgoing net-radiation flux again decreases considerably. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
FIELD OPERATION OF ROCKET-GRENADE ATMOSPHERIC SOUNDING SYSTEM, by Milton Berdan. 15 Feb 60, 42p. USASRDL Technical rept. 2096.
Order from LC mi$3.30, ph$7.80 PB 148 540

This report provides a description of the installation and operation of the instrumentation system used for the rocket-grenade atmospheric sounding experiments conducted on the Island of Guam during October and November 1958. This report describes only the instrumentation, system, and equipment used, and does not deal with the data acquired or the reduction and evaluation of these data. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
HIGH ALTITUDE RADIOSONDE FLIGHTS, 1956. PART IV, by Marvin Lowenthal and A. Arnold. 15 Mar 59, 231p. 6 refs. USASRDL technical rept. 2018; AD-226 686.
Order from LC mi$10.20, ph$36.30 PB 146 391

The 1956 series of Signal Corps cooperative high-altitude radiosonde flights is described. Temperature and wind data were analyzed, and the results are discussed. The monthly data for 8 locations in North America are presented for January and July 1956, as well as cross sections along the east and west coasts for the same months. (Author) (See also PB 138 430)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MEASUREMENT OF ELECTRIC FIELD, AIR-EARTH CURRENT, AND CONDUCTIVITY, by Joseph J. Kreig. 1 Dec 59, 14p. 4 refs. USASRDL technical rept. 2085; AD-231 864.
Order from LC mi$2.40, ph$3.30 PB 148 000

Instrumentation for measuring, simultaneously, the three basic atmospheric electric elements-electric field, air-earth current, and conductivity-is described. The apparatus includes an automatic switch which allows a micro-microammeter to monitor four inputs, and a multi-point recorder for registering the data on a single chart. The instrumentation has operated for extended periods in the Arctic with a nominal amount of maintenance. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MEASUREMENT OF THE CONCENTRATION AND SIZE DISTRIBUTION OF PARTICULATES IN THE ARCTIC AIR OF GREENLAND, by Robert W. Fenn. 15 Feb 60, 14p. 12 refs. USASRDL Technical rept. 2097; AD-237 035.
Order from LC mi$2.40, ph$3.30 PB 148 541

A series of aerosol measurements at a remote site on the Greenland Icecap (Fist Clench, 210 miles east of Thule Air Force Base) was conducted during August 1959 in order to determine the concentration and the size distribution of the natural aerosol in air which is free of direct contamination from the soil or any human activity. Analyses made with a Goetz Aerosol Spectrometer and a particle cascade impactor show concentrations between 1 and 3 particles per cm^3 and a very narrow size spectrum of 1 micron $\pm$ 0.1 micron diameter Some aspects for a possible explanation of this very distinct and characteristic aerosol distribution are discussed. (Author)

California U., Los Angeles.
SCATTERING PROPERTIES OF ATMOSPHERIC AEROSOLS, by Robert S. Fraser. Scientific rept. no. 2 on Light in the Atmosphere, Contract AF 19(604)2429. Oct 59, 189p. 57 refs. AFCRC-TN-60-256; AD-233 288.
Order from LC mi$8.40, ph$28.80 PB 146 645

The purpose of the presented study was to determine the intensity and polarization of light scattered by a unit volume of an atmospheric aerosol, for different models of size distribution of aerosol particles. The four polarization parameters were expressed in terms of the four Stokes parameters. Each of the four polarization parameters showed an appreciable dependence on each of the three size distributions of atmospheric aerosol models and on the wave length of the incident light. The total intensity is the only polarization parameter for atmospheric aerosols which has been measured. Measured values of the total intensity of light scattered by atmospheric aerosols were found to be similar to those computed for different models. A normalized scattering matrix was computed for each of the three aerosol models. By introduction of one of these matices into the equation of radiative transfer for a turbid atmosphere, a numerical solution can be obtained in principle. However, numerical computations of the solution become practical only if the number of terms in the series of the matrix elements is reduced. To reduce the number of these terms, it is necessary to introduce restrictive assumptions either into the law of scattering or into the model of size distributions of aerosol particles, or into both.

Electrical Engineering Research Lab., U. of Texas, Austin.
AN EXPENDABLE ATMOSPHERIC RADIO REFRACTOMETER, by A. P. Deam. Rept. on Contract Nonr-375(08). 15 May 59, 36p. 3 refs. Rept. no. 108; AD-217 261.
Order from LC mi$3.00, ph$6.30 PB 146 586

This report describes a device which has been designed to measure atmospheric index of refraction profiles at a frequency of 403 mc. It is a prototype instrument and should be capable of ejection from an aircraft as well as elevation with a balloon. Transmitted frequency is received at a receiver whose recorded output is relative radio index of refraction. This instrument has been successfully tested in a balloon flight to elevations of the order of 60,000 feet. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
ELECTRON DENSITIES IN THE UPPER IONOSPHERE FROM ROCKET MEASUREMENTS, by John S. Nisbet. Scientific rept. no. 126 on Ionospheric Research, Contract DA 36-061-ORD-577, 10 Dec 59, 176p. 77 refs. AD-234 128.
Order from LC mi$8.10, ph$27.30 PB 147 249

An investigation of electron densities in the upper F region of the ionosphere by new techniques employing long range rockets is described. Investigations were confined to propagation measurements between the missiles and ground stations, and to methods not requiring radio links with the missile in addition to those already incorporated for telemetry and tracking purposes. The vehicles were limited to those with satellite launch missions, and to IRBM's. Since such vehicles have considerable horizontal velocity components, suitable methods of analysis were developed. A matrix method is described for analyzing oblique dispersion measurements to provide vertical electron density height profiles. In this method account is taken of horizontal gradients, refraction, and the varying ray path zenith angles in the ionosphere. Two methods of measuring ionospheric dispersion were compared: Faraday rotation, and a method using the difference between the apparent positions of the missile obtained by 2 tracking systems operating on different frequencies. (Author)

Johannes Gutenberg-Universität, Mainz (West Germany).
ON THE HEAT BALANCE OF THE TROPOSPHERE, by Fritz Kasten, Gunther Korb and others. Final rept. on Contract AF 61(052)18. Jan 59, 123p. 19 refs. AFCRC TR-59-234; AD-232 639.
Order from LC mi$6.30, ph$19.80 PB 146 300

A study is summarized on the radiation balance of the troposphere that was begun in 1955 and is led now to a provisional conclusion. Theoretical foundations are given to calculate the synoptic distribution of the tropospheric radiation balance for single days. The resulting values are averaged with respect to large scale weather situations. The results of the months investigated are represented in maps. Charts of cloudiness and total water vapor content of the troposphere are enclosed for direct comparison. The maps of absorption, emission and tropospheric radiation balance show regions of high and low values of the respective quantities. High values of the tropospheric radiation balance mean considerable energy loss of the troposphere caused by radiative processes, vice versa. For all regions investigated maximum values of the tropospheric radiation balance are found during November and amount to 250 - 300 cal $cm^{-2}d^{-1}$. Minimum energy loss, expressed by small values of the radiation balance, results for the period from May until July with values of 140 - 190 cal $cm^{-2}d^{-1}$. (Author)

Ohio State U. Research Foundation, Columbus.
FLIGHT TEST RESULTS FOR ML-419 RADIOSONDE TEMPERATURE ELEMENTS MODIFIED TO REDUCE RADIATION ERRORS, by John H. Snow. Technical rept. no. 4A on Contract DA 36-039-sc-78153. Dec 59, 67p.
Order from LC mi$3.90, ph$10.80 PB 148 549

Fourteen balloon flights were made to compare the indicated temperatures of regular ML-419 elements and modified elements. The results and conclusions from these flights are summarized: (a) Nighttime flights: unshielded metal-coated elements have smaller radiation errors than the ML-419 element now in use; aluminum- or gold-coated elements are about equally effective at night; properly shielded metal-coated elements may have less error than unshielded elements. (b) Daytime flights: the modified elements, in all cases surrounded by radiation shields, were cooler than the ML-419 elements at low altitudes (up to 60,000 ft.) and became progressively warmer at higher altitudes; the arrangement which gave the best results was a white-painted 10-inch shield with an aluminum-coated element.

Ohio State U. Research Foundation, Columbus.
METHODS FOR REDUCING THE RADIATION ERROR OF THE ML-419 RADIOSONDE TEMPERATURE ELEMENT AT ALTITUDES UP TO 150,000 FEET, by John H. Shaw. Technical rept. no. 4 on Contract DA 36-039-sc-78153. June 59, 63p. 10 refs. AD-228 264.
Order from LC mi$3.90, ph$10.80 PB 148 548

The factors which influence the radiation error of the ML-419 Temperature Element have been evaluated. It is concluded that a significant reduction in the daytime and nighttime radiation errors of such elements is most likely to be achieved by coating the element with a highly reflecting metallic surface such as polished aluminum. This element should be placed inside a thin-walled radiation shield, black to all radiation on the inside, and a good scatterer of solar radiation and a good emitter of thermal radiation on the outside. The shield should be open at the top, and the element should be placed at such a depth that it rarely receives direct sunlight and is not in the path of air which has had thermal contact with the sides of the shield. Calculations indicate such a system should have a radiation error of less than ±0.5°K at all altitudes to 130,000 ft. (Author)

Stanford Research Inst., Menlo Park, Calif.
UPPER ATMOSPHERE CLUTTER RESEARCH. PART I. VHF AND UHF AURORAL INVESTIGATIONS AT COLLEGE, ALASKA, by R. I. Presnell, R. L. Leadabrand, and others. Final rept. pt. 1, on Contract AF 30(602)1762. Apr 59, 88p. 8 refs. SRI Proj. 2225; RADC-TR-59-34; AD-211 937.
Order from LC mi$4.80, ph$13.80 PB 147 131

The results of radar investigations of the aurora at frequencies of 216, 398, and 780 mc are presented. The characteristics of the echoes that have been recorded are range, depth in range, bearing, elevation angle, height, strength, times of occurrence, duration of echoes, and polarization effects. Two distinct types of echoes have been shown to exist, discrete and diffuse. They differ mainly in that the discrete echoes occur at night and the diffuse echoes occur during the day, and the diffuse echoes arise from a much larger reflecting region than the discrete echoes. The echoes have been compared with visual aurora, magnetic activity, earth potentials, 41-mc auroral radar data, and auroral absorption. An indication of the aspect sensitivity of the auroral reflections has been obtained. Crude estimates of the wavelength dependence of reflected echo power have been obtained for the reflections using nonsimultaneous data at 3 frequencies. (Author)

Stanford Research Inst., Menlo Park, Calif.
UPPER ATMOSPHERE CLUTTER RESEARCH. PART III: RUSSIAN EARTH SATELLITES 1957 ALPHA AND BEAT RADIO AND RADAR DATA AND A SIMPLE SATELLITE POSITION PREDICTION TECHNIQUE, by W. E. Jaye and L. H. Rorden. Final rept. part 3 on Contract AF 30(602)1762. May 59, 66p. 6 refs. RADC-TN-59-45; AD-212 618.
Order from LC mi$3.90, ph$10.80 PB 147 025

The technique is based on equations derived for circular orbits; it is assumed that the earth is a spherically symmetrical body, that the satellite has a negligible mass, and that there are no drag forces. These equations were used to successfully predict the position of the satellite on a day-to-day basis, and to point the radar beam at the path of the satellite. Included is a description of the Doppler-frequency measuring technique and estimates of the accuracy of the measurements. The accuracy was considered to be quite good, in view of the simple equipment used. Generally, errors in the maximum slope of the Doppler-frequency-time curve were less than 5% and in the time of closest approach less than ±15 seconds. The equations used to relate satellite position to Doppler data are developed and discussed. Analysis of the accuracy of the equations shows that the calculated results are of about the same order of accuracy as the experimental data. (Author)

Stanford Research Inst., Menlo Park, Calif.
UPPER ATMOSPHERE CLUTTER RESEARCH. PART VII. DOPPLER INVESTIGATIONS OF THE RADAR AURORA AT 400 MC, by R. L. Leadabrand, R. L. Presnell and others. Final rept. pt. 7, on Contract AF 30(602)1762. Mar 59, 47p. 11 refs. SRI Proj 2225; RADC-TR-59-50; AD-213 581.
Order from LC mi$3.30, ph$7.80 PB 147 150

Using a relatively sensitive 400-mc radar located at College, Alaska, the variation of Doppler shift of auroral echoes has been determined as a function of the following parameters: (1) Azimuth angle of the radar ray, (2) Off-perpendicular intersection angle of the radar ray and the earth's magnetic field, (3) Elevation angle of the radar ray, (4) Range of the echoes, (5) Altitude of the reflection centers, (6) Time of day, (7) Number of occurrences, and (8) Amplitude of the echoes. These data have been further delineated in terms of the type of echo seen (discrete or diffuse) and whether or not the data were taken before or after magnetic midnight. An estimate of the spectrum spread of auroral echoes has been determined by pulse and CW techniques. A consistent trend in these data has been found which indicate an East-West motion of the ionospheric irregularities. There is no appreciable variation in the direction of motion with time of day or with respect to magnetic midnight. The mean velocity of the East-West motion appears to be about 500m per sec. (Author) (See also PB 147 025)

ENGINEERING

Dynamic Analysis and Control Lab., Mass. Inst. of Tech., Cambridge.
BASIC RESEARCH AND DEVELOPMENT IN FLUID POWER CONTROL FOR THE UNITED STATES AIR FORCE, by J. Lowen Shearer. Progress rept. no. 2, 1 Feb-31 May 59, on Contract AF 33(616)6120. [1959] 48p. 7 refs. WADC Technical rept. no. 59-491.
Order from LC mi$3.30, ph$7.80 PB 149 285

This report describes continuing applied research and development work on vital problems encountered in providing high performance hydraulic and pneumatic control systems for advanced system design and development. Increased emphasis on high pressure pneumatic components and systems reflects approach to an ultimate objective of employing hot gas power to operate such systems. Control valves, servomotors, gas bearings, and techniques of control are the major items discussed in this report. (Author)

Aeronautical Accessories Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
THE EFFECTS OF CABIN ATMOSPHERES ON COMBUSTION OF SOME FLAMMABLE AIRCRAFT MATERIALS, by Howard A. Klein. Rept. on Aircraft Environmental Control. Apr 60, 32p. WADC Technical rept. 59-456.
Order from OTS $1.00 PB 161 841

The effects of varying atmospheric conditions on the combustion of certain flammable materials creating fire hazards in aircraft were measured in a test chamber. Atmospheric compositions used were pure oxygen and oxygen-nitrogen and oxygen-helium mixtures in various proportions. Pressures varied from sea level to 25,000 ft altitude. Flammable materials tested included cotton cloth, 8 samples of aircraft wire, and aircraft fluids including JP-4 fuel, hydraulic fluids, and lubricating oils. Test data indicates the burning rate or ignition temperatures for each type of material under specific atmospheric conditions. Plots of the data illustrate the trends shown by the test results. (Author)

Aeronautical Structures Lab., Naval Air Material Center, Philadelphia, Pa.
EVALUATION OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) MULTI-SHAKER VIBRATION EQUIPMENT FOR CONDUCTING GROUND VIBRATION SURVEYS OF NAVAL AIRCRAFT (PHASE A) by Warren W. Yenney, Jr. and G. Borod. 15 Nov 50, 45p. Rept. no. ASL NAM DE-244, pt. 1.
Order from LC mi$3.30, ph$7.80 PB 146 464

The Massachusetts Inst. of Tech. (M. I. T.) multi-shaker equipment has been evaluated for conducting ground vibration surveys of naval aircraft by employing it to obtain the vibration characteristics of a standard service type F7F-3N airplane. The report describes the methods used in supporting the shakers and attaching them to the various aircraft components as well as the general testing procedures. Since it is intended that this report serve as an example of the types of information that may be obtained with the equipment, sufficient photographs, plates, and records have been included to aid in explaining the methods employed in these tests to prospective users of this equipment.

Air Force Missile Development Center, Holloman AFB, N. Mex.
SEALED CABIN ATMOSPHERE PROBLEMS, by Erwin R. Archibald and David G. Simons. Dec 59, 19p. 6 refs. AFMDC-TR-59-42.
Order from LC mi$2.40, ph$3.30 PB 146 356

Certain physiologic problems encountered in the design and operation of hermetically sealed cabins have been discussed. Known parameters which limit human performance were presented, along with a discussion of atmospheric environmental factors as to upper and lower limits for a flight of 24 hours duration, where conditions of "no performance decrement" are desired. Parameters discussed included: inspired carbon dioxide partial pressure, alveolar oxygen partial pressure, and total cabin pressure. (Author)

Airborne Instruments Lab. [Deer Park] N. Y.
ALTIMETERS FOR LOW ALTITUDE AND FLARE-OUT: AN INVESTIGATION OF THE STATE OF THE ART AND EQUIPMENT AVAILABILITY, by E. N. Hooton and T. C. Wellington. Rept. on Task 17, Contract FAA/BRD-16. June 59, 44p. 27 refs. Rept. no. 5791-17.
Order from OTS $1.25 PB 161 854

Increasing demands for all-weather landing capability require a study of the state of the art in the field of altimetry, with emphasis on these altimeters suitable for low-altitude and flareout. The three primary techniques used in the design of absolute altimeters are CW (radio), pulse (radar), and sonic (operating in the AF range). Subject to certain reservations--due to lack of established flareout criteria--it is concluded that quantized FM/CW techniques can meet the present low-altitude and flareout requirements. By mid 1960 there will be a choice of equipments. With the likelihood of higher accuracy requirements in the future, it is probable that non-quantized CW altimeters will be used more extensively. Currently under development, this equipment will be phased into service by the end of 1960. If extensive development of radio altimeters exhausts the possibility of further substantial improvement in performance, the capabilities of pulse radar altimeters may prove attractive. Present development shows that a high degree of accuracy is possible with light-weight equipment. Sonic altimeters have not found favor in the past because of poor signal-to-noise characteristics. Although the sonic CW altimeter shows promise, this equipment is not likely to be universally applicable. (Author)

Airborne Instruments Lab. [Mineola] N. Y.
RUNWAY CHARACTERISTICS AND PERFORMANCE OF JET TRANSPORTS IN ROUTINE OPERATION, VOLUME I. Rept. for 20 June-11 Nov 59 on Task 15, Contract FAA/BRD-16. Mar 60, 104p. Rept. no. 5791-15.
Order from OTS $2.50 PB 161 856-1

A measurement program has been completed to determine the characteristics and performance of jet aircraft during landings and takeoffs. Data were obtained by photographing the displays of the Airport Surface Detection Equipment (ASDE) radar at New York International Airport (Idlewild), with proper time and identification references. Techniques of data reduction and statistical analysis were developed to determine jet aircraft characteristics and performance. The results of this analysis as well as the data will be useful in various airport research programs, for they comprise a comprehensive record of routine airline operations during various wind and temperature conditions. In addition, the data can be used in the analysis of aircraft performance to determine runway length criteria, and acceleration and deceleration during landings and takeoffs. This technique of obtaining large samples of routine aircraft characteristics and performance data--some-

thing not heretofore available in a practical manner--should be encouraged to obtain similar information on other aircraft types.

Airborne Instruments Lab., Deer Park, N. Y.
RUNWAY CHARACTERISTICS AND PERFORMANCE OF JET TRANSPORTS IN ROUTINE OPERATION, VOLUME II. APPENDIX E. TABULATION OF BASIC DATA. Rept. on Task 15, Contract FAA/BRD-16. Mar 60, 281p. Rept. no. 5791-15.
Order from OTS $4.00 PB 161 856-2

See also PB 161 856-1

Airborne Instruments Lab., Deer Park, N. Y.
RUNWAY CHARACTERISTICS AND PERFORMANCE OF SELECTED PROPELLER-DRIVEN AIRCRAFT IN ROUTINE OPERATION. Rept. on Task 15, Contract FAA/BRD-16. Apr 60, 185p. 2 refs.
Order from OTS $3.00 PB 161 857

The average times for an aircraft to decelerate to 60 miles per hour from crossing the runway threshold are 28, 25, 31, and 14 seconds, respectively, for the four categories studied. The ground speeds, 900 feet past the runway threshold, are 114, 109, 98, and 61 knots. The rate of deceleration increases to a maximum at a velocity between 75 to 85 knots for four-engine aircraft and 50 knots for the twin engine aircraft. (Author)

Armour Research Foundation, Chicago, Ill.
DETERMINATION OF EMISSIVITY AND REFLECTIVITY DATA ON AIRCRAFT STRUCTURAL MATERIALS. PART III. TECHNIQUES FOR MEASUREMENT, by O. Harry Olson and James C. Morris. Rept. for 1 May 57-1 May 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3002. Apr 60, 104p. 5 refs. WADC Technical rept. 56-222, Pt. III.
Order from OTS $2.50 PB 161 839

Total normal emissivity is the ratio of total normal radiance emitted by a material to that emitted by an ideal blackbody at the same temperature. Parts I and II describe equipment and techniques employed for obtaining total normal emissivities of conducting materials, such as metals, at elevated temperatures. Part III describes equipment and techniques developed to make similar measurements on non-conducting materials such as refractories and glasses. Several samples are heated simultaneously in a tubular, wire wound furnace and presented successively in the field of view of a thermistor detector through a port in the furnace wall. The equipment and methods are described and data are presented for a list of materials. Low temperature measurements were made with equipment described in Part I and II. An integrating sphere reflectometer was used to measure spectral reflectivity and transmission in the spectral range, 0.3 to 3.0 microns. This employs a Perkin-Elmer monochromator, a comparison integrating sphere, and a lead sulfide detector. (Author) (See also PB 151 603)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A DISCUSSION OF RESTRAINT AND PROTECTION OF THE HUMAN EXPERIENCING THE SMOOTH AND OSCILLATING ACCELERATIONS OF PROPOSED SPACE VEHICLES, by Carl C. Clark and R. Flanagan Gray. Rept. on Proj. TED ADC AE-1412. 29 Dec 59, 56p. 8 refs. Rept. no. 5 on Task MR 005.12-0005.6; NADC MA-5914; AD-234 597.
Order from LC mi$3.60, ph$9.30 PB 146 961

It is not the forces generated by acceleration or deceleration (at least to somewhat beyond 30 G) which damage man, but rather the body distortions which can result from an unbalanced action of these forces. By proper packaging of the human, tolerance will depend on the consequences of local tissue compression or extension rather than on the consequences of gross tissue and organ displacements and distortions. Techniques of centrifuge simulation are presented. A moulded body form contour couch provides a broadened support and reduces body distortion. Tight bandaging of the body and training in techniques of complete body straining are important aspects of these experiments. Water immersion can further reduce body distortions while under acceleration. particularly if in addition the lungs are pressurized. Work on the consequences of long duration acceleration is underway; a man has tolerated 2 G for 24 hr.

Columbia U., New York.
ON STRESS INTERACTION IN FATIGUE AND A CUMULATIVE DAMAGE RULE. PART II. 7075 ALUMINUM ALLOY, by Alfred M. Freudenthal and Robert A. Heller. Rept. for 1 Feb-31 Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3982. Jan 60, 23p. 4 refs. WADC Technical rept. 58-69. Pt. II; AD-234 448.
Order from OTS $0.75 PB 161 837

The object of this investigation was the determination of the effects of stress interaction, under randomized stress distributions representing gust and maneuver loads on aircraft wings, on the fatigue life of 7075 aluminum alloy specimens. On the basis of numerous rotating bending fatigue tests it has been demonstrated that the linear cumulative damage rule does not provide a safe fatigue life estimate of unnotched specimens. A non-linear rule representing the test results fairly well has been proposed. (Author) (See also PB 140 816)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SPECIFICATION FOR A PROXIMITY WARNING INDICATOR: PILOT RESPONSE EVALUATION TEST, by C. Wightman. Rept. on Contract AMB-15. Aug 58, 31p. 11 refs. Rept. no. JA-1266-S-5.
Order from OTS $1.00 PB 161 855

By fixing a number of possible input variables near their optimum values, it has been possible to design an experiment which will provide the desired information at much lower cost and complexity than would be required for a full treatment of all variables. The result will be an evaluation of proximity warning indicator utility under good conditions. The path to follow in future developments of such devices as well as the utility of present models should be indicated by the experimental results. (Author)

Corporation for Economic and Industrial Research, Washington, D. C.
SIMULATION OF THE NAVY AIRCRAFT OVERHAUL OPERATION, by Kenneth W. Webb. Technical rept. on Contract Nonr-2755(00). 4 May 59, 24p. Rept. no. 169-2R.
Order from LC mi$2.70, ph$4.80 PB 146 535

This report describes the formulation and use of a mathematical model for simulating the Navy airframe and engine overhaul for a calender quarter.

David Taylor Model Basin, Washington, D. C.
PRELIMINARY INVESTIGATION OF PLAN FORM EFFECT ON AUGMENTATION PARAMETER FOR PERIPHERAL-JET GROUND-EFFECT MACHINES, by Anibal Alfredo Tinajero. Feb 60, 44p. 3 refs. Aero rept. 972. AD-237 673.
Order from LC mi$3.30, ph$7.80 PB 147 727

Results of static tests of four peripheral-jet ground-effect machine plan forms, with jet angle of divergence of -45° and with various tangential deflection angles. Test divided into two parts: hovering tests (zero propulsive thrust) and propulsive thrust tests. For hovering condition most desirable plan form is circular; for configurations with propulsive thrust other than zero the % drop in augmentation decreases as plan form length-to-width ratio increases. (Author)

Daystrom Systems, La Jolla, Calif.
HIGH SPEED COMMUNICATIONS EQUIPMENT, by Bill L. Waddell, Ronald H. Jones, and Gregory Johnson. Final rept. on Contract FAA/BRD-118, formerly Contract C-13ca-693. 226p. 280 refs. Rept. no. 6005-6.
Order from OTS $3.50 PB 161 858

The scope of this report is limited to those systems which use primarily wire or cable for data transmission. All lines are considered to be one-half duplex or more. The data rates handled by the lines, terminals, and terminal equipment are in excess of 600 WPM, or 455 bits/second. The minimum message length is considered as 120 characters of seven bits per character. Point-to-point or multipoint networks are considered. The report describes the requirements of the FAA for the system, a theoretical background for understanding the new field of High Speed Data Communication, the equipment available now and in the future for such a system, and evaluations of the relative capabilities of the equipment to perform to the system requirements and theoretical parameters. Techniques of utilizing the equipment in a system are described and evaluated. Recommendations are presented for further investigation which would allow the data presented here to be utilized for specific applications.

Forest Products Lab., Madison, Wis.
SUMMARY OF RESEARCH BY FOREST PRODUCTS LABORATORY ON COMPOSITE CONSTRUCTION FOR FLIGHT VEHICLES, by Donald G. Coleman. Rept. for July 57-July 58 on Rubber, Plastics and Composite Materials, Contract AF 33(616)58-1. Feb 60, 9p. WADC Technical rept. 52-184, Sup. 6.
Order from LC mi$1.80, ph$1.80 PB 149 183

Developments in the program of research in composite construction for flight vehicles conducted by the U.S. Forest Products Laboratory during 1958 are summarized. In general the approach has been to derive design criteria mathematically, and then to check by test. Four technical reports issued during the fiscal year are abstracted. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
THE APPLICABILITY OF SIMULATION TO THE INVESTIGATION OF AIR TRAFFIC CONTROL PROBLEMS, by S. M. Berkowitz, W. W. Felton and others. Final rept. for 8 Aug 49-10 Feb 50 on Contract Cca-27722. 17 Mar 50, 118p. 7 refs. Rept. no. F-2130-1.
Order from LC mi$6.00, ph$18.30 PB 147 957

This report presents methods and devices for simulating the flight of aircraft in the general area and in the final approach areas of an airport under various conditions of wind and under various traffic control systems. Tow devices are highly recommended as capable of being pressed into immediate service for solving the problems currently demanding attention. In the final approach area each of these simulators can represent various numbers and speeds of aircraft, aircraft separation times, glide path lengths. locations of exit strips, control procedures, and wind effects. In the general approach area, the transparency simulator can study and evaluate the relative merits of different methods of air traffic control. Both simulators allow study of delays, flow rates, acceptance rates, dead runway time, distance separations at any time, time separations at any point and such other time-space concepts as may be useful in establishing measures of effectiveness of various control procedures and geographic configurations.

Motorola, Inc., Scottsdale, Ariz.
HYPERBOLIC COORDINATE CONVERTER, by E. H. Lange. Final engineering rept. 15 Sep 59-15 Jan 60, on Contract FAA/BRD-130. 15 Jan 60, 154p.
Order from OTS $3.00 PB 161 853

A study has been conducted to establish the optimum design for a practical, airborne computer that would accept the hyperbolic information available from present low-frequency navigational aids and convert it to a form better suited for air traffic control and general navigation. The outputs chosen for display are distance-to-go and cross-track distance, since these coordinates correspond to displacement from, and distance along, a pre-assigned corridor. The design philosopy employed resolves the conflicting requirements of computer simplicity, long-range operation, and high accuracy report of present-position. The associated computation time is shown to be compatible with the dynamic constraints imposed by atmospheric noise and aircraft velocity considerations. The recommended coordinate converter can be readily combined with other navigational aids to form a complete and integrated control system. Full derivations of the appropriate mathematical results are included along with substantial documentation of the major conclusions reached.

National Research Labs., Ottawa (Canada).
GENERALIZED TABLES FOR THE CALCULATION OF TRAJECTORY CURVES FOR BODIES MOVING IN AIR, by M. M. Currie. 1 Apr 60, 57p. 1 ref. Aeronautical rept. LR-277.
Order from LC mi$3.60, ph$9.30 PB 148 427

Tables are presented from which the cartesian coordinates of a trajectory can be readily derived for any initial conditions if the terminal velocity of the body is known. (Author)

Naval Ordnance Test Station, China Lake, Calif.
ALIGNMENT OF MOVING INERTIAL NAVIGATION SYSTEMS, by Richard B. Seeley and Roy Dale Cole. 17 Dec 59, 48p. 6 refs. NOTS TP-2279; NAVORD rept. 6561; AD-234 263.
Order from LC mi$3.30, ph$7.80 PB 146 340

This report describes and discusses some of the techniques by which a moving inertial platform may be aligned by using external velocity measurements, and also presents some of the major problems and error sources affecting such alignment. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
CAPTIVE FLIGHT TESTS OF THE KD2C-2 POWER PLANT TEST PACKAGE, by H. M. Keuhaus. Rept. on Proj. TED MTC PP-301. 10 Sep 50, declassified 12 June 56, 49p. Technical rept. no. 78.
Order from LC mi$3.30, ph$7.80 PB 148 639

Captive flight tests of the KD2C-2 power-plant package, a pulsejet-type air-engine assembly, were conducted on an A-26 parent airplane at various airspeed and altitude conditions for the purpose of determining the performance and cooling characteristics of the installation. The flight-test program disclosed that the KD2C-2 power-plant installation in its final configuration could be operated satisfactorily throughout the range of flight conditions investigated.

[Pacific] Missile [Range] Port Mugu, Calif.
DEVELOPMENT AND EVALUATION TESTING OF KDH-1 TARGET P/A, by George M. Miller. 1 Apr 49, declassified 12 June 56, 32p. 7 refs. Proj. TED MTC PA-(602, 603); Technical rept. no. 45.
Order from LC mi$3.00, ph$6.30 PB 148 627

This report treats of the results and conclusions derived from 87 flight tests of the KDH-1 target P/A conducted at NAMTC. These tests revealed many difficulties in launching, propulsion, and control that were not apparent in tests of previous low-performance target P/A. After a study of these problems, remedies were devised and tested, with resultant improvements. The test results discussed in this report provided valuable information for the construction and operation of other target P/A of this type, but did not develop the KDH-1 target P/A to a state where it could be used satisfactorily for Fleet operation. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
EVALUATION OF ELECTRONIC COMPONENTS IN CTV-N-4 AND CTV-N-6 (GORGON) AIRFRAMES, by L. E. Day. Rept. on Proj. TED MTC EL-303. 20 Oct 49, declassified 12 June 56, 77p. 5 refs. Technical rept. no. 61.
Order from LC mi$4.50, ph$12.30 PB 148 632

This report describes the work accomplished in preparing for the flight tests. It includes the development of an instrumentation recovery system and modification of JB-2 pneumatic servos for use in GORGON airframes. The results achieved are of value because of their applicability to other missile test projects.

P[acific] Missile [Range] Port Mugu, Calif.
EVALUATION OF THE KD2G-1 TARGET P/A, by Homer W. Parker. Rept. on Proj. TED MTC PA-614. 28 Oct 49, declassified 12 June 56, 80p. 4 refs. Technical rept. no. 62.
Order from LC mi$4.50, ph$12.30 PB 148 633

The evaluation program was organized to study each flight in three parts. The first part consisted of the preflight preparations required to prepare the P/A for flight. The second part covered the P/A from the time of launching until the P/A was recovered by the retrieving crew. The third part covered the postflight analysis of damage, repair requirements, servicing difficulties and routine maintenance.

[Pacific] Missile [Range] Port Mugu, Calif.
EVALUATION OF THE KD2R-3 TARGET P/A, by D. E. Humbert and J. H. Hooper. Rept. on TED MTC GM-618. 20 May 52, declassified 12 June 56, 51p. 2 refs. Technical rept. no. 88.
Order from LC mi$3.60, ph$9.30 PB 148 640

The KD2R-3 meets the majority of the performance requirements, but that certain changes must be made for its improvement. The P/A was found to be acceptable from a maintenance and serviceability standpoint provided minor changes are made.

[Pacific] Missile [Range] Port Mugu, Calif.
FLIGHT AND GROUND TESTS OF THE KDH-1 TARGET P/A, by George M. Miller. Rept. on TED MTC PA-612. 19 Apr 50, declassified 12 June 56, 36p. Technical rept. no. 72.
Order from LC mi$3.00, ph$6.00 PB 148 637

[Pacific] Missile [Range] Port Mugu, Calif.
FLIGHT TESTING OF THE KDG-2 TARGET P/A, by J. B. Stevens and Norman Rohn. Rept. on Proj. TED MTC PA-610. 12 Apr 50, declassified 12 June 56, 68p. 13 refs. Technical rept. no. 71.
Order from LC mi$3.90, ph$10.80 PB 148 636

In the flight test phase of the project, air speed, rate of climb, receiver range, maneuverability and controllability, endurance, and launching characteristics

were examined. The changes considered most essential as a result of these tests include: elimination of the propeller spinner, strengthening the tank section to withstand parachute landings, modification of the servomotors, adoption of the 32-foot standard parachute, and improvement of the flotation characteristics. Certain other changes discussed in this report are considered desirable but not necessary.

[Pacific] Missile [Range] Port Mugu, Calif.
THE GENERAL PERFORMANCE AND SPECIFICATION CONFORMITY OF THE KD2R-2 TARGET P/A, by George M. Miller. Final rept. on Proj. TED MTC PA-609. 1 Sep 59, declassified 12 June 56, 43p. 5 refs. Technical rept. no. 59.
Order from LC mi$3.30, ph$7.80 PB 148 630

The tests described herein were conducted for determination of the general performance of the KD2R-2 and its conformance with specifications. The results obtained from these tests indicate that the KD2R-2 conforms generally to the Detail Specifications, but does not have adequate flotation or watertight integrity characteristics. With the recommended modifications incorporated, the P/A should be suitable for Fleet use. It is considered to have very satisfactory stability and structural integrity characteristics. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
TEST AND EVALUATION OF THE KD3G-2 (SNIPE) TARGET P/A, by W. C. Slowey. Final rept. on Proj. TED MTC PA-604.2. 19 June 50, declassified 12 June 56, 76p. 8 refs. Technical rept. no. 74.
Order from LC mi$4.50, ph$12.30 PB 148 638

In the over-all performance phase of the project, air speed, maneuverability and controllability, endurance, launching characteristics, parachute recovery, and flotation times were examined. Component performance evaluation was based on behavior during flight and upon laboratory-type ground tests of those components to which failures were attributed or in which failures were anticipated. As a result of these tests, the changes to the target P/A recommended as most essential include: attachment to the fuselage of a protective longitudinal keel, use of a stronger and more easily repairable tank section, modification of the servomotors, shielding of ignition leads, improvement in design and construction of engine cowl, strengthening of parachute suspension cables, and improvement of flotation characteristics.

[Pacific] Missile [Range] Port Mugu, Calif.
TEST AND EVALUATION OF THE XKD2R-1 TARGET P A, by George M. Miller. 27 Sep 48, declassified 12 Jun 56, 46p. 6 refs. Proj. TED MTC PA-607; Technical rept. no. 32.
Order from LC mi$3.30, ph$7.80 PB 148 625

This report discusses the numerous static and flight tests of the XKD2R-1 target P/A, and its evolution to a remotely-controlled target pilotless aircraft suitable for Fleet use. A total of 89 flight tests were made during the test and evaluation program. Many modifications were made to the aircraft with the result that the XKD2R-1 became a reliable and efficient target P/A suitable for production and service use. The modified XKD2R-1 proved to be superior to all previous service target P/A. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A NEW THEORY OF SANDWICH PLATES. GENERAL CASE, by Yi-Yuan Yu. Technical note no. 6 on Contract AF 49(638)453. Nov 59, 28p. 8 refs. AFOSR-TN-59-1163; AD-234 222.
Order from LC mi$2.70, ph$4.80 PB 146 741

The general 2-dimensional case is given of a new theory of elastic sandwich plates. Extension as well as flexure is considered, and the core of the sandwich may be either isotropic or orthotropic. The general theory is valid for any symmetrically arranged 3-layered plate and for vibration analysis involving wide frequency ranges. For sandwiches with very thin faces simplified equations good for limited frequency ranges are deduced. A brief discussion is given on sandwiches with cores composed of Kelvin-Voigt material. (Author)

Princeton U., N. J.
MANEUVERING CAPABILITY OF AN ANNULAR JET GROUND EFFECT MACHINE, by W. B. Nixon. Rept. on Contract DA 44-177-TC-524. May 60, 71p. 9 refs. Dept. of Aeronautical Engineering rept. no. 515.
Order from LC mi$4.50, ph$12.30 PB 148 776

An elementary analysis, employing non-mixing theory, is made of three general methods of control. The possible advantages of redistributing the annular jet strength are investigated. The slanted jet "integrated" system is the most effective within certain restrictions. Separate thrusting and tilting are seen to have some attributes, particularly in practical application. Side force fins are suggested. The pitching moments introduced with the application of control forces are discussed. Yaw control is found to be more effective with the slanted jet. A comparison with other surface vehicles accentuates the maneuvering limitations of a GEM. Operation over land may require much higher hovering capability than is generally conceded on the basis of performance. (Author)

Princeton U., N. J.
SOME QUALITATIVE CHARACTERISTICS OF A TWO-DIMENSIONAL PERIPHERAL JET, by W. B. Nixon and T. E. Sweeney. Rept. on Contract DA 44-177-tc-524. Sep 59, 19p. Aeronautical Engineering rept. no. 484; AD-233 215.
Order from LC mi$2.40, ph$3.30 PB 146 607

Base pressure distributions of a 2-dimensional peripheral jet model in simulated hovering flight is discussed. Flow patterns were deduced from these distributions and were verified with smoke studies. The standing vortex associated with this type of device is plotted as a function of altitude and angle of inclination, and the relationship between the vortex and static instability is shown for 3 initial jet angles. Also included is a brief discussion of the unsteady flow pattern generated at certain altitudes and initial jet angles. This flow is plotted and is shown to deteriorate, apparently, into a Karman street - possibly explaining the critical altitude reported by other investigators. (Author)

Southern Research Inst., Birmingham, Ala.
DETERMINATION OF THE MECHANICAL PROPERTIES OF AIRCRAFT-STRUCTURAL MATERIALS AT VERY HIGH TEMPERATURES AFTER RAPID HEATING, by James B. Preston and J. Robert Kattus. Rept. for May 57-June 59 on Development and Evaluation of Materials for ICBM and IRBM Applications, Contract AF 33(616)3494. Apr 60, 81p. 18 refs. WADC Technical rept. 57-649, Pt. II.
Order from OTS $2.25 PB 161 893

The short-time, elevated-temperature tensile properties were determined and are reported (1) for unalloyed beryllium at temperatures from ambient through 1500°F (2) for ten combinations of base materials (ETP copper, A-nickel, unalloyed molybdenum, and molded graphite) with protective coatings (chromium and nickel by electroplating; aluminum oxide, zirconium oxide, and zirconium silicate by flame spraying; silicon carbide and silicon carbide-nitride by a diffusion reaction on the surface of graphite), and (3) for a typical high-temperature alloy with linear temperature gradients normal to the axis of loading. (Author) (See also PB 131 664)

Stanford U., Calif.
HIGH TEMPERATURE STRUCTURES, by N. J. Hoff. Rept. on Contract AF 49(638)223. June 58, 46p. 30 refs. SUDAER no. 79; AFOSR-TN-60-383.
Order from LC mi$3.30, ph$7.80 PB 148 750

A survey is given of the new problems confronting the airplane and missile structural designer and analyst in consequence of aerodynamic heating. The need to expand the knowledge of the structures man into such fields as gas dynamics, thermodynamics and the physics of the solid state is pointed out. (Author)

United Research, Inc., Cambridge, Mass.
A METHOD FOR DETERMINING THE ECONOMIC VALUE OF AIR TRAFFIC CONTROL IMPROVEMENTS AND APPLICATION TO ALL-WEATHER LANDING SYSTEMS. VOLUME I. Rept. on Contract FAA/BRD-17. [1960] 28p.
Order from OTS $0.75 PB 161 852

The method developed for the determination of economic benefits associated with Air Traffic Control improvements is based on the measure of the effects of these improvements (1) in dollar terms on the demand for and the cost of airline passenger transportation, (2) on the costs of general aviation transport, including value of passenger time, and (3) on the annual value of the accidents (loss of property and life) prevented. To determine the annual net return from any selected improvement, the dollar values determined for each of the above measures are summed and the annual operating costs of the improvement are then subtracted. A present value formula which takes into consideration the applicable interest rate and the number of years the improvement can be expected to be in operation is then applied to determine the investment in an improvement which can be justified. In applying the method to a selected improvement the two necessary preliminary steps are determination of the physical effect of the improvement and calculation of the annual reduction in the physical units of disruption, delay, cancellation and diversion. Economic benefits associated with an improvement can then be computed. The method is applied to the effects of an all-weather landing system.

Vehicle Research Corp., Pasadena, Calif.
LIFT CHARACTERISTICS OF WINGS EXTENDED THROUGH PROPELLER SLIPSTREAMS, by Scott Rethorst, Winston Royce and T. Yao-tsu Wu. Rept. no. 1 on Contract Nonr-2388(00). Sep 58, 178p. 16 refs.
Order from LC mi$8.10, ph$27.30 PB 146 592

The study has shown that the lift generating capabilities of wings extending through a jet varies greatly with the wing plan form. The study has shown the existence of and located the finite optimum plan forms for such wings for an extensive range of wing areas and jet velocity ratios. The results obtained have been shown in the limit to approach well known uniform flow results. The results suggest that programmed sectional wing twist, provided for example by flaps, would permit the attainment of an exceptionally high stalling lift coefficient with a gradual stall pattern progressing inboard to the root.

Vehicle Research Corp., Pasadena, Calif.
LIFTING SYSTEMS FOR VTOL VEHICLES, by Scott Rethorst and W. W. Royce. Rept. no. 2 on Contract Nonr-2388(00). 2 May 59, 76p. 4 refs.
Order from LC mi$4.50, ph$12.30 PB 146 523

The various lift generating systems currently of interest for VTOL vehicles are analyzed and compared. Among the lift systems discussed are fixed wing, actuator disc, both ducted and unducted, annular jet, and pressure leakage devices. The force generation of each of these devices is derived from fundamentals. A simple theory for the annular jet is formulated and developed far enough to demonstrate its primary features so as to permit comparison with the other arrangements. Efficiency and force effectiveness, at both zero and forward velocities, are then calculated to provide a uniform basis for the comparative evaluation of these several lifting systems.

Chemical Engineering

Brigham Young U. [Provo, Utah].
HIGH TEMPERATURE STUDIES, by H. Tracy Hall. Final rept. for 19 June 56-31 Mar 60 on Contract DA 04-495-ORD-792. [1960] 41p. 6 refs. OOR rept. 1692.2-Met.
Order from LC mi$3.30, ph$7.80 PB 148 443

An apparatus for subjecting up to 10 cubic centimeters of material to pressures of 15,000 atmospheres at temperatures as high as 10,000°C has been developed and described. The apparatus is relatively simple in its design and could readily be scaled-up by a factor of 25 in volume, if desired. Temperatures of 10,000°C can usually be maintained for periods of 5 to 15 seconds, but in some instances have been maintained for as long as one minute. With this new apparatus, a survey of the effects of very high temperature

has been made on several carbide, boride, nitride, phosphide, oxide, sulfide, and some miscellaneous systems. One material produced under these high-temperature, moderate pressure conditions may have immediate practical use. This material is fused silicon carbide. The compressive strength of this material is 30 times as great as that of ordinary hot-pressed SiC. This high strength silicon carbide may be useful as a cutting tool material. Some of the oxide systems of chromium and manganese exhibited rather high compressive strengths following high temperature treatment. This was true also for ZrB_2 and TiB_2. Some of the metallic oxides produced under high temperature conditions formed semi-conducting materials and might be of further interest with respect to their electrical properties.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
DESALINATION OF WATER. [July 60] 4p. 78 refs. OTS Selective Bibliography SB-419.
Order from OTS $0.10 OTS SB-419

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations.

Solar Aircraft Co., San Diego, Calif.
PORTABLE GAS TURBINE FOR GENERATOR DESIGN STUDY, by Leland F. Blinman. Final rept. on Contract DA 18-108-405-cml-195. 13 Mar 59, 63p. Solar ER-815; AD-212 298.
Order from LC mi$3.90, ph$10.80 PB 148 446

Gas turbine attributes for use as portable fog generators include: low weight, reliable starting and operation, controlled gas stream temperature, large volume and high velocity exhaust gas stream, low maintenance. The object of this study was the delineation of a fog generator design, based upon the gas turbine cycle, that provides the following characteristics: exhaust gas output of 2 lb/sec at 1000 deg F, variable from 800 to 1000 deg F.; fog oil rate of 150 gal/hr.; started by hand cranking (or high pressure air impingement); total weight of 102 lb, an envelope of 23 in. x 23 in. x 28. in. high; overhaul interval 50 to 200 hours.

Southern Research Inst., Birmingham, Ala.
DEVELOPMENT, CONSTRUCTION, AND TESTING OF OSMIONIC DEMINERALIZERS, by R. E. Lacey, E. W. Lang, and C. E. Feazel. Rept. on Contract no. 14-01-001-88. June 60, 95p. 7 refs. Saline Water Research and Development Progress rept. no. 38.
Order from OTS $2.25 PB 161 862

An operable over-all design for osmionic demineralization has been demonstrated on a small scale, although the size, shape, or materials of particular components may still be changed to obtain better or lower-cost operation. The estimated costs of demineralization, based on the above design, appear to be competitive with those of other processes. However, certain problems that may alter the cost picture remain to be studied in more detail.

Civil Engineering

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DUSTPROOFING AND WATERPROOFING OF SOILS. FIELD AND LABORATORY INVESTIGATIONS OF SELECTED MATERIALS, by G. R. Kozan and J. D. Stouffer. Dec 59, 90p. 7 refs. Technical rept. no. 3-530, rept. 1; AD-231 925L.
Order from LC mi$4.80, ph$13.80 PB 146 565

Based on an extensive review of soil-treatment agents, 13 materials were selected for evaluation of their dustproofing and waterproofing capabilities. Of the materials investigated, aniline-furfural, MC-O asphalt, sodium methyl-ethyl propyl siliconate, the quaternary ammonium chloride, the commercial road oil, and the chemically modified MC-O asphalt were sufficiently effective both as dustproofers and waterproofers to warrant further investigation.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PREFABRICATED AIRFIELD AND ROAD SURFACING MEMBRANES: TORRID ZONE STORAGEABILITY TESTS, 1954-1957, by S. G. Tucker. May 60, 32p. 2 refs. Technical rept. no. 3-515, rept. 2.
Order from OTS $1.00 PB 161 869

Laboratory and field tests were conducted on coated cotton duck, cotton knit, and cotton tire-cord fabrics to determine their suitability for three years storage in the Torrid Zone. The performance under exposure of dry-back adhesive, which is used to fasten strips of membrane together, was also observed. In the laboratory, the tensile strength of each membrane was determined before, during, and after the storage period; the effects of weathering were also determined by measuring thicknesses and weighing samples of the membranes before and after the three-year storage period. In the field, membrane rolls on wooden and cardboard cores were placed in a rack and exposed to prevailing weather conditions with no protection from rain or sun. The membranes were inspected periodically, and photographs taken to record important developments. Temperature, rainfall, and relative humidity data were recorded throughout the storage period. (Author)

Bureau of Yards and Docks, Washington, D. C
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES, VOLUME 1. 22 Dec 59, 283p. Technical pub. NAVDOCKS P-322; BUDOCKSINST 11014.13B.
Order from LC mi$11.10, ph$44.10 PB 147 655

Efficient and economical management requires that undermaintenance and overmaintenance be avoided, that corrective action be taken on deficiencies before deterioration necessitates major repairs, and that the various items of public works and public utilities meet their functional requirements. This publication has been prepared to gather together the numerous and interrelated responsibilities pertaining to maintenance inspection of public works, public utilities, and civil works facilities. Application of inspection, as outlined herein, will assist in protecting the Government's very large property investment.

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 2. INSPECTION GUIDES-ELECTRICAL. 2 June 58, 64p. 16 refs. Technical pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from LC mi$3.90, ph$10.80 PB 147 652

See also PB 147 655

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 3. INSPECTION GUIDES-MECHANICAL. June 58, 78p. 22 refs. Technical pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from LC mi$4.50, ph$12.30 PB 147 653

See also PB 147 652

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 4. INSPECTION GUIDES-STRUCTURAL. June 58, 48p. 16 refs. Technical Pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from LC mi$3.30, ph$7.80 PB 147 654

See also PB 147 653

Columbia U., New York.
ON THE INDEPENDENCE OF YEARLY WATER INPUTS IN DAMS, by J. Gani and B. R. Bhat, (U. of California). Rept. on Contract Nonr-266(59). [1959] 17p. 11 refs. CU-8-59-Nonr-266(59)MS.
Order from LC mi$2.40, ph$3.30 PB 148 573

The paper considers an assumption in Moran's theory of dams [Australian J. Appl. Sci. 5:116-124, 1954], this is that the yearly water inputs into a reservoir are independently distributed. To test the hypothesis, two models are constructed for the annual discharges of 17 Australian rivers. The first, a Markov process with normal residuals, leads to the tentative conclusion that discharges from most of the rivers (some only after transformation) are serially independent. From the second model, a simple Markov chain, it is shown that no reliable conclusion can be drawn. Moran's assumption is accepted as a useful first approximation for all but two of these rivers. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
DESIGN CHARTS FOR R/C BEAMS SUBJECTED TO BLAST LOADS, by J. R. Allgood and G. R. Swihart. Final rept. 11 May 60, 141p. 16 refs. Technical rept. 069. AD-237 958.
Order from LC mi$7.20, ph$22.80 PB 148 241

An ultimate load theory is combined with an idealized dynamic theory to form a computational program for the development of a set of design charts for reinforced concrete beams. The behavior of beams under blast loading is reviewed to aid in the explanation of the computational program and the charts. A procedure for the treatment of shear and bond is presented; the design curves are given and exemplified; and their limitations are discussed.

Electrical and Electronic Engineering

Admiral Corp., Chicago, Ill.
EVALUATION-DEVELOPMENT OF MIL-C-14157 CAPACITORS FOR NUCLEAR RADIATION ENVIRONMENT, by E. R. Pfaff. Scientific rept. no. 3 on Contract NObsr-77612. May 60, 77p.
Order from LC mi$4.50, ph$12.30 PB 148 237

In environmental tests forty-nine of the fifty irradiated samples failed within 154 hours. Of the fifty control samples, eighteen are remaining on test after 400 hours. The irradiated group with the pulsed voltage applied failed rapidly after 65 hours indicating a possible structural change in the units. After 300 hours of irradiation Mylar and Kraft paper were extremely brittle and the units had high internal gas pressure. Preliminary studies of FS-5 and FC-43 dielectric fluid indicate they evolve Fluorine gas during irradiation. Capacitors impregnated with C_{16-18} alkyl bi-phenyl dielectric fluid and solid impregnants are being investigated. (Author)

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
SIMULTANEOUS HEAT AND MASS TRANSFER AND ITS APPLICATION TO AIRBORNE ELECTRONIC COOLING, by A. Saltzman. Technical note. 4 May 56, 29p. 3 refs. Rept. no. NADC-EL-N5626.
Order from LC mi$2.70, ph$4.80 PB 148 422

Emphasis is placed on the role of momentum and mass transfer as the "cause" of the cooling problem, and on the limitations of using air alone as a coolant. The main facets of the cooling problem include important design features of the electronic cooling tower system such as means of relegating air to carrier of vapor heat, enthalpy concept, techniques of diffusing vapor heat through stagnant air, high heat capacity characteristics of a two component (vapor-air) system, the high latent heat of vaporization at low dry bulb temperatures, application of fin technology to evaporative cooling, and the application of conventional techniques of calculations of number and height of transfer units.

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
BIBLIOGRAPHY ON THERMOELECTRICITY, by S. Goldman. Rept. on Contract NOrd-7386. Nov 58, 25p. 130 refs. TG-326.
Order from LC mi$2.70, ph$4.80 PB 149 555

The bibliography lists the literature cited in Physics Abstracts, Electrical Engineering Abstracts, and Chemical Abstracts from January 1939 through mid 1958. While only a handful of the papers listed deal with engineering applications of thermoelectricity, this should not be taken as a measure of the relative engineering importance of these effects. Rather this is simply an indication of the severe proprietary restrictions on the publication of the results of the applied work.

Armour Research Foundation, Chicago, Ill.
CONTINUOUS FEED BATTERY, by H. F. Bauman and Howard T. Francis. Final rept. 15 Apr 56-15 July 57, on Contract NObs-72131. 30 Sep 57, 15p. AD-158 048.
Order from LC mi$2.40, ph$3.30 PB 148 385

The proposed system was based on a magnesium or aluminum anode with hydrogen peroxide as the cathode reactant. The magnesium-hydrogen system was investigated including determinations of anode evolutions of hydrogen and conditions for platinum black formation resulting in highest cell potential. The maximum load potential of the magnesium-hydrogen peroxide cell was 1.00 v at a cathode current density of 10 amp/sq ft, and changes in cell composition caused little change in potential. Magnesium anodes were used at current densities to 75 amp/sq ft with little polarization in 3.5% NaCl solution. Evolution of hydrogen from such an anode decreased as current density was increased and was approximately half that of the cathode gas in a magnesium-hydrogen cell. Conditions of platinum black formation were reflected in large changes in the cathode reaction potential. Magnesium-hydrogen cells were discharged for long periods by replacing the anode as consumed, but with no electrolyte changes. (Author)

Armour Research Foundation, Chicago, Ill.
PROCEEDINGS OF THE CONFERENCE [NO. 1] ON RADIO INTERFERENCE REDUCTION HELD AT THE ARMOUR RESEARCH FOUNDATION, OF ILLINOIS INSTITUTE OF TECHNOLOGY, DECEMBER 7-8, 1954. Dec 54, 356p. 63 refs.
Order from LC mi$11.10, ph$54.60 PB 148 071

Vehicular radio noise suppression, control of radio influence voltage in DC rotating electrical machines, shipboard electronic and electrical installation methods for reduction of electronic interference, problems of radio interference measurements, instrumentation for interference and field strength measurement, research investigations of interference measuring instruments, problems in shielding electronic equipment, reduction of corona type interference, audio frequency interference considerations in aircraft electronic system design, interference considerations in aircraft antenna systems, a method of making screen room interference measurements, broadband absorbent material for use in microwave darkrooms, counter techniques in interference measurements, impulse spectrum analysis for calibration of impulse noise generators, interference considerations in design of communications receivers, contract noise and problems of its suppression, radar modulator suppression, receiver susceptibility to RF pulse interference, harmonic and spurious energy measurements in high power transmitters, bridged-T technique for the measurement of spurious radiation, techniques for the measurement of spurious radiation and harmonics from transmitters, low-impedance gaskets for radio-frequency applications, suppression capacitors, high-performance antenna wave filters for radio interference suppression, propagation and antenna considerations in the prediction of man-made interference.

Armour Research Foundation, Chicago, Ill.
PROCEEDINGS OF THE CONFERENCE [NO. 3] ON RADIO INTERFERENCE REDUCTION HELD AT THE MUSEUM OF SCIENCE AND INDUSTRY, CHICAGO, ILLINOIS, FEBRUARY 26-27, 1957. Feb 57, 503p. 81 refs. AD-234 211.
Order from LC mi$11.10, ph$77.40 PB 148 072

Contents: Calculation and measurement of radar interference signal levels; a self contained interference blanker for radar receivers; RF interference - free design techniques in radar systems; a new technique for evaluating RF leakage and susceptibility of electronic equipment; high power radar spurious frequency outputs; quicker and simpler means for interference detection and suppression; insertion loss measurements of RF suppression filters with rated current applied; some unusual aspects of MIL - I - 6181B radio interference measurements; the measurement of the susceptibility of a radio receiver to interference; design and evaluation techniques for reducing radio interference from UHF communication equipment; suppression of spurious outputs from pulsed transmitters; bidimensional interference analysis; problems in the development of an airborne interference blanker; natural interference parameters in the airborne weapon system environment; radio interference studies conducted on typical USAF aircraft and equipment; results of the UHF mutual environment test program at Rome Air Development Center; interference problems in pulse systems; precipitation static noise generation in aircraft antennas near dielectric surfaces; interference sources and effective reduction procedures for power line interference; theoretical formulas for calculating the shielding effectiveness of perforated sheets and wire mesh screens; brushless, regulated generator of radio interference-free design; design of combination fluid or pressure and RF gaskets; the control of interference through basic design; radio interference reduction in an existing equipment; electronics interference reduction aboard naval vessels; field intensity measurements on industrial, scientific and medical RF equipment; measurement of radiated and conducted energy from high-frequency stabilized electric arc welders; general interference prediction considerations; ground effects in the near field: the measurement of RF leakage from coaxial cables; prediction of power densities in the vicinity of large antennas and detection of impulse signals in random noise.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
INVESTIGATION OF COLD-TEMPERATURE CHARACTERISTICS OF SONOTONE, 100-AMPERE-HOUR, NICKEL-CADMIUM BATTERIES, by James E. Griffin. 30 Nov 59, 33p. Technical rept. 1607-TR; AD-232 337.
Order from LC mi$3.00, ph$6.30 PB 146 661

This report describes the engineering tests and summarizes the results of the tests conducted at an ambient temperature of -65°F. on two 12-volt. nickel-cadmium batteries. Tests included discharge characteristics of the batteries after they were cold-soaked at -65°F, both prior to and after application of a short circuit at the battery terminals; charging characteristics of the batteries at -65°F.; and discharge characteristics of the batteries into a low impedance.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
FIELD SPLICE AND CONNECTORS FOR COAXIAL CABLE TYPE RG-85A/U, by Morton Pomerantz. 3 Dec 57, 29p. 4 refs. Technical memo. no. M-1930; AD-156 262.
Order from LC mi$2.70, ph$4.80 PB 146 590

Series LC connector Type UG-1179( )/U has been newly designed for use with RG-85A/U cable in fixed station radio receiving installations. This one connector, used in conjunction with other standard connectors eliminates the need for the special fittings and splices which have been used in such installations in the past. The simplicity of the design of the UG-1179( )/U permits greater ease of assembly and maintenance, and alleviates to a great extent the possibility of damage in normal handling. The high cost of the standard Navy splice kit has been eliminated. These features have overcome the inherent shortcomings of the special fittings which have been used in the past. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MICROWAVE CIRCUITRY FOR A FREQUENCY TRANSLATOR, by Robert D. Standley, Charles P. Heinzman, and Nathan Lipetz. 6 Oct 58, 22p. 10 refs. USASRDL Technical rept. 1994; AD-211 334.
Order from LC mi$2.70, ph$4.80 PB 148 112

The microwave circuitry covered by this report was developed for a frequency translator which used a highly stable ammonia beam Maser output of 23,870 mc to stabilize a 300 mc signal. This was achieved through the use of harmonic conversion and dual mixing techniques. Detailed design information of a harmonic generator, TE_{011} mode filters, and polarization convertors is included. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PIEZOELECTRIC QUARTZ VIBRATORS: PROPERTIES OF CUTS AND MODES OF VIBRATION, by R. Bechmann. 31 Dec 58, 59p. 52 refs. USASRDL Technical rept. 2003; AD-220 106.
Order from LC mi$3.60, ph$9.30 PB 146 653

The parameters of the various modes of quartz bars and plates practically used for frequency control were calculated and are compared with experimental data. The results are given in the form of tables for the various cuts and the figures given are of practical importance as design data for the production of resonator and filter crystals. The temperature behavior of the so-called zero temperature cuts and the dimensions of the quartz vibrator are discussed. The filter crystal design is also considered. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE USE OF AN X-BAND SOLID-STATE RUBY MASER WITH A CONVENTIONAL DUPLEXING SYSTEM, by John L. Carter, Morris Katzman, and Irving Reingold. 15 Jan 60, 19p. USASRDL technical rept. 2095; AD-234 085.
Order from LC mi$2.40, ph$3.30 PB 148 002

A series of experiments were performed with an X-band solid-state ruby maser and several conventional types of X-band duplexer tubes under conditions which simulated actual radar system application. Leakage levels for the onset of deterioration of maser performance and for saturation of the maser were determined. Measurements were also made of the recovery time of the maser after it had been fully saturated. The results indicate the degree of improvement required of the duplexer, or the degree of protection that must be provided in addition to the duplexer, if optimum use is to be made of the maser gain characteristics. (Author)

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH AND INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth and D. L. Goldwater. Scientific rept. no. 7 on Contract AF 19(604)3904. 15 Jan 60, 14p. AFCRC-TN-60-143; AD-234 040.
Order from LC mi$2.40, ph$3.30 PB 146 322

Life studies with thorium impregnated matrix cathodes have been carried to 10,000 hours at the 1.0 amp./sq. cm. level ($1550^{o}C_{B}$); 8,000 hours at 2.4 amp./sq. cm. ($1620^{o}C_{B}$) and 3,400 hours at 3.0 amp./sq. cm. ($1720^{o}C_{B}$). The determination of the surface density of thorium on tungsten corresponding to maximum emission has yielded a value of 4.1×10^{14} atoms/sq. cm. with estimated P. E. of 6%. Bombardment of a thorium-on-tungsten monolayer with electrons of energy of 370 volts has been carried to a total integrated bombardment of 81 amp. hr./sq. cm.

Bendix Radio Div., Bendix Aviation Corp., Baltimore, Md.
INTEGRATED AIRBORNE CNI CONTROL AND DISPLAY EQUIPMENT PROGRAM, by D. G. Erskine and W. D. Philips. Final rept. for 19 Apr 57-4 June 59 on Contract AF 33(600)35175. 4 June 59, 86p. 12 refs. WADC Technical rept. 59-271; AD-235 134.
Order from LC mi$4.80, ph$13.80 PB 149 786

The operational feasibility of an integrated communication-navigation-identification (CNI) control subsystem is discussed. The purpose of this subsystem was to reduce the total amount of critical cockpit area required for the controls of CNI equipments and to simplify their operation, thus relieving the pilot of some of his tasks. The developed subsystem allows the pilot to select and tune most of the CNI equipments with his left hand without visual reference to the primary control panel, which is in the form of a standard adding machine 10-key keyboard. An equipment indicator, located on the instrument panel, is provided for verification of control settings, and appropriate electromechanical devices were incorporated to prevent wrong operation. Tests comparing the operation of the integrated subsystem with the present CNI controls were made, and the results indicate that the subsystem offers an appreciable reduction of the pilot's task with surprisingly little training. Less than half the cockpit area now used for CNI controls is needed for the integrated subsystem. Possibilities of controlling the subsystem from the ground by data link were studied and found feasible and highly desirable for reducing the pilot's work load. (Author)

California U., Los Angeles.
EXTENDED SYNTHESIS TECHNIQUES FOR MULTIPOLE SAMPLED-DATA CONTROL SYSTEMS, by E. B. Stear and C. T. Leondes. Rept. on Contract AF 49(638)438. Oct 59, 16p. 4 refs. AFOSR-TN-59-1223; AD-233 276.
Order from LC mi$2.40, ph$3.30 PB 146 735

The presentation is made of a logical and efficient procedure for the synthesis of multipole sampled-data control systems. It is assumed that the specifications on the system are stated in the time domain, a common situation. It is not assumed in the synthesis procedure presented that the specifications are stated only at the sampling instants of the system, but rather at arbitrary and necessary instants of time. In addition to this, a lower bound is established for the sampling rate based on system requirements. (Author)

Case Inst. of Tech., Cleveland, Ohio.
EVALUATION OF DYNAMIC INTERACTION FIELDS IN A TWO DIMENSIONAL LATTICE, by R. E. Collin and W. H. Eggimann. Scientific rept. no. 12 on Contract AF 19(604)3887. 19 Mar 60, 37p. 2 refs. AFCRC-TN-60-381. AD-237 886.
Order from LC mi$3.00, ph$6.30 PB 148 195

The dynamic interaction fields due to a two dimensional lattice of electric and magnetic dipoles are evaluated. The series involved are summed by means of the Poisson summation formula and other means in order to yield results in closed form. The application of the theory to a disc type artificial dielectric medium is considered. (Author)

Colgate U. [Hamilton, N. Y.]
AN INDUCTIVE RELIABILITY CRITERION FOR RECEIVING SYSTEMS, by Leonard S. Schwartz. Rept. on Contract AF 30(602)2018. Mar 60, 21p. 18 refs. RADC TN-60-3; AD-234 475.
Order from LC mi$2.70, ph$4.80 PB 147 180

Bayes' and Likelihood Tests, used in the detection of signals in noise are reviewed. Their dependence on knowledge of the a priori probabilities and channel statistics is pointed out. An attendant inability to assist in setting decision thresholds when channel statistics are unknown is noted. The nature of a priori information is discussed since prevailing misconceptions concerning this are at the root of much of the weakness of present theories of detection. It is pointed out that the primary aspects of knowledge are a priori and empirical. Only the latter contains probabilistic elements. Possible methods for instrumenting detection systems for both radar and communications operating on principle of inductive probability are discussed. These systems are shown to be potentially capable of achieving any desired degree of reliability, even when operating in a state of almost total initial ignorance regarding channel statistics. (Author)

Compagnie Generale de Télégraphie Sans Fil (France)
SUPERGAIN AND VOLUMETRIC ANTENNAS, by E. Spitz. Technical (Final) rept. on Contract AF 61(052)102. 15 June 59, 74p. 9 refs. AFCRC-TR-59-194; AD-228 779.
Order from LC mi$4.50, ph$12.30 PB 146 389

Research was conducted on the problem of radiating structures placed in a certain limited space. Efforts are based on theoretical work on superdirectional antennas. Two problems are considered: the case of a classical antenna, but developed into volume with all supergain effects excluded and the case of a supergain antenna. The performance is given of a practical form of a built volumetric antenna. Supergain antennas consisting of 5 and 11 sources were calculated, and a method of evaluation is indicated. Five and 11 source supergain structures were built with the individual sources isolated by ferrite unilines. Performances are shown.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
AIR FORCE HANDBOOK: METHODS OF COOLING SEMICONDUCTOR DEVICES, by Steven K. Morrison and James P. Welsh. Rept. on Contract AF 30(602)1842. May 60, 74p. 17 refs. Rept. no. HM-1247-D-5; RADC-TR-60-22, supplement to RADC-TR-58-126.
Order from LC mi$4.50, ph$12.30 PB 148 783

This Handbook was prepared to aid electronic engineers in the thermal design of reliable military electronic equipment. Enumerated herein are recommended principles and techniques for the thermal design of electronic equipment using semiconductor devices. (See also PB 146 874)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
INTERPRETATION OF SOME BACKSCATTER ECHOES IN TERMS OF FIELD-ALIGNED IRREGULARITIES IN THE F REGION, by P. F. Weaver, Jr. Technical rept. no. 49 on Studies on Propagation in the Ionosphere, Contract DA 36-039-sc-78258. 15 Dec 58, 93p. 26 refs. Research rept. EE-389; AD-229 659.
Order from LC mi$5.40, ph$15.30 PB 147 246

Long-range radar echoes at 14 mc were studied which seem to be explicable in terms of direct backscatter from field-aligned irregularities in the F region of the ionosphere. These echoes were regularly observable during the evening hours with a high power pulsed transmitter and a rhombic antenna beamed toward the north. A typical echo was spread in range from about 1000 km to about 2000 km and had a fading rate comparable to that of auroral echoes observed at the same frequency. Because of the observed aspect sensitivity of the echoes, contours of the angle between a plane perpendicular to the earth's magnetic field and ray paths from Ithaca were calculated for F-region heights. These contours of off-perpendicular angle indicated that the observed echoes were coming from an area of near-perpendicularity where angles as low as 9^{o} were found. Because of refraction in the F region, all northward ray paths from Ithaca which would be "reflected" back to earth are bent into perpendicularity at some point along their trajectory. The assumption is therefore made that the observed echoes arise from backscattering by irregularities in the F region elongated along the earth's magnetic field. Calculations on the basis, allowing for refraction and delay time in the F region, lead to echoes at about the observed range. (Author)

David Sarnoff Research Center, Princeton, N. J.
STORAGE LIGHT INTENSIFIER DISPLAY PANEL, by H. O. Hook and W. F. Davidson, Jr. Final rept. 1 Apr 56-30 Sep 58, on Contract DA 36-039-sc-71194. 30 Sep 58, 122p. 5 refs. AD-215 163.
Order from LC mi$6.30, ph$19.80 PB 149 103

Layer type storage light intensifiers with 40 elements per inch were made and performed well. Bi-stable storage for 30 minutes is reported. Less satisfactory results were obtained with more complicated structures. Some characteristics of powdered CdS photoconductors are reported and related to the operation of storage light intensifiers. Spectral match of the 4 RCA electroluminors and CdS photoconductor is almost the same. Optical geometry and absorption in feedback paths are evaluated experimentally and theoretically. (Author) (See also PB 149 366)

Diamond Ordnance Fuze Labs., Washington, D. C.
CONSTRUCTION OF TUBES EMPLOYING PLANAR PERIODIC ELECTROSTATIC FOCUSING, by Burton J. Udelson and McKay R. Bradley. 16 May 60, 31p. 8 refs. Technical rept. TR-828.
Order from LC mi$3.00, ph$6.30 PB 148 464

A new technique has been developed for constructing tubes employing the planar periodic electrostatic focusing of an electron sheet beam. Use of this technique permits the achievement of both mechanical ruggedness and excellent alignment of the electrodes. The technique, in brief, consists in assembling the entire tube structure in separate halves, grinding their surfaces simultaneously with an abrasive wheel, and then bolting the two halves together at each end. Two entirely different methods of assembling the tube halves were developed. Experimental tubes embodying each of these methods were constructed, and each gave excellent beam transmission through the electrostatically focused structure, in one case as high as 99.8 percent. A method of measuring the beam shape and width, and of determining the relative quality of the sheet beam emerging from an electron gun, is described. (Author)

Electric Storage Battery Co., Yardley, Pa.
INVESTIGATION OF AgO PRIMARY BATTERIES, by P. Ruetschi and R. F. Amlie. Quarterly rept. no. 2, 1 Sep-30 Nov 59, on Contract DA 36-039-sc-78319. [1959] 21p. AD-233 532.
Order from LC mi$2.70, ph$4.80 PB 147 974

Electroformed and pasted AgO plates were compared by discharging at the 10-hr rate (300 ma, for the particular size plates used). Various techniques of fabricating and electroforming AgO plates made by the ESB "DP-Process" were studied to obtain improved discharge efficiencies. Theoretical discharge efficiencies of about 91% were realized with the best electroformed plates; this efficiency value is the same as that realized from plates of commercial silver (II) oxides, made with chemically prepared AgO. The influence of sintering temperature was studied on DP-Process electrodes made of discrete Ag particles of about 1μ. This parameter was relatively critical since the discharge efficiency was optimized by keeping the sintering temperature low, at 450° to 500°C. The effect of total charge input was also investigated by charging at several current densities ranging from approximately 4 to 1 ma/cm^2. About 90% of the theoretical capacity was realized with a 75% overcharge and capacity increase was very small with additional charging. The voltage cut-off meter-relay unit was completed and put into operation. Efforts were greatly facilitated by this instrument which automatically interrupts the current at the end of charge or discharge at a present voltage level. Two or more electrodes can be discharged per day on the laboratory bench with a minimum of attendance to give an accurate record of voltage and elapsed time.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
THE DEVELOPMENT AND EVALUATION OF A PANORAMIC RADIO DIRECTION FINDING RECEIVER, by Edward E. Kellum. Technical rept. no. 14 on Contract Nonr-1834(02). 25 Sep 59, 61p. 31 refs. AD-228 194.
Order from LC mi$3.90, ph$10.80 PB 148 599

A panoramic radio direction finding receiver is a device that enables an operator to determine the direction of arrival and frequency of any received signal over a specified bearing sector and frequency band. The purpose of this investigation is to determine the performance of the receiver when used for direction finding. Test results indicated that panoramic radio direction finding is not useful if only a Watson-Watt type of display is used. It is essential that a bearing converter be used; however, the bearing converter used in this test is not satisfactory because of the bearing spread. Methods to lessen the bearing spread are (1) decreasing the IF amplifier bandwidth in the receiver, (2) increasing the intermediate frequency in the bearing converter, and (3) triggering the timing pulse circuit only when the frequency in the bearing converter is the correct frequency. These methods are discussed in the experimental results. A block diagram and description of method (3) above is given.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
EVALUATION OF A LABORATORY MODEL INJECTION TYPE RDF RECEIVER, by Harry A. Shubert. Technical rept. no. 12 on Contracts Nonr-1834(02) and DA [36] 039-sc-74898. 31 Mar 59, 47p. 2 refs. AD-225 274.
Order from LC mi$3.30, ph$7.80 PB 146 357

Descriptions and data are presented on the construction and operation under laboratory conditions of a 2-channel radio direction finding (RDF) receiver matched in phase and gain automatically. The channels are matched by means of a signal injection system. Schematic diagrams, explanations of operation, and photographs and analysis of results are presented. A review of the general principles of operation of a direct reading RDF system with emphasis on the details pertinent to this project is given. An attempt was made to show why the requirements on the receiver are very rigid. The principles of operation of the injection system for channel matching, and an explanation of the construction of the system used are outlined. An analysis is presented of results obtained, in which the results are compared to theoretical calculations and curves. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
NEW TECHNIQUES IN SWITCHING CIRCUIT SYNTHESIS, by Donald Lee Epley. Doctoral thesis. Technical note no. 13 on Contract AF 49(638)63. 1 May 60, 103p. 42 refs. AFOSR-TN-60-614.
Order from LC mi$5.70, ph$16.80 PB 148 765

Three new switching theory concepts and methods analogous to electrical network theory methods are defined and applied to problems in switching circuit synthesis. The first, the removal synthesis technique, is used to synthesize transmission contact networks with p input terminals and q output terminals. Transmission contact networks are synthesized to realize a transmission matrix containing switching functions between each input-output terminal pair. The second new concept introduced is the 0, 1-configuration of a switching function. Using this representation of switching functions and a mapping procedure, a new method of finding the minimum sums of a given function is developed. The third concept, sensitivity of a contact circuit to contact errors, is used to design circuits with error protection. Two different sensitivities, contact and condition, are defined. Contact sensitivity is used to develop a design procedure for the single contact error and equally likely input combinations case. Condition sensitivity is used in a similar design procedure applicable to multiple contact error case and which includes differences in likelihoods of occurrence of input combinations.

Electron Tube Research Lab., U. of Minnesota, Minneapolis.
STUDIES ON BASE NICKELS FOR OXIDE-COATED CATHODES, by D. E. Anderson. Scientific rept. nos. 5 and 6, 15 Apr-15 Oct 59, on Contract AF 19(604)3890. [1959] 97p. 3 refs. AFCRC TN-60-112.
Order from LC mi$5.40, ph$15.30 PB 146 327

An investigation was made of the applied voltage and diode current (I-V characteristics) of thermionic diodes under μsec pulse conditions. Studies were made of the influence of diode spacing and of deviations from parallel-plane geometry on the observed emission and coating resistance. A new system was developed for the controlled reduction of oxide coatings using a C-Ni diffusion couple. Oxide cathodes based on 0.22% and 0.08% Al-Ni alloys exhibited stable emission levels of over 11 amp/sq cm for operating times of over 5000 hr at 1093°K. The activation of passive-based cathodes exposed to a constant Ba pressure produced appreciable enhancement of emission. Studies of the influence of a heated Ti anode on the emission from an oxide cathode revealed no interaction except when the anode was heated directly over the cathode. (See also PB 143 974)

Electronic Communications, Inc., Timonium, Md.
FERRITE PHASE SHIFTER FOR THE UHF REGION. PART II, by C. M. Johnson and G. V. Buehler. Scientific rept. no. 2, 2 May 58-30 Sep 59, on Contract AF 19(604)2407. 31 Oct 59, 77p. 6 refs. AFCRC TN-60-138; AD-234 145.
Order from LC mi$4.50, ph$12.50 PB 146 324

Ferrite properties which influence phase shifter performance were investigated, and improved versions of the ferrite-loaded, folded-stripline, UHF phase shifter were constructed. Some theoretical relations were derived from conventional ferromagnetic theory to explain the performance of this type of phase shifter, but good quantitative agreement with the experimental results was not attained. This disagreement is attributed to demagnetizing effects. A preliminary investigation was made to determine the nature of these effects and some of the results are included. (Author) (See also PB 137 478)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
A CIRCUIT FOR BROAD-BAND IMPEDANCE MATCHING OF A PAIR OF LOADS, by James J. Epis. Rept. on Contract DA 36-039-sc-71053. 26 Feb 58, 34p. 2 refs. Technical memo. no. EDL-M129; AD-158 648.
Order from LC mi$3.00, ph$6.30 PB 147 438

A circuit is described in which two loads are coupled to a common transmission line. The circuit, in itself incorporates often-used circuit elements; as a result of the manner in which these elements are inter-connected the transmission line to the generator does not have reflected waves, or standing waves, regardless of the impedance mismatches of the two loads. Thus, the signal generator operates into a perfectly matched system, and undesirable interactions between the loads and the generator do not occur. In many cases, this operation can be maintained over a broad frequency band. The theoretical analysis developed for the circuit is verified by experiment, and several useful and practical applications of the circuit are considered. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HEATER INDUCED FREQUENCY MODULATION IN THE QK-518 BACKWARD WAVE OSCILLATOR, by J. F. Lipman. Rept. on Contract DA 36-039-sc-73170. 18 Oct 57, 16p. Technical memo. no. EDL-M119; AD-161 274.
Order from LC mi$2.40, ph$3.30 PB 147 437

An experimental study has been made on several QK-518 backward wave oscillator tubes to determine frequency modulation characteristics with ac heater power. One source of frequency modulation is resistance in the common heater-cathode lead within the tube. A second source appears to be attraction of electrons by the heater on the positive half cycle, thereby causing frequency pushing. These two effects are opposite. A typical tube has about a 1.5-megacycle deviation at the low-frequency end of the band. As the frequency is increased toward the high frequency end of the band, the deviation decreases to zero, reverses in phase and increases to about one megacycle. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
INVESTIGATION OF THE FEASIBILITY OF A BROADBAND WAVEGUIDE ROTARY JOINT USING CIRCULAR POLARIZATION, by P. D. Cogshall.

Rept. on Contract DA 36-039-sc-75012. 23 Mar 59, 32p. 10 refs. Technical memo. no. EDL-M171; AD-215 073.
Order from LC mi$3.00, ph$6.30 PB 147 440

Circular polarization techniques in round and square waveguide are studied for application in a broadband rotary joint. Broadband quarter-wave plates are constructed and assembled in an experimental rotary joint in S-band. Characteristics of resonant conditions and methods of eliminating them are investigated. Resonant slots are used to suppress resonances by absorbing the orthogonal mode in a round waveguide rotary joint. The peak power capability is determined in an X-band model by measuring the breakdown power in a waveguide resonant loop. The measurement techniques are discussed. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
AN INVESTIGATION OF UHF SPECTRA OF SINGLE CRYSTALS OF $BaTiO_3$, by Howard Diamond. Rept. on Contract DA 36-039-sc-73170. 15 Apr 58, 11p. 7 refs. Technical memo. no. EDL-M135; AD-161 275.
Order from LC mi$2.40, ph$3.30 PB 147 439

The need for spectral information on good, single crystals of $BaTiO_3$ is emphasized. The frequency range from 65 to 300 mc is investigated using a method which continuously displays dielectric constant versus frequency; the particular range was chosen to check a previously reported resonance at 120 mc. Using spectrographic techniques, no such resonance was found. In the frequency and temperature range considered, the crystal showed a gradual reduction of dielectric constant at the higher frequencies. (Author)

Electronics Research Lab., U. of California, Berkeley.
AN ITERATIVE APPROXIMATION TO FLAT DELAY IN AN EQUAL RIPPLE MANNER, by Charles A. Kulmann. Rept. on Contract N7onr-295(29). 15 June 59, 31p. 5 refs. Rept. no. 89; Series no. 60, issue no. 242; AD-233 099.
Order from LC mi$3.00, ph$6.30 PB 146 582

To date, there has been no analytic solution to the equal ripple delay function; the data presented here is the result of iterative solutions using a high-speed digital computer. In addition to the obvious use for precision delay line design, the results of this paper may also be used in the design of pulse amplifier interstage networks. Since phase distortion in an amplifier will result in dispersion of the transmitted pulse and the resultant difficulty in the resolution of closely spaced pulses, it is desirable to concentrate on the phase (or delay) characteristic. In this paper, the desired constant delay time is approximated in an equal ripple manner over the useful band of frequencies. Results are given in graphic form for orders of approximation up to N = 12 and for values of delay ripple from 0.01% to 10% for a normalized bandwidth of $0 \leq \omega \leq 1$. Denormalization techniques for both low-pass and band-pass cases are outlined in examples. (Author)

Electronics Research Lab., U. of California, Berkeley.
A MICROWAVE ANECHOIC CHAMBER, by F. D. Clapp and D. J. Angelakos. Rept. on Contract N7onr-29529. 21 Sep 59, 13p. 3 refs. Rept. no. 90; Series no. 60, Issue no. 251; AD-235 449.
Order from LC mi$2.40, ph$3.30 PB 148 622

Study of the data leads to the conclusion that the room is about equally effective with the walls either straight or corrugated, with the provision that if the walls are straight, the antenna must be placed in an asymmetrical position in the room. If the walls are corrugated, it is essential that angular joints in the corrugations be suitably covered to prevent additional reflections. If these stipulations are followed, spurious reflections should be at least 20 db down from the main lobe at any angle, and will be considerably better for most cases. This is obviously not good enough for investigation of small side-lobe arrays but is adequate for many purposes.

Emerson and Cuming, Inc., Canton, Mass.
DIELECTRIC EMBEDDING MATERIAL FOR 500°C SERVICE. Final rept. for 1 July 57-31 Mar 58 on Contract NObs-72339. 1 Apr 58, 27p. AD-218 998.
Order from LC mi$2.70, ph$4.80 PB 148 852

A survey of possibly useful commercially available materials and a literature search revealed that the major part of the problem was bonding material suitable for this temperature service. A number of promising types were experimentally evaluated in various modifications. A silica gel bond and a low melting lead glass bond were found most useful. With further development, these materials can be used for the contemplated tasks. A program for further work is included. (Author)

General Electric Microwave Lab., Palo Alto, Calif.
MEASUREMENT AND CONTROL OF HARMONIC AND SPURIOUS MICROWAVE ENERGY, by Vernon G. Price, John P. Rooney, and Richard H. Stone. Final rept., Change A, for July 59-Jan 60 on Contract AF 30(602)1670. 18 Mar 60, 75p. 8 refs. Technical Information Series rept. R60ELM112-4; RADC-TR-60-77.
Order from LC mi$4.50, ph$12.30 PB 148 534

Leaky wall filters were fabricated and are reported herein. A design for a coaxial probe section (to be used in the rotating joint of a radar system) is reported. This probe section is designed to measure the harmonic energy to the fift'. harmonic whether the signals are propagating in either the forward or reverse direction. It is to be noted that all of the harmonic energy in a radar system must pass through the rotary joint (if the radar has one), and hence this is a unique place to make measurements. Measurements were made of the harmonic output of the VA-125 traveling-wave tubes and are reported herein. Thus, limited data are now available on magnetrons, klystrons, and traveling-wave tubes. (See also PB 145 604)

General Electronic Labs., Inc., Cambridge, Mass.
1000 TO 3000 MC RECEIVER FRONT END, by Martin W. Levine. Final technical rept. for 1 May 56-30 June 59 on Contract DA 36-039-sc-72326. [1959] 69p. 1 ref. E-136-F; AD 226 296.
Order from LC mi$3.90, ph$10.80 PB 146 546

The development is presented of a 1000-to 3000-mc front end for providing the tuning function for a radio interference and field strength measuring set (AN/URM-85) and which incorporates the latest design features. A survey into the current state of the art revealed design features which could lead to the development of a receiver front end with superior performance characteristics. A system concept was developed which exploited these design features and a design approach for an experimental model of a 1000-to 4000-mc front end was prepared. After fabrication of the experimental model, and evaluation indicated that the performance of this design with minor modifications would comply with all the required performance criteria. After modifying this design, 2 service test models of the 1000 - to 4000-mc front end were fabricated, evaluated and found to meet the objectives of the technical requirement. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION ON THE AGING EFFECTS RESULTING FROM PLATING METHODS AND MATERIALS, by Richard B. Belser. Quarterly rept. no. 1, 1 Apr-1 July 54, on Contract DA 36-039-sc-56753. [1954] 40p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 138 211

Studies of aggregation and physical properties of sputtered films of platinum metals, molybdenum, chromium, aluminum and gold.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION ON THE AGING EFFECTS RESULTING FROM PLATING METHODS AND MATERIALS, by Richard B. Belser and Walter H. Hicklin. Quarterly rept. no. 3, 1 Oct 54-1 Jan 55, on Contract DA 36-039-sc-56753. [1955] 51p. 1 ref.
Order from LC mi$3.60, ph$9.30 PB 138 212

Positive-ion bombardment of glass and quartz substrates and its effects on the adherence and the aging of gold, silver and aluminum films deposited thereon by sputtering and evaporation. Films deposited on substrates, which were subjected to bombardment before deposit and aged by heating thereafter, were remarkably free of bubbles and pin holes common to films deposited on substrates which were not subjected to bombardment. Behavior of bimetal films indicate that these films hold much interest for studies of diffusion and the behavior of metals but that only selected metal pairs, of proven stable performances, should be given serious consideration as coatings for quartz resonators. (See also PB 138 211)

I. T. E. Circuit Breaker Co., Philadelphia, Pa.
ANTENNA CONTROL GROUP ANDB TYPE 2. 3NS6. Technical manual. Rept. on Contract NObsr-64741. 11 Dec 56, 133p. NAVSHIPS 92913.
Order from LC mi$6.90, ph$21.30 PB 147 953

The Antenna Control Group Type 2. 3NS6 consists of an antenna pedestal with servo control suitable for use with the Antenna Assembly 2. 3NS3 and a 30 foot antenna similar to the 2. 3NS3. The control group has been primarily designed to automatically slave a master antenna unidirectionally up to a maximum velocity of 26 rpm.

ITT Labs., Nutley, N. J.
INVESTIGATION OF ELECTRICALLY VARIABLE DELAY LINES, by S. R. Hoh and G. R. Leef. Final rept. on Contract AF 30(602)1859. Jan 60, 52p. 9 refs. RADC-TR-59-214; AD-231 095.
Order from LC mi$3.60, ph$9.30 PB 146 597

Electrically variable delay lines based on ferroelectrics were investigated analytically and experimentally. This work was supported by evaluations of available materials as well as by a material development program. A material Q of 100 was obtained with a barium-strontium titanate which is the highest ever reported in this frequency range. A new multisection delay line was developed incorporating ferroelectrics. This line has an attenuation comparable to standard delay cables and, in addition, miniaturization and controllability. (Author)

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
DOPPLER PHASE-DIFFERENCE INTEGRATOR, by G. M. Hyde and K. E. Perry. Rept. on Contract AF 19(122)458. 12 Nov 58, 34p. 2 refs. Technical rept. no. 189; AD-206 258.
Order from LC mi$3.00, ph$6.30 PB 148 369

The Doppler phase-difference integrator is a type of constant false-alarm rate (CFAR) detector that operates by integrating unit vectors formed on the phase difference between successive target return pulses from the receiver of a phase-coherent radar. The detection process is accomplished mainly by means of digital circuitry. Since it has been found that for successful detection a fairly large number of hits on target (50 or more) are necessary, the device is not adaptable to all radars. However, this detector does show some interesting features in the ability to map out ground clutter and in the possibility of plotting wind velocities in storm clutter. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS. Quarterly rept. no. 5, 15 Mar-15 June 58, on Contract DA 36-039-sc-73143. 15 July 58, 28p.
Order from LC mi$2.70, ph$4.80 PB 147 178

This report discusses our experimental investigation of the relaxation of optically oriented sodium atoms. Experimental data are presented on the relaxation time at various buffer gas pressures in an unlined glass cell and a polyethylene-lined cell. Analysis of the experimental results indicates that polyethylene definitely inhibits the wall relaxation of the aligned atoms. (See also PB 145 405)

Materials Research Lab., Watertown Arsenal, Mass.
SIMPLE METHOD OF RECORDING FREQUENCY IN NUCLEAR MAGNETIC RESONANCE STUDIES, by J. A. Hofmann and P. L. Sagalyn. June 60, 7p. MRL rept. no. 77.
Order from LC mi$1.80, ph$1.80 PB 148 409

In studies of broad nuclear magnetic resonance lines where the line is scanned by varying the spectrometer frequency, deviations from frequency sweep linearity can produce significant errors in the measured areas, second moments, etc., unless frequency markers are recorded along side the resonance curve at sufficiently small frequency intervals. This note describes a convenient, relatively automatic system for recording such frequency markers, using commercially available equipment.

Melabs., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts and Harold D. Tenney. Quarterly progress (scientific) rept. no. 7, 10 Dec 59-9 Mar 60, on Contract AF 19(604)4071. 9 Apr 60, 37p. 12 refs. AFCRC-TN-60-552.
Order from LC mi$3.00, ph$6.30 PB 148 403

Theoretical calculations showing the effects of various types of cross relaxation mechanisms on maser inversion ratio are given. Examples of three spin, four spin, and five spin processes are given and the results compared to experiments which have been described in the recent literature. Transient solutions of the rate equations are obtained and methods of measuring the cross relaxation probability described. The design of a superconducting iron-cored electromagnetic is described. It is anticipated that this magnet will allow the use of longer slow-wave structures than are possible with the conventional laboratory electromagnet. (Author) (See also PB 146 323)

Michigan U. Research Inst., Ann Arbor.
AN INTRODUCTION TO THE PRACTICAL APPLICATION OF FERROELECTRICS, by T. W. Butler, Jr. Technical Memo. no. 61 on Contract DA 36-039-sc-63203. Oct 58, 26p. 7 refs. 2262-191-T; AD-208 107.
Order from LC mi$2.70, ph$4.80 PB 147 225

Properties of ferroelectric materials and to physical principles involved in their applications. Three groups of applications which make use of (1) the high permittivity, (2) the nonlinear properties and (3) electro-mechanical properties are discussed. Applications utilizing the nonlinear properties are of much greater interest to the electrical engineer.

Michigan U. Research Inst., Ann Arbor.
LARGE-SIGNAL ANALYSIS OF CROSSED-FIELD DEVICES, by O. Gandhi and J. E. Rowe. Semiannual progress rept. no. 1, 1 Sep 58-1 Mar 59, on Contract DA 36-039-sc-78223. Aug 59, 46p. 14 refs. 2820-1-P; AD-228 064.
Order from LC mi$3.30, ph$7.80 PB 147 992

A large-signal theory for planar crossed-field amplifiers and oscillators is developed in which the effects of space charge, circuit loss and finite values of the gain parameter D are accounted for. The working equations are formulated from the Lorentz force equation, the continuity equation and a transmission-line equation developed from the equivalent circuit for the RF structure. The space-charge force between electrons is calculated using a Green's function method for essentially point charges in the interaction region. The equations are valid for thick streams. The working equations will subsequently be solved as an initial boundary-value problem. The dependent variables and their derivatives will be given at the input boundary. The initial conditions are specified. (Author)

Michigan U. Research Inst., Ann Arbor.
LARGE-SIGNAL ANALYSIS OF CROSSED-FIELD DEVICES, by O. Gandhi and J. E. Rowe. Semiannual progress rept. no. 2, 1 Mar-1 Sep 59, on Contract DA 36-039-sc-78223. [1959] 47p. 2 refs. 2820-2-P; AD-232 554.
Order from LC mi$3.30, ph$7.80 PB 147 993

A numerical procedure for the solution of the large-signal crossed-field equations is developed and the differential equations are transformed into difference equations. A flow diagram is developed to illustrate the iterative method of solving the equations. The large-signal results are compared with results from a small-signal theory and it is determined that the agreement is good within the limitations of the small-signal theory assumptions. A study of truncation error is presented. The effect of cyclotron waves is considered and the accuracy of replacing the slow-wave structure with an infinitely conducting sheet for space-charge field calculations is evaluated. (Author) (See also PB 147 992)

Michigan U. [Research Inst.] Ann Arbor.
REDUCTION OF SIGNAL-TO-NOISE RATIO WITH RANGE FOR PbTe AND THERMISTOR DETECTORS, by A. LaRocca and G. Zissis. Rept. on Proj. Michigan [Contract DA 36-039-sc-52654]. July 56, 23p. 1 ref. 2144-246-T; AD-201 131.
Order from LC mi$2.70, ph$4.80 PB 146 563

When contrast signal was used to obtain signal-to-noise values, the S/N of a PbTe cell decreased with range at a much faster rate than did the S/N of a thermistor. Contrast signal is the signal resulting from the experimental idealization of target and background produced by using two sources of known emissivity to furnish the radiation used for measurement of S/N. (Author)

Michigan U. Research Inst., Ann Arbor.
RESEARCH ON CROSSED-FIELD ELECTRON DEVICES, by R. W. Larson, R. J. Martin and others. Quarterly progress rept. no. 4, 1 Sep-1 Dec 59, on Contract DA 36-039-sc-78260. [1959] 48p. 6 refs. 2854-5-P; AD-233 439.
Order from LC mi$3.30, ph$7.80 PB 147 968

A discussion of the initial experimental tests on the crossed-field stream analyzer with the potential trap

in the sole is presented and some analog computer calculations of electron trajectories through the trap are given. A general verification of previous results has been obtained. Extensive calculations of heating-wave amplification in the presence of beam space-charge and circuit loss are given and the significance of the results is discussed. Starting conditions for the M-type BWO are obtained when d=0 and some interesting aspects with regard to their dependence on H and r are commented on. A generalized analysis of the two-beam crossed-field amplifier is developed in which the slip between the two beams is accounted for. A physical interpretation of the growth mechanism in such a device is offered. (Author)

Microwave Associates, Inc., Burlington, Mass.
VARIABLE CAPACITANCE MICROWAVE DIODE. Quarterly progress rept. no. 3, 1 May-31 July 59, on Contract DA 36-039-sc-78236. [1959] 49p. 10 refs. AD-229 343.
Order from LC mi$3.30, ph$7.80 PB 146 456

The negative-resistance varactor amplifier is analyzed. Amplification is possible for any ratio of signal frequency to cutoff frequency. As this ratio increases, the admissible range of pump frequency narrows and the noise figure increases; also, the "gainwidth" (the range of possible signal frequencies for a given pump frequency) narrows. The first samples of hermetically sealed varactors have passed all required environmental tests. (Author) (See also PB 145 960)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HIGH POWER MICROWAVE SWITCH, by S. J. Tetenbaum. Quarterly progress rept. no. 4, 16 Mar-15 June 59, on Contract DA 36-039-sc-78044. 30 July 59, 16p. AD-228 198.
Order from LC mi$2.40, ph$3.30 PB 146 533

Satisfactory construction techniques have been developed for both the forsterite and synthetic mica switch tubes. The major problem associated with the latter tube is that the raw material is non-uniform, both from block to block and within a block, and most of the raw material was slightly porous, making it unusable as a vacuum envelope. High power measurements performed on forsterite switches with and without metal gaskets and with Helium, Argon and Neon gas fillings, have shown that except for life, the switches meet the acceptable requirements. The switches exhibited short life due to excessive gas cleanup and a rapid variation of the breakdown power with time. Possible reasons for these effects are discussed and changes in tube construction are suggested for improving the switch life. The electromagnetic and switching power supply have been constructed and tested. They meet all requirements. (Author) (See also PB 145 809)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HIGH POWER MICROWAVE SWITCH, by S. J. Tetenbaum. Final rept. for 15 June 58-31 Aug 59 on Contract DA 36-039-sc-78044. 1 Nov 59, 51p. 4 refs. AD-230 934.
Order from LC mi$3.60, ph$9.30 PB 148 335

A high power cyclotron resonant gas switch covering the 2.7 to 3.7 kmc band was designed and tested. Three different discharge tubes were investigated. An encapsulated window tube was unsatisfactory because the available windows tended to crack at high average powers. A synthetic mica tube was unsatisfactory because the raw material was non-uniform and tended to be porous. A forsterite tube was readily fabricated and exhibited satisfactory electrical properties. The major obstacle to the practical use of the forsterite switch is its short life, being only about 40 hours even with a 500 cc gas reservoir. This is due to excessive gas cleanup, probably caused by ion trapping in the tube walls. Changes in design and construction are suggested which offer promise of increasing switch life. (Author) (See also PB 146 533)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
THE SCANNING PROCESS IN PICTURE TRANSMISSION, by A. E. Laemmel. Rept. on Contract AF 30(602)1471. 29 Mar 57, 51p. 23 refs. Rept. R-563-57, PIB-491; RADC TN-57-215; AD-131 112.
Order from LC mi$3.60, ph$9.30 PB 146 371

This report examines several fundamental aspects of the picture scanning process used in electrical facsimile or telephoto systems. In particular, scanning processes are analyzed with respect to the relation between the required time-bandwidth product and the unavoidable degradation of resolution which usually results. Upper bounds on the performance of such systems are given, together with several improved methods of scanning which hold promise of getting closer to ideal conditions than those presently in use. All of the results obtained are completely independent of the picture statistics and number of gray levels used, so that they may be used alone with any sort of copy, or together with a coding or mapping process with more restricted types of copy. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
SOME STATISTICS CONCERNING TYPEWRITTEN OR PRINTED MATERIAL, by Sid Deutsch. Rept. on Contract AF 30(602)1471. 31 Oct 56, 29p. Rept. R-526-56; PIB-456; RADC TN-57-22; AD-114 236.
Order from LC mi$2.70, ph$4.80 PB 146 372

The first set of statistics assumes that the original sample is composed of discrete resolution elements that are binary quantized and .01 inch square. The second set of statistics assumes that the original sample is binary quantized and continuously scanned in a vertical direction along lines that are .01 inch apart. The third set of statistics assumes that the original sample is composed of discrete resolution elements that are binary quantized and .01 inch square. The fourth set of statistics again assumes discrete quantized square elements.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
CRYSTAL DETERIORATION STUDIES, by P. P. Lombardini, R. J. Doviak, and H. Kritikos. Final rept. Task 2 on Contract AF 30(602)1615.

15 Apr 58, 172p. 185 refs. Rept. no. ES-28-030-05; RADC TR-58-95; AD-148 811.
Order from LC mi$8.10, ph$27.30 PB 146 367

A study of deterioration of microwave crystal rectifiers was conducted in two phases. In Phase A an experimental investigation was undertaken to determine the threshold power levels needed for partial and total burnout under conditions of different pulse-widths and exposure time. A new indicator of crystal burnout was developed. Phase B was concerned with a critical review of the available literature on crystal burnout.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
INTERFERENCE STUDIES, by O. M. Salati, R. A. Rosien and others. Final rept. Task 1, vol. 1, 15 Aug 56-15 Apr 58, on Contract AF 30(602)1615. 15 Apr 58, 210p. 38 refs. Rept. no. ES-27-030-05; RADC-TR-58-96; AD-148 812.
Order from LC mi$9.30, ph$31.80 PB 146 366

This report presents the results of research on the theory of interference prediction and interference measurement techniques. Eight separate sections are devoted to permissible interference levels or susceptibilities, data presentation, methods and devices for measuring spurious and harmonic radiation, out of band pulsed and CW interference in a microwave receiver, loss of radar information due to blanking, bandwidth conservation in pulsed radars, graphical techniques for great circle calculations, comments on military interference specifications, and prevention of moding in magnetrons.

National Research Labs., Ottawa (Canada).
ANALYSIS AND COMPUTER STUDY OF AN ADAPTIVE CONTROL SYSTEM, by D. A. Dawson. Sep 59, 95p. 8 refs. Mechanical Engineering rept. MK-4.
Order from LC mi$5.40, ph$15.30 PB 148 080

The concept of total cost or economic penalty is formulated for adaptive control of regulators. The cost is assumed to be a function of the error and the manipulated variable, although the function need not be known a priori. A circuit is then described which will optimize the system, that is, will vary the gain of the controller so as to bring it towards the value associated with the minimum total cost. The results of an experimental study are included which describe the effect of variations of the parameters of the adaptive circuit on the over-all behaviour. It is found that with such a circuit the gain oscillates about the optimum value while the cost oscillates around some value above the minimum possible value. An attempt is made to define quantities which describe the effectiveness of such adaptation. The adaptive system is also modified so as to optimize with respect to two controller variables. (Author)

Naval Ordnance Lab., White Oak, Md.
A CONTINUOUS OSCILLOGRAPHIC METHOD FOR THE DETERMINATION OF DETONATION VELOCITIES IN SOLID CAST EXPLOSIVES, by Adolph B. Amster, Paul A. Kendall and others. 16 Mar 59, 15p. 10 refs. NAVORD rept. 6280; AD-225 615.
Order from LC mi$2.40, ph$3.30 PB 148 454

The continuous electronic measurement of detonation velocities in solid cast explosives is made possible by using a new technique. A fine nichrome wire is cast within and parallel to the long axis of a confined explosive. A record of its resistance during detonation serves to locate the ionization front associated with detonation. The measurement is recorded on an oscillograph. From the photograph of this record, instantaneous detonation velocities are measured to within ±2%. This new method makes possible study of the development, stability, and decay of detonations by non-optical means. (Author)

Naval Ordnance Lab., White Oak, Md.
A FREQUENCY-MODULATION MAGNETIC-TAPE PLAYBACK SYSTEM, by D. J. Torpy. 1 Aug 58, 22p. NAVORD rept. 6156; AD-206 317.
Order from LC mi$2.70, ph$4.80 PB 147 226

Data recording systems which make use of frequency-modulation of a carrier signal recorded on magnetic tape are subject to noise resulting from speed variations in the recording or playback mechanisms. This report describes a playback system which reduces this noise by utilizing a constant-frequency reference signal recorded simultaneously with the data signal, but on a different channel of the tape, to obtain a measure of the speed variations. By using this information, the system reduces the noise to a fixed level which is independent of the magnitude of the speed variations. (Author)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by J. W. Davisson and Joseph Pasternak. Status rept. no. 4. Mar 60, 182p. 2 refs. NRL Memo. rept. 1037.
Order from LC mi$8.40, ph$28.80 PB 147 307

A thorough review of the status of thermoelectricity was provided by a conference held at the Bureau of Ships in December. Each activity described its contracts and evaluated the progress that had been made on them. All of these contracts are described in the final section of this report. Another meeting was a symposium presenting new materials prospects to complement the array of engineering studies. Most of the attention was devoted to refrigeration, but feasibility of a variety of other applications including such things as distillation and pumping were also discussed. (See also PB 145 603)

Navy Electronics Lab., San Diego, Calif.
ANTARCTIC PHOTOMETRY FOR THE DEVELOPMENT OF AN ICE RECONNAISSANCE TELEVISION, by J. M. Hood, Jr. 6 Apr 59, 20p. 2 refs. Research and Development rept. 904; AD-220 475.
Order from LC mi$2.40, ph$3.30 PB 148 644

A series of photometric measurements were made in the Antarctic to assist in the development of a helicopter-borne ice-reconnaissance television. A detailed photometric description of the environment is presented along with broad recommendations for the functional design of a suitable television system. A detail brightness range of 20 to 1 and meteorological

ranges as high as 75 naut mi were measured. Recommendations are made for a system having a 600-to-800 line scan with a minimum video bandwidth of 10 Mc. A single fixed lens of 1-in focal length in combination with the standard 1-in vidicon should give good area coverage and stable observer orientation. (Author)

New York U. Coll. of Engineering, N. Y.
THE CORRELATION PROCESS, by B. Harris and L. S. Schwartz. Technical note on Contract AF 30(602)1655. 15 Apr 59, 65p. 19 refs. RADC-TN-59-145; AD-214 598.
Order from LC mi$3.90, ph$10.80 PB 147 301

Three aspects of the process are considered: (1) The application of inductive probability to the correlator to improve the performance as a sequential detector, as well as to permit the automatic assimilation of a priori knowledge into the decision. (2) The expansion of the correlation function in a series of orthognal functions whose coefficients are determined by linear passive elements. This permits the cross-correlation function to be determined by a smaller bank of coefficient detectors instead of a large bank of parallel correlators. In this method the correlation function can be displayed by impulse triggering the corresponding circuit. (3) Pattern recognition as a means of determining whether or not the cross correlation function indicates the inputs are correlated. Further development of this idea is required before its usefulness can be determined.

New York U. Coll. of Engineering, N. Y.
ENERGY RELATIONS IN FEEDBACK CONTROL SYSTEMS CONTAINING A NON-LINEAR ELEMENT, by Richard Wolfson. Rept. on Contract AF 49(638)586. Jan 60, 52p. 4 refs. Technical rept. 400-7; AFOSR-TN-60-17; AD-232 433.
Order from LC mi$3.60, ph$9.30 PB 147 337

Equations among the average output powers in a single-loop, non-linear feedback control system are developed. These "energy distribution equations" have a form that relates summations of the output power at all frequencies in the non-linear network, to circuit responses calculated at the source frequencies.

New York U. Coll. of Engineering, N. Y.
INFORMATION FLOW CRITERIA FOR FEEDBACK CONTROL SYSTEMS, by S. S. L. Chang. Rept. on Contract AF 49(638)586. Jan 60, 33p. 5 refs. Technical rept. 400-8; AFOSR-TN-59-1328; AD-231 893.
Order from LC mi$3.00, ph$6.30 PB 146 715

Information capacity in Shannon's sense is suggested as an additional criterion for control systems and components. This criterion applies equally well to linear as well as nonlinear systems, and enables a designer to determine the tolerable amounts of small signal nonlinearities in components. Equations are derived for calculating required system capacity from given signal properties and allowed error, loss of information rate in system components, required capacities of system components, and calculation of information capacities from the characteristics of system components with either direct or indirect limiting. (Author)

Ohio State U., Columbus.
PROCEEDINGS OF THE OSU-WADC RADOME SYMPOSIUM, by Robert Fouty and W. A. Greene. Rept. on Radome Techniques and Components, Contract AF 33(616)5410. June 58, 764p. 141 refs. WADC Technical rept. 58-272, vol. I; AD-155 831.
Order from LC mi$11.10, ph$102.90 PB 149 186

This report is one of three containing the papers submitted for the 1958 Radome Symposium. The papers contain technical information pertaining to the design, fabrication, and testing of radomes for ground and airborne use. (Author)

Ohio State U. Research Foundation, Columbus.
THE ANALYSIS AND PRODUCTION OF DENSE ELECTRON BEAMS FOR USE IN MICROWAVE TUBES, by R. M. Campbell. Final rept. on Contract AF 18(600)980. Mar 60, 104p. 9 refs. AFOSR-TR-60-50.
Order from LC mi$5.70, ph$16.80 PB 147 771

Several mathematical methods of analysis were studied and a pinhole-camera gun tester was built. Of the mathematical methods studied, a relaxation method in conjunction with a resistance analog network appeared to be the most useful. A paraboloidal-spheroidal gun, a nonconfocal spheroidal gun, and a modified Heil gun were analyzed mathematically using the relaxation method. This method was also used to study the space-charge-limited potential distribution in spheroidal and paraboloidal diodes. A toroidal gun capable of high perveance but with resulting low convergence was studied using a gun tester. The pinhole-camera gun tester was utilized to study the paraboloidal-spheroidal gun, the nonconfocal spheroidal gun, the modified Heil gun, and a spherical cathode gun. Current density distributions in the beams, and in some instances transverse velocity distributions, were measured. In all cases, the measurements were made for a range of cold cathode-to anode spacings. These data are presented in detail and are intended as a guide in the design and utilization of these and similar electron guns. (Author)

Ohio State U. Research Foundation [Columbus].
LARGE-SIGNAL BEHAVIOR OF A DEGENERATE PARAMETRIC AMPLIFIER, by Y. P. Vaddiparty. Scientific rept. no. 3 on Contract AF 19(604)4060. Nov 59, 13p. 4 refs. AFCRC TN-60-161; AD-233 983.
Order from LC mi$2.40, ph$3.30 PB 146 606

Degenerate parametric amplifiers with the signal frequency at about half the pump frequency have been studied under strong saturating signals. Certain peculiarities of behavior including a shift in the frequency of maximum gain and sudden jumps in gain at certain frequencies in the pass band were observed. A semi-quantitative explanation in terms of the strong nonlinearity of the diode under saturating signals is provided. The results may be useful in providing information on the signal-handling capacity of an amplifier, particularly for modulated signals. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
KD2C-1 ZERO DRAG TELEMETERING ANTENNA DEVELOPMENT, by James C. Coe. 26 Nov 47, declassified 12 June 56, 22p. Technical rept. no. 23.
Order from LC mi$2.70, ph$4.80 PB 148 624

A Zero Drag telemetering antenna has been developed for the KD2C-1 in which the metal structure of the target drone is excited by a radio transmitter and feed line entirely contained inside the fuselage. This antenna was found to be decidedly superior to a quarter wave vertical antenna which used the metal structure of the target drone for a counterpoise as is common practice. The superiority was particularly marked with horizontally-polarized waves. In the course of the investigation, many antennas and feed lines in various combinations were installed and tested, and were found to be inferior to the internally-fed antennas as the representative patterns show. The Zero Drag antenna showed no effect upon the pattern of the control receiver. (Author)

Philco Corp., Lansdale, Pa.
NUCLEAR RADIATION RESISTANT POWER TRANSISTOR, RESEARCH AND DEVELOPMENT, by G. F. Watson. Quarterly progress rept. no. 2, 15 Aug-15 Nov 59, on Contract DA 36-039-sc-78307. [1959] 32p. R109-B; AD-231 899.
Order from LC mi$3.00, ph$6.30 PB 148 341

The calibration of the MIT nuclear reactor was verified. It was demonstrated that exposure of surface barrier transistors in core tube 3GV6 at a power level of 1 megawatt, for periods of 1.8 min and 18 min will provide accumulated dosages of 10^{13} and 10^{14} NVT, respectively. The haziness apparent at the bottom of etched pits was eliminated by the use of larger diameter jets. A cabinet-model precision plater was constructed and put into operation. Emitter electrodes 80 mils diam and collector electrodes 100 mils diam were plated with this system. Considerable progress was made in device assembly techniques. A brush plating technique was developed for gold plating only the top of the stem. Consistently good blank-to-tab soldering was obtained through the use of nickel tabs and a modified soldering fixture. Some difficulty has been experienced in soldering the collector electrode to the stem pedestal. A new stem mounting fixture is presently being evaluated. Un-mounted electrical samples were constructed. (Author)

Porter, H. K., Co., Inc., Prospect Park, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON NON-NICKEL BEARING ALLOY BRAID WIRE, by F. J. Ferrari and W. J. Donnelly. Final engineering rept. for 23 June 57-31 Dec 58 on Contract DA 36-039-sc-72778. [1959] 15p. AD-218 990.
Order from LC mi$2.40, ph$3.30 PB 148 642

The study was conducted to obtain background in the drawing techniques of a substitute non-nickel-bearing 0.015-in.-diam. braid wire for 18-8 stainless steel used in the production of CX-1065/G (Spiral 4) cable and delivery of a pilot run production of this substitute wire. A trial lot of 100 lb of 1/4-in.-diam. rod was used to produce 0.015-in.-diam. braid wire according to the following practice: (1) pickling in HNO_3-HR (10-2 wt-%); (2) coating with Cowles and Lime; (3) cold reduction with HR Vaughn to 0.115-in. diameter in 5 holes; (4) cleaning with alkaline degrease; (5) annealing the strand in dissociated NH_3 atmosphere at 2000°F and 6 fpm; (6) pickling in HNO_3-HF; (7) coating with Cowles and Lime; (8) cold reduction with HR Vaughn to 0.051-in. diameter in 4 holes; (9) cleaning with alkaline degrease; (10) annealing the strand in dissociated NH_3 atmosphere at 2000°F and 10 fpm; (11) pickling in HNO_3-HF; (12) coating with Cowles and Lime; (13) cold reduction with HFV Vaughn to 0.031-in. diameter in 3 holes; and (14) cold reduction with 12 HF Vaughn to 0.015-in. diameter in 7 holes. Because of the lower corrosion resistance of the non-nickel bearing alloy substitute, the conversion practice employed in the production of 18-8 stainless steel braid wire must be modified. Bright annealing must be used in place of batch annealing and nonmetallic coating should be used to avoid exposure to severe acid clean cleaning.

Raytheon Co., Newton, Mass.
INVESTIGATION OF THE CORRELATION OF STANDARD DIODE EMISSION STUDY CONTRACT FINDINGS WITH PRODUCTION TYPE TUBES USING STANDARD PRODUCTION EQUIPMENT, by F. Hill, C. Bardsley and others. Scientific rept. no. 3, 16 June-15 Sep 59, on Contract AF 19(604)4095. 11 Nov 59, 43p. AFCRC TN-59-965; AD-233 494.
Order from LC mi$3.30, ph$7.80 PB 146 329

The Raytheon Company is conducting an investigation of the effect of the variable parameters of commercial exhaust procedure upon the reliability of emission capabilities of a commercial vacuum tube (6AH6). This is an attempt to correlate previous findings from exhaust studies with commercial methods of exhausting vacuum tubes. A total of 123 tests were conducted during this period on an improved exhaust machine. The improvement in pumping speed was attained on this exhaust urit by increasing the plumbing size between the exhaust stem of the vacuum tube and the vacuum pump. A comparison of initial electrical characteristics (0 hour readings) with the methods of exhaust processing show that the machine is capable of producing good tubes up to a speed of 1050 tubes/hour. A 25% reduction in current at exhaust lighting will only produce satisfactory tubes at 530 tubes/hour. A 25% increase in current at exhaust lighting produced heater burn-outs showing the limitations in heater design. Tests conducted at 900 tubes/hour without the use of oil diffusion pumps produced satisfactory tubes. (Author) (See also PB 143 399)

Ramo-Wooldridge Div., Canoga Park, Calif.
STUDY OF FAULT LOCATION AND PREDICTION TECHNIQUES LEADING TO PLANS FOR AUTOMATIC AND DYNAMIC TESTING OF MILITARY GROUND EQUIPMENT, PARTS III, IV, AND V. Final rept. on Contract AF 30(602)1997. 15 Feb 60, 205p. 50 refs. C62-9U37; RADC-TR-59-248B.
Order from LC mi$9.30, ph$31.80 PB 146 110

Part III. Details on Mechanization
Part IV. Recommendations
Part V. Illustration of Application of Automatic Fault Locator to a Representative Electronic System
(See also PB 146 109)

Raytheon Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freeman. Step 1 Final rept. for 23 June 52-15 Oct 56 on Contract DA 36-039-sc-30237. [1956] 197p.
Order from LC mi$8.70, ph$30.30 PB 147 538

Machinery was developed for automatic and semiautomatic transistor manufacture. The transistor types for which this automation was accomplished were the low power germanium audio family, the 2N64 and 2N65. New surface treatments and packaging techniques were developed to accomplish and improve the product parameters and reliability. The automation program sponsored by this contract resulted in an overall increase in operator productivity of 4.6 to 1.

Raytheon Co., Waltham, Mass.
INVESTIGATION OF THE CORRELATION OF STANDARD DIODE EMISSION STUDY CONTRACT FINDINGS WITH PRODUCTION TYPE TUBES USING STANDARD PRODUCTION EQUIPMENT, by F. Hill, C. Bardsley and others. Scientific rept. no. 4, 16 Sep 59-15 Jan 60, on Contract AF 19(604)4095. 11 Mar 60, 36p. AFCRC-TN-60-184.
Order from LC mi$3.00, ph$6.30 PB 148 123

The effect is investigated of the variation in exhaust parameters upon the quality of emission on a 6AH6 type commercial vacuum tube. All tests conducted on the improved Sealex exhaust machine were burned on life for 500 hours and were evaluated for emission characteristics. Speed tests conducted from 530 to 1300 tubes per hour under standard exhaust conditions and with lighting variations show no difference in emission levels during life burning. All tests show the initial 24-hour slump. Extreme variations in exhaust lighting conditions (50% less lighting positions or a 25% reduction in lighting current) show gassy tubes at initial test. Tests conducted at 1200 tubes per hour show high initial gas scrap. A re-evaluation of tests conducted on an exhaust unit having poor pumping efficiency shows these tubes to have lower emission levels. An exploratory aging study points to the fact that this may be the reason for the previously-noted 24-hour slump. (Author) (See also PB 143 399)

Raytheon Co., Waltham, Mass.
STUDY OF PLATINOTRON DEVICES, by Gerry Perloff and W. C. Brown. Quarterly rept. no. 1, 1 Nov 58-1 Feb 59, on QKS-779, Contract DA 36-039-sc-78229. [1959] 56p. 3 refs. AD-227 039.
Order from LC mi$3.60, ph$9.30 PB 148 550

A study of platinotron devices was initiated. The research program is aimed at developing a microwave tube capable of producing a minimum of 100 w CW power and operating in the vicinity of 35 kmc with a minimum bandwidth of 10%. A design was laid out, major parts were ordered, and assembly of parts begun. Copper brazing of stainless steel parts was accomplished successfully. Some additional experiments on the adequacy of the liquid cooling system were made and it was determined that with stainless steel tubing with an inside diameter of .004", heat fluxes of 5 - 10 kw per sq cm could be successfully handled. It was determined that a flow of .25 gal per min of water could be obtained in an experimental header-vane assembly consisting of 21 stainless steel tubular vanes, each having 004" I. D. and each .261" long. If a bulk temperature rise of 50°C is assumed, a flow of .25 gal per min. represents more than 3 kw of anode dissipation. Results obtained to data indicate that this general approach to obtaining appreciable CW power in the millimeter region is quite feasible.

Rome Air Development Center, Griffiss AFB, N. Y.
IMPACT OF TRANSPORTATION ON ELECTRONIC EQUIPMENT, by John F. Carroll. Apr 60, 20p. 1 ref. RADC-TN-60-48.
Order from LC mi$2.40, ph$3.30 PB 147 641

The general impact of various modes of transportation on electronic equipment is considered in terms of amplitude, frequency, source impedance, and time. An analysis is made of a single degree of freedom, fixed end beam, using linear and non-linear response. It is concluded that no available measurements of environment are adequate to describe a source in quantitative terms, however, from observation of tests and field experiences, unrealistic failures in tests or deficiencies in test procedures can be determined. Proper design criteria can be derived only when test procedures become more realistic. (Author)

Schwinger, Julian, Cambridge, Mass.
INVESTIGATION OF HIGH FREQUENCY LIMITATIONS IN MILLIMETER WAVE GENERATORS, by Julian Schwinger. Semiannual rept. no. 1, Feb-Aug 59, on Contract DA 36-039-sc-78282. [1959] 35p. 5 refs. AD-231 593.
Order from LC mi$3.00, ph$6.30 PB 147 934

The theory developed dealing with the interaction between the electromagnetic field in a cavity resonator and a number of two-level molecules is generalized to include a gaussian spread in the molecular frequency. Using the formalism previously developed for a quantum-mechanical field in a lossy cavity, expressions are obtained by means of second-order perturbation theory for the expectation values of the field strength and field energy in the cavity and of the power loss by the molecules. It is shown that the parts of the field energy resulting from induced and spontaneous emission, respectively, initially increase as the square of the time and approach steady-state values after (different, in general) transient periods, each of which is determined by two time constants: cavity relaxation time and inverse molecular frequency spread. It is also shown that both the induced and spontaneous emission power radiated by the molecules increase initially linearly with the time and approach steady-state values after transient periods. (Author)

Shallcross Mfg. Co., Selma, N. C.
VIBRATOR TEST SET TS 747 ( )/U, by John L. McCotter, Jr. and John S. Shallcross. Final rept. for 8 Apr 57-18 Mar 59, on Contract DA 36-039-sc-73239. [1959] 83p. AD-228 801.
Order from LC mi$4.80, ph$13.80 PB 146 339

A vibrator test set was developed which is capable of testing vibrators in accordance with test procedures

recommended by vibrator manufactures. The instrument evaluates vibrators with the following tests: (1) the output voltage is checked from the power supply to determine if it is normal at a normal input voltage, (2) the operation of the vibrator is checked at high and low input voltages to determine that it will operate under both conditions, (3) provisions are made for testing the characteristics of a vibrator under load, (4) the operating frequency of the vibrator is measured at any instant by a built-in frequency measuring circuit, (5) buffering may be changed from primary to secondary or changed in value with switches on the panel, (6) a circuit breaker protects the vibrator power supply and it may also be used to determine the exact starting voltage of a vibrator, (7) a resistive load is provided for the secondary contacts of a self-rectifying type vibrator in order to observe the condition of these contacts, (8) a built-in electronic switch makes it possible to observe primary and secondary wave forms at the same time, and (9) the input voltage is provided in 3 continuously variable ranges, to provide a means for testing a vibrator above and below its normal operating voltage.

Smyth Research Associates, San Diego, Calif.
TROPOSPHERIC AND IONOSPHERIC RADAR REFRACTION EFFECTS, by L. J. Anderson, S. Weisbrod and others. Final rept. on Contract AF 30(602)1624. [1959] 114p. 4 refs. SRA-91; RADC-TR-59-84; AD-217 406.
Order from LC mi$6.00, ph$18.30 PB 147 149

This report describes simple methods for computing refraction effects, such as radar elevation angle and range errors, total ray bending and Faraday rotation, caused by the troposphere and the ionosphere. These methods are applied to radiosonde and ionogram data for Fairbanks, Thule and Leuchars, Scotland, to obtain the statistical distribution of refraction effects at these locations. The application of the methods to the computation of refraction effects at a given time and location is described in detail, and numerical examples are given. The statistical analysis shows that tropospheric refraction is greatest and most variable at Fairbanks. There is a seasonal trend at all stations, with maximum refraction at Thule and Fairbanks in winter, and in Scotland in summer. Ducting is weak at all stations; the lowest trapped radar frequency being 800 megacycles. (Author)

Sperry Piedmont Co., Charlottesville, Va.
SOUND WAVE RAY TRACER (MOD I). Final engineering rept. on Contract Nonr-790(00). Sep 58, 175p. Rept. no. 240-104.
Order from LC mi$8.10, ph$27.30 PB 146 104

The Sound Wave Ray Tracer MOD I, is a device which computes and plots a family of sound rays from the measurement of the velocity of sound through a medium as a function of depth. The equipment handles both surface and bottom reflections. The family of rays provides a complete picture of the sound field, and the density of the rays is an indication of the sound intensity. The equipment is built in and around a desk type cabinet. All operating controls are on the front of the unit. Electrical inputs are 115-volt, 60-cycle, single-phase, and 115-volt, 400-cycle, two-phase; the latter being supplied by a separate motor generator. These connections are made by means of connectors at the rear of the desk. All electronic units are housed in the pedestals of the desk assembly and all mechanical units are mounted on a base plate on the top of the desk.

Stanford Electronics Labs., Stanford U., Calif.
AN EXPERIMENTAL INVESTIGATION OF CROSSED FIELD INTERACTION, by T. Sato. Rept. on Contract AF 33(616)6207. 8 Feb 60, 85p. 32 refs. Technical rept. no. 385-5; AD-234 277.
Order from LC mi$4.80, ph$13.80 PB 147 245

An experimental study of the diocotron effect in a thin electron beam is presented. The diocotron effect is the amplification of microwave signals in an electron beam moving between parallel conducting plates, under crossed-field conditions. The diocotron effect was measured by means of an experimental tube. This tube has a variable-length drift section located between two magnetron-type beam coupling sections. The diocotron effect was directly measured by changing the drift section length and observing the change in the total gain of the tube. The diocotron effect was detected and measured as functions of the beam parameters and degree of modulation. Agreement with the small-signal theory of Heffner and Unotoro is good.

Stanford Research Inst., Menlo Park, Calif.
TECHNIQUES FOR PREVENTION AND REMOVAL OF ICE ON RADOMES, by I. G. Poppoff and R. C. Goettelman. Final rept. on Contract AF 30(602)1442]. 30 Apr 57, 70p. 17 refs. SRI Project SU-1614; RADC TR-57-123; AD-131 180.
Order from LC mi$3.90, ph$10.80 PB 146 374

Investigation of coatings that might reduce accretion and adhesion of ice showed that fabrics and other materials presently used for radomes already have the desired property of low ice adhesion. However, ice adhesion can be lessened further by the use of some silastics, silicones, and Teflon. Of the many "ice-phobic" coatings investigated, none was capable of reducing ice accretion more than 30% compared with radalon-neoprene. Several hypothetical systems were designed to illustrate the practicality and, in some instances, the cost of utilizing the techniques investigated in this study.

Syracuse U. Research Inst., N. Y.
STUDY OF SYSTEM RELIABILITY: ENTROPY OF A CONTINUOUS CHANNEL, by F. M. Reza. Final rept. on Contract AF 19(604)2452. Jan 60, 37p. 14 refs. Rept. no. EE-507-6001-F; AFCRC-TR-60-F.
Order from LC mi$3.00, ph$6.30 PB 148 093

The main object of this report is to outline some results for continuous channels similar to those discussed for discrete systems, principally, the entropy associated with a random variable assuming a continuum of values.

Tung-Sol Electric, Inc., Bloomfield, N. J.
UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION, by B. G. Firth and Warren C. Johnson. Quarterly rept. no. 3, 1 Apr-30 June 59, on Contract DA 36-039-sc-78081. [1959] 24p. AD-225 838.
Order from LC mi$2.70, ph$4.80 PB 147 989

The spot size obtainable in an MgO cathode-ray tube gun is better than originally thought possible. Evidence shows the high velocity electrons may be adequately focused, and the emission sustaining current reduced to the same order of magnitude as the beam current. Cathode improvement is required to achieve beam currents of 1 to 1.5 ma for picture tube applications. From tests made thus far, secondary emission preamplifier tubes appear to be within the realm of possibility. They can be used also to provide dynatron oscillations up to 15 mc and higher. Larger and somewhat better cooled cathodes are expected to make better audio amplifier tubes. Correction of cathode defects was achieved primarily by ultrasonic cleaning of cathode sleeves, cleaner hydrogen firing, better spray coating conditions, and the use of purer materials. (Author) (See also PB 147 988)

Vitro Labs., West Orange, N. J.
GENERAL USAGE ASSEMBLIES FOR NAVY ELECTRONIC EQUIPMENT. Quarterly progress rept. no. 9, 1 Feb-30 Apr 58, on Contract NObsr-72538. 22 May 58, 38p. KLX-10114.
Order from LC mi$3.00, ph$6.30 PB 149 288

The objectives of this work include the development of specifications for General Usage Assemblies, the purchase of representative types of sample assemblies from various manufacturers, construction of prototypes for evaluation of additional types, and the performance of similar work for transistorized General Usage Assemblies. Life tests of eleven types of General Usage Assemblies purchased from outside manufacturers are being conducted. Those units having the longest time on test have now passed 7000 hours. Additional failures occurring during the period of this report have been considered in arriving at revised estimates for mean time to failure for each of the types of assembly under test. Intensive investigation of the behavior of transistors under various conditions has led to the formulation of preliminary designs for three types of assemblies.

Westinghouse Research Labs., Pittsburgh, Pa.
ADVANCES IN SCREEN STRUCTURE AND DATA DISTRIBUTION FOR THE ELF DISPLAY SYSTEM, by E. A. Sack. Rept. on Contract NObsr-72782. 1 Mar 60, 34p. 5 refs. Scientific paper 410FF298-P1.
Order from LC mi$3.00, ph$6.30 PB 149 289

Each element of a typical ELF screen is a configuration of four capacitors, two diodes and a resistor. Microcircuit structures have been developed which achieve a display resolution of 256 elements per square inch. The switching matrix which distributes brightness control signals to the ELF elements is an integral part of the screen array. At present, multi-junction silicon diode strips perform the switching function. Several one-inch-square model screens have been assembled. Larger arrays, eight inches wide by four inches high, are under construction. Screens with edge dimensions measured in feet appear to be feasible. The highlight brightness of experimental screens with 400 cps excitation is 10 foot-lamberts. Contrast ratios of between 50 and 100 to 1 are obtained with 200-volt control signals. Halftone uniformity is satisfactory. In one display system, brightness information is distributed at approximately one element per microsecond with a frame storage time of 5 seconds. Much longer image storage is possible with new switching techniques. (Author)

Ordnance, Missiles, and Satellite Vehicles

Air Force Missile Development Center, Holloman AFB, N. Mex.
WEAR, SOLID LUBRICATION, AND BEARING MATERIAL INVESTIGATION FOR HIGH-SPEED TRACK APPLICATIONS, by Milton R. Wolfson. Mar 60, 59p. 2 refs. AFMDC-TR-60-7.
Order from LC mi$3.60, ph$9.30 PB 148 204

High-speed wear and lubrication were investigated on 60 track tests made with the Stanford Research Institute test slipper. The variables were velocity, bearing material, nominal bearing pressure, and track condition. Wear rate of stainless steel increased with velocity (825 to 2,500 fps) while there was little or no apparent effect on molybdenum. Wear rate was reduced by several solid track coatings, most notably by metallic zinc and slaked lime. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
THE ACCURACY OF AMR INSTRUMENTATION. 5 May 60, 81p. 63 refs. RCA Quality Analysis TR no. 11; AFMTC-TR-60-13.
Order from LC mi$4.80, ph$13.80 PB 148 217

This report gives the best available estimates of the accuracy of RCA/MTP tracking instrumentation in use on the AMR range. These estimates are made on the basis of studies conducted over a considerable period of time. The report provides a definitive discussion of the character of the errors encountered and discusses methods used to determine estimates of errors. Comprehensive statements are made concerning the errors of measurement for the various instrumentation systems. Included also is a section on the determination of the accuracies of reduced data in position, velocity, and acceleration.

Air Force Missile Test Center, Patrick AFB, Fla.
A LEAST SQUARES PITCH AND YAW REDUCTION FOR NARROW ANGLE TRACKING CAMERAS, by George H. Rosenfield. Rept. on Missile Test Project Contract AF 08(606)3413. Jan 60, 57p. 7 refs. RCA Data Processing Technical rept. no. 57; AFMTC-TR-60-8.
Order from LC mi$3.60, ph$9.30 PB 148 314

A rigorous least squares adjustment is presented for computing the pitch and yaw elements of missile attitude, utilizing the measured V-angle of the missile body image vector with reference to the film co-

ordinate system. The solution directly computes absolute pitch and yaw using the missile images exposed on the photographic records from two or more photogrammetric tracking cameras. Camera orientations and measured V-angles only are required in the reduction together with an approximation of the missile attitude. An outline of the computational program and a numerical example is presented to facilitate programming for electronic computation. The procedure is applicable only to pitch and yaw reduction from long focal length, narrow-angle tracking cameras. It is based upon the assumptions that the line of sight from the camera to the missile coincides with the optical axis of the lens, and that the photographic plane is perpendicular to the line of sight. (Author)

American Inst. for Research [Pittsburgh, Pa.]
TECHNIQUES FOR HUMAN FACTORS EVALUATION OF PROTOTYPE SPECIAL WEAPONS AND ASSOCIATED EQUIPMENT, by James W. Shearer, Dan A. Peterson, and Edward B. Slebodnick. Rept. on Contract AF 29(601)513. Apr 59, 134p. AIR-259-59-FR-198; AFSWC-TR-59-14; AD-217 701.
Order from LC mi$6.90, ph$21.30 PB 146 599

The purpose of this study was to develop a method for systematic evaluation of human factors aspects of prototype special weapons equipment. Human factors inputs to system design have customarily been made in early planning stages and later on in operational testing stages. But until the present time there has been no set of techniques for coordinating human factors analyses of prototype equipment with engineering tests of prototype equipment. The techniques developed in this study are intended to fill this gap. Techniques developed include a guide to evaluation of preliminary manuals or instructions pamphlets, a guide to static evaluation of equipment, and an observational record form for use in functional try-outs of equipment. The guides assist the analyst in making recommendations for design of equipment and for content and format of instruction manuals. The observational record form is used in noting operational requirements for personnel, time, and training. It also is used for identifying personnel errors and error-likely situations. (Author)

Applied Psychological Services, Wayne, Pa.
TECHNIQUES FOR EVALUATING OPERATOR LOADING IN MAN-MACHINE SYSTEMS. APPLICATION OF A PREVIOUSLY DERIVED MODEL TO THE LAUNCHING OF AN AIR-TO-AIR MISSILE, by Arthur I. Siegel and J. Jay Wolf. Rept. on Contract Nonr-2492(00). June 59, 45p. 4 refs. AD-225 525.
Order from LC mi$3.30, ph$7.80 PB 146 684

Further evaluations were made of a previously derived model of the human operator in a man-machine system. The model was applied to the pilot's task of launching an air-to-air missile. Thirty-five computer runs, each representing 88 launchings by a given pilot type, were completed. For the average pilot (F = 1.00) a failure probability between 0.40 and 0.435 was indicated in the stress threshold range coincident with that previously derived for landing aboard a carrier. This range of failure probabilities does not coincide with the 0.186 value for failure probability given by outside criterion data for this launching task. Agreement with the 0.186 value was achieved by interpolation when F = 0.91, i.e., pilots who are 9% faster than average. The 9% discrepancy was believed to be a result, at least in part, of a fallible criterion. Over the two tasks the model (1) gave results which agreed in the main with information received from pilots; (2) was generally consistent; and (3) predicted reality reasonably well. It appears that the goal of prediction of the effectiveness of the human operator in man-machine systems has been achieved to some extent for single operator situations.

Army Ordnance Corps, Washington, D. C.
ACCEPTANCE INSPECTION EQUIPMENT DESIGN MANUAL FOR ORDNANCE MATERIEL. 1 Mar 56, 196p. ORD-M608-12.
Order from LC mi$8.70, ph$30.30 PB 146 182

The purpose of this manual is to prescribe the policies and procedures used in the preparation, interpretation and maintenance of all inspection equipment drawings. This manual also establishes and prescribes definite design data and practices applicable to inspection equipment.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
SATELLITE FREQUENCY MEASUREMENTS, by O. P. Layden and H. D. Tanzman. 1 Oct 59, 48p. USASRDL Technical rept. 2067; AD-229 155.
Order from LC mi$3.30, ph$7.80 PB 149 384

The investigation being carried out on the frequency observations of radio signals from the Russian and American satellites is discussed. Various plots of frequency versus time are given for the Russian and American satellites in orbit as well as take-off curves for all American satellites. The equipment used to obtain Doppler measurements is described and the frequency and time accuracy associated with the system is discussed. (Author)

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
VARIABILITY OF BALLISTIC METEOROLOGICAL PARAMETERS, by A. Arnold and R. Bellucci. 30 Aug 57, 114p. 16 refs. Technical memo. no. M-1913; AD-144 154.
Order from LC mi$6.00, ph$18.30 PB 148 119

Variability data from various sources have been examined. This examination led to equations describing variability of wind and of density. The magnitude of variability depends on geographic location, season of the year, and possibly other parameters. The data on wind velocity are more extensive, permitting a more thorough examination. For mid-latitudes and to moderate altitudes, for all seasons, and with an attempt made to remove instrumental error, the following equations were obtained: Time variation: r.m.s. velocity $= 4t^{0.5}$ where t is the time interval in hours (between the values of 1/2 and 12) and the velocity in miles per hour. Distance variation: r.m.s. velocity $= \frac{3}{2}s^{0.5}$ where s is the distance interval in miles (between the values of 4 and 80). The above equations cover conventional winds. For ballistic winds the r.m.s. value should be reduced by 20 per cent.

Avco-Everett Research Lab., Mass.
AIR SCOOPING VEHICLE, by Felix Berner and Morton Camac. Rept. on Contract AF 04(647)278. Aug 59, 121p. 17 refs. Research rept. 76; AFBMD-TR-59-17.
Order from LC mi$6.30, ph$19.80 PB 147 213

A satellite vehicle is described which collects gases from the upper atmosphere and stores them in liquid form. Such a vehicle could serve as a filling station in space, furnishing liquid oxygen or air to other spacecraft. The vehicle represents an alternative to launching these liquids into orbit from the surface of the earth. The two methods are compared on an economic basis, and it is shown that the proposed vehicle permits substantial savings when operated beyond about one year. The feasibility of developing such a system for long-time operation is investigated. Several practical designs are discussed. (Author)

Avco-Everett Research Lab., Mass.
CONTROLLED RECOVERY OF NON-LIFTING SATELLITES, by R. W. Detra, F R. Riddell, and P. H. Rose. May 59, 20p. 9 refs. Research rept. 54.
Order from LC mi$2.40, ph$3.30 PB 147 202

This paper considers the problem of recovering, at a pre-selected site, satellites that are orbiting close to the earth (i.e., within a few hundred miles of the earth's surface). Considerations are limited to vehicles which accomplish re-entry into the atmosphere with drag devices. The discussion centers on two possible means of effecting controlled recovery of satellites.

Avco-Everett Research Lab., Mass.
THE DRAG BRAKE MANNED SATELLITE SYSTEM, by R. W. Detra, A. R. Kantrowitz and others. Aug 59, 26p. 19 refs. Research rept. 64; AD-227 524.
Order from LC mi$2.70, ph$4.80 PB 147 206

The manned satellite designs which have been most frequently proposed are extrapolations either of airplanes or of missile nose cones. A new approach is presented to the design of a manned satellite system. The central feature of this design is a variable area drag brake. For a given capsule and payload, the elements associated with attitude stabilization, recovery from orbit, re-entry, landing accuracy control and final landing of the system described comprise less than half the weight required for the same functions in presently envisioned retro-rocket systems. (Author)

Avco-Everett Research Lab., Mass.
A ROUGH ESTIMATE OF THE ATTENUATION OF TELEMETERING SIGNALS THROUGH THE IONIZED GAS ENVELOPE AROUND A TYPICAL RE-ENTRY MISSILE, by S. C. Lin. Rept. on Contract AF 04(645)18. Feb 56, 51p. 20 refs. Research rept. 74; AD-221 395.
Order from LC mi$3.60, ph$9.30 PB 147 212

A rough estimate was made on the attenuation of telemetering signals to be expected through the ionized gas layer surrounding a typical long range missile reentering the earth's atmosphere at hypersonic speeds. The results indicate that in the frequency range used by the standard telemetering system, (e.g., the RDB system, $f \approx 200$ mc) it would be difficult to send any signal through the ionized gas throughout the critical part of the trajectory. If the electron-ion recombination rate turns out to be sufficiently rapid, microwave frequencies ($f \approx 3 \times 10^{10}$ cps.) will probably be satisfactory. Even if the electron-ion recombination rate is very slow, microwaves still seem to work at sufficiently high altitudes (above 150,000 ft or so) according to the present estimate. The low frequency end of the spectrum ($f \lesssim 1$ mc) can probably be utilized for transmission below the ionosphere. (Author)

Avco-[Everett] Research Lab., Mass.
A THEORY FOR THE ABLATION OF GLASSY MATERIALS, by Hans A. Bethe and Mac C. Adams. Rept. on Contract AF 04(645)18. Nov 58, 32p. 10 refs. Research rept. 38.
Order from LC mi$3.00, ph$6.30 PB 147 198

The ablation of glassy materials, when subjected to aerodynamic heating, is treated theoretically. The approximate equations are shown to be extremely accurate for determining the energy absorbed per unit mass of ablated material. For simplicity the analysis is restricted to the stagnation region of a blunted body and only steady state ablation is considered.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
BIOSATELLITE, DEVELOPMENT AND STUDY WITH; LETTER REPORT CONCERNING LIFE SUPPORT SYSTEM, by George H. Kydd and Peter Craig. Rept. MA-4 on BuMed Proj. MR 005.15-0002.16. 6 Jan 60, 14p. 1 ref. TED ADC AE 1412.2; NADC MA L6001; AD-231 598.
Order from LC mi$2.40, ph$3.30 PB 146 346

A closed system environmental chamber was designed and constructed for the purpose of studying animals under simulated capsule conditions for long periods of time. The chamber was considered to have worked well. Preliminary observations were made on the CO_2 scrubber, the circulating pump, temperature regulation, relative humidity, and the O supply system.

Ballistic Research Lab., Aberdeen Proving Ground, Md.
FREE FLIGHT RANGE TESTS OF A 10-CALIBER CONE CYLINDER, by Eugene D. Boyer, Apr 60, 33p. 15 refs. Memo. rept. no. 1258.
Order from LC mi$3.00, ph$6.30 PB 148 513

The aerodynamic properties of a ten-caliber cone cylinder are presented and analyzed. The Magnus data are definitely non-linear. It is shown that at

subsonic Mach number the non-linear Magnus moment should cause a limit motion. Finally the data are combined with results of a finned model program to yield the properties of the fins. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
MICROFLASH PHOTOGRAPHIC INSTRUMENTATION OF THE INTERIOR BALLISTICS LABORATORY, by E. L. Bonhage and H. G. McGuire. July 59, 24p. 4 refs. Memo. rept. no. 1216; AD-225 582.
Order from LC mi$2.70, ph$4.80 PB 148 459

Various high speed photographic instrumentation systems used to obtain well defined photographs of fast moving objects are described. Several experimental applications are explained briefly to illustrate the manner in which plate cameras or high speed continuous film cameras were used to record ballistic events illuminated with either one-shot flash sources or a single flash tube pulsed at a high rate. Experimental conditions dictating the choice of equipment, camera settings, film and developing procedures are discussed. Photographic results of each experiment, to show the quality of pictures obtained by these techniques are included. (Author)

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK. Quarterly rept. no. 5 on Contract AF 04(647)59-3. 15 June 60, 47p. 3 refs.
Order from OTS $1.25 PB 161 093-4

This issue includes graphs representing the data obtained during the period, an addition to the foreword, an accumulative index, and an addition to the tabular indexes. (See also PB 161 093-3)

Diamond Ordnance Fuze Labs., Washington, D. C.
PROCEDURE FOR DETERMINATION OF GAS EVOLVED BY THERMITE MIXTURES, by Robert E. McIntyre. 4 Feb 60, 24p. 3 refs. Technical rept. TR-702; AD-233 048.
Order from LC mi$2.70, ph$4.80 PB 146 752

A manometric procedure for the rapid determination of gases in pyrotechnic mixtures has been developed. The pressure readings are made using a strain gage pressure transducer, and readings taken at 135°C and at room temperature allow the determination of condensable and noncondensable gas as well as total gas. The sensitivity of the method is 0.01 ml of gas for the usual sample weighing 2 g, or 0.05 ml/g. About 30 min is required for a determination. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PROPOSED VEHICLE FOR TEST AND RECOVERY OF GUIDED MISSILE FUZES, by D. A. Worcester and R. J. Gath. 5 Feb 60, 9p. Technical rept. TR-808; AD-233 018.
Order from LC mi$1.80, ph$1.80 PB 146 751

Determination of burst-height accuracy of guided missile fuzes is difficult because of the limited number of flights and, in some circumstances, the limitations of down-range field instrumentation which must cover a large impact area. A system has been designed to permit testing of complete fuzes by dropping in modified bombs with parachute recovery of the fuzes subsequent to function. This system permits simulation of approach conditions over an instrumented area, provides for accurate determination of burst height, and allows reuse of fuzes. Thus burst-height accuracy can be determined at low cost with a small number of fuzes. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
T320-TYPE (FIREFLY) FUZES, by Warren V. Moore. Summary 16 May 60, 22p. TR-822.
Order from LC mi$2.70, ph$4.80 PB 146 913

Mechanically operated 20- and 30-mm pyrotechnic-delay fuzes, capable of providing timed burst 1 sec and 2 sec after firing, have been designed and subjected to limited field testing. The 20-mm fuzes were designed specifically to check external ballistics of the M56 round when fired crosswind from an aircraft. The 30-mm fuzes are patterned after the 20-mm designs; the 1- and 2-sec delays in these fuzes differ only in burning rate and amount of delay powder. The basic design employs a spring-loaded firing pi.. that is held in place by two arming rods; a pyrotechnic delay and explosive train. The arming rods move out under centrifugal force, freeing the firing pin to start the delay. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF A PYROTECHNIC PHOTO RELAY FOR USE WITH A PHOTOCELL CONTACT FUZING SYSTEM, by Erling Bertrand. Mar 60, 21p. 8 refs. Technical rept. 2645; AD-235 187.
Order from LC mi$2.70, ph$4.80 PB 146 520

A pyrotechnic photo relay was designed to be used as part of a self-destructive device in a missile. As part of a photocell contact fuzing system, the relay will be initiated by the stab action of a firing pin in the fuze upon contact of a missile with the ground. Within less than 200 microseconds, the relay will emit sufficient light to activate a photocell located up to 7 feet from the relay. The configurations of the relay and the type of pyrotechnic compositions were established (NOL-130 primer mixture; 65/35 zirconium powder/potassium perchlorate flash composition) and the light output was brought under control; the firing time was investigated. When tested by dropping a weight on the firing pin, it was found that the functioning times were erratic and would occur as much as 700 microseconds after the weight struck the pin. An explosive ram was constructed to replace the drop weight. With this testing arrangement consistent firing times were obtained and the desired amount of light was produced within the required time interval. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
WORK IN CONNECTION WITH IMPROVING PACKING FOR AERIAL DELIVERY OF FUZE, VT, (T178) M517, by J. M. Spilman. Final engineering rept. June 59, 15p. 3 refs. FR: 5-60; AD-230 645.
Order from LC mi$2.40, ph$3.30 PB 146 984

Three new designs and the standard design of packing supports were evaluated. During laboratory rough handling and simulated aerial delivery tests results showed that the design of polystyrene base and nose supports offered a greater degree of physical protection to the fuze. This was compared by observing battery failure which was found from previous tests to be the most sensitive part of the fuze to damage. In addition since the former design utilized two steel supports (basic design) and two cushions, savings in material and labor costs also resulted as did use of nonstrategic material by using the new design of polystyrene supports. For this reason it was recommended that the new design of packing supports be utilized. (Author)

Hermes Electronics Co., Cambridge, Mass.
PRECISION OF COMPENSATED TRACKING SYSTEMS, by Richard J. Davisson. Rept. on Contract AF 19(604)5905. 5 Nov 59, 147p. 136 refs. Rept. no. M-810; AFCRC-TR-59-356; AD-230 096.
Order from LC mi$7.20, ph$22.80 PB 147 343

Factors affecting the precision which can be achieved with various types of missile and satellite tracking systems are described. The "ranges" which are measured in pulse and doppler system are expressed as power series expansions in the reciprocal of the radio frequency employed. The terms of these series are discussed in relation to the tropospheric and ionospheric effects from which they arise, and methods for eliminating the principal refraction errors are described. It is shown that overall ranging errors can be reduced to the order of 30 ft or less by these techniques. Precision angle measurements are shown to be much more difficult to achieve. (Author)

Integrated Range Mission, White Sands Missile Range, N. Mex.
COORDINATE SYSTEMS AND TRANSFORMATIONS USED IN THE PREPARATION OF MISSILE DATA, by Marvin Mundt. Nov 58, 34p. 10 refs. Technical rept. 73; AD-207 497.
Order from LC mi$3.00, ph$6.30 PB 149 184

A report devoted to the discussion of the several coordinate systems and coordinate transformations used at the White Sands Missile Range. It has been designed to serve as a reference manual for those people who need to know about the coordinate systems and coordinate transformations used by the Data Reduction Division in the preparation of missile data. (Author)

Military Intelligence Service [Dept. of the Army] Washington, D. C.
HANDBOOK ON GUIDED MISSILES OF GERMANY AND JAPAN. 1 Feb 46, declassified 20 Feb 56, 211p. MID 461; ATI-742.
Order from LC mi$9.60, ph$33.30 PB 148 367

Naval Ordnance Lab., Corona, Calif.
FILTERING SAMPLED FUNCTIONS, by E. D. Fullenwider and B. I. McNamee. 12 July 56, rev. Apr 59, 44p. 12 refs. Technical memo. no. 64-104.
Order from LC mi$3.30, ph$7.80 PB 148 851

A method suitable for use with a digital computer in filtering any function of time sampled at a constant rate is described. Each point of the output is found by replacing the corresponding point of the input with a suitable linear combination of itself with adjacent values. The constants in the linear combination are those which minimize the rms magnitude of the difference between the desired and the actual frequency-response functions. This dependence of the output on both past and future values of input makes the filter more versatile than network filters. The spectral density of the input need not be known. Examples include a square filter, equivalents of network filters, and filters similar to network filters but without phase shift.

Naval Ordnance Lab., White Oak, Md.
A PIEZOELECTRIC FORCE GAGE FOR MEASURING DRAG ON TWO-DIMENSIONAL MODELS IN THE SHOCK TUBE, by William G. Luke and Luther W. Slifer. 1 Apr 59, 61p. 4 refs. NAVORD rept. 6211; DASA-1170.
Order from OTS $1.75 PB 161 872

The design, development, testing, and final evaluation of a piezoelectric force gage for measuring drag forces in a shock tube are described. The gage is a one-inch cylinder of square cross section which, when mounted, extends across the entire width of the shock tube. It has a central test section which is free to respond to applied forces while the end sections are rigidly mounted to the shock tube walls. In this way, registry of end and wall effects is minimized so that the gage configuration may be considered two-dimensional. The sensing element of the gage is a one-half-inch-diameter, four-pile, plastic-bonded, tourmaline crystal stack which is readily adaptable to other gage configurations. The plastic-bonded element is superior in ruggedness to conventional, solder-bonded elements and has a comparable sensitivity of 24 micro-microcoulombs per pound. It is capable of withstanding forces up to 30 pounds. This is adequate for shock pressures up to 10 psi but breakage of the crystals is expected to occur frequently when larger forces are applied. Inaccuracies of the gage are estimated to be less than 15 per cent under any of the test conditions for which it is intended. The errors result primarily from the sensitivity of the gage to temperature and from record-reading inaccuracies due to noise level. (Author)

Naval Ordnance Lab., White Oak, Md.
PISTON TYPE STRAIN GAGES, by V. C. D. Dawson. 13 Jan 59, 15p. 5 refs. Ballistics research rept. 11; NAVORD rept. 6251; AD-220 458.
Order from LC mi$2.40, ph$3.30 PB 148 452

For the past several years piston type strain gages have been used at the Naval Ordnance Laboratory's ballistic range facilities to record pressures. The theory used to predict the frequency response, sensitivity and pressure limit of such gages is presented. (Author)

Naval Ordnance Test Station, China Lake, Calif.
THE DEVELOPMENT OF THE SQUIB MK 1 FOR USE IN NAVY ROCKET IGNITERS, by R. L. Smith. 6 Apr 56, 30p. 6 refs. NOTS 1384; NAVORD rept. 5039.
Order from LC mi$2.70, ph$4.80 PB 149 270

The Squib Mk 1 was developed in response to the need in Naval ordnance for a high-quality squib to initiate small metal-cased igniters. The first fully specified, non-proprietary Navy squib, the Squib Mk 1 overcomes the deficiencies of earlier squibs in reliability, safety, and quality control. The results of proof testing in 2.75-in. folding-fin aircraft rocket igniters and motors were entirely satisfactory. Of more than 12,000,000 squibs produced, none have been rejected. (Author)

Naval Ordnance Test Station, China Lake, Calif.
HANDBOOK ON THE EFFECTIVENESS OF CLUSTER WEAPONS AGAINST UNITARY TARGETS, by Eldon L. Dunn. 12 Jan 60, 177p. 3 refs. NOTS TP-2382; NAVORD rept. 7019; AD-234 857.
Order from LC mi$8.10, ph$27.30 PB 146 990

This report contains the results of a parametric study on the effectiveness of cluster weapons against unitary targets, where a unitary target is a target such as a tank or ship which may be regarded as a unit for purposes of tactical warfare. The effects of number of bomblets, delivery error, ammunition dispersion, target length and width, warhead effectiveness and inclination of trajectory are considered. The results of the study are presented in handbook form so that one may quickly determine the effectiveness of any proposed cluster weapon, once specific values have been assigned to the above parameters. (Author)

Naval Ordnance Test Station, China Lake, Calif.
LOCKSEAL JOINT FOR ROCKET COMPONENTS, by Sydney R. Crockett. 11 Oct 57, 56p. 2 refs. NOTS-1492; NAVORD rept. 5275; AD-150 474.
Order from LC mi$3.60, ph$9.30 PB 146 529

In response to the need for an improved means of uniting the components of a rocket, the Lockseal Joint has been conceived and developed. It locks and seals one component to another by forcing metal from the wall of one into a rubber-lined, circumferential groove in the surface of the other. In work to date it has been applied to 1- to 3-in., soft-steel and hardened-steel motor tubes, and to 1- to 5-in., soft-aluminum and hardened-aluminum tubes--the walls of both steel and aluminum tubes being of varying thicknesses. Numerous tests have demonstrated its superiority in many respects, including strength, axial alignment, and producibility, to joints now commonly used in rocket design. (Author)

Naval Ordnance Test Station, China Lake, Calif.
A METHOD OF IGNITING SMALL PROPELLANT GRAINS IN A LARGE COMBUSTION CHAMBER, by Carl D. Runge. 28 Oct 59, 18p. NOTS TP-2355; NAVORD rept. 6612; AD-234 839.
Order from LC mi$2.40, ph$3.30 PB 146 985

Several methods of igniting a short ammonium nitrate grain housed in a long grain chamber were explored. The requirement for this use occurs in short-duration torpedo tests in which grains of considerably less than full length are needed. The result of the experimental investigation was an effective pyrotechnic ignition system for this situation. The ignition method which proved most successful used an assembly of ammonium perchlorate propellant and boron potassium nitrate pellets on the ammonium nitrate grain base.

Naval Ordnance Test Station, China Lake, Calif.
A PHOTOMETRIC SYSTEM FOR MEASURING INTENSITY AND DURATION OF PYROTECHNIC SIGNALS: DESCRIPTION AND USE, by R. E. Lawrence. 17 Sep 58, 31p. NOTS 2105; NAVORD rept. 6408; AD-207 684.
Order from LC mi$3.00, ph$6.30 PB 146 991

A description is given of the photometric instrumentation developed for the measurement of the intensity, duration, and inherent delay of flash signals used for inflight evaluation of missile fuzes. The delay time and the duration are typically measured to the nearest 0.1 millisec. The light intensity is normally read to an accuracy of about 5%. This report serves as an operational manual for the technicians who use the equipment and as a source of information for others who may wish to duplicate the equipment and methods. (Author)

Naval Ordnance Test Station, China Lake, Calif.
PINHOLE CAMERA DETERMINES SPATIAL POSITION, ORIENTATION, OR DYNAMIC SURFACE PRESSURE OF MISSILE, by D. B. Clark and W. H. Allan. 14 Apr 59, 22p. NOTS TP 2217; NAVORD rept. 6526.
Order from LC mi$2.70, ph$4.80 PB 146 525

A new technique was devised for measuring the roll, yaw, and pitch orientation of a missile. These measurements may be made while the missile is accelerating in the launching tube or while the missile is in free flight. The technique uses a pinhole camera located in the nose of the missile and electronic flash lamps for reference lights. The camera photographs the pulsating reference lights that are located downrange--one on each side of the trajectory line.

Naval Ordnance Test Station, China Lake, Calif.
ROCKET THRUST VECTORING BY USE OF SECONDARY INJECTION; A NEW METHOD OF RECLAIMING ENCAPSULATED ELECTRONIC COMPONENTS; TEMPERATURE-PRESSURE PROBE FOR HIGH-TEMPERATURE GAS STREAM, by L. T. Bankston, E. H. Bartel and others. 3 June 60, 3p. Technical Brief 1; NOTS TP-2449.
Order from LC mi$1.80, ph$1.80 PB 147 910

Naval Ordnance Test Station, China Lake, Calif.
THE WATER EXIT OF A MISSILE RELEASED BELOW THE SURFACE OF THE OCEAN, by Warner Goldsmith. Rept. for June-Aug 57. 3 Aug 57, 27p. NOTS 1838; NAVORD rept. 5622; AD-160 387.
Order from LC mi$2.70, ph$4.80 PB 146 095

Equations of motion are developed describing the behavior of a missile at the water-air interface of an ocean after release of the missile from a submerged position. The missile is modeled as a rigid right-circular cylinder and is assumed to execute plane motion under the action of gravity, forces produced by surface waves, and a current of constant velocity. The initial conditions for the present problem must be derived numerically as the terminal values for the subsurface motion of the missile which has been described in a previous report. A complete analysis of the surface emergence of the missile requires the numerical solution of the differential equations on an automatic computer. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
A METHOD FOR PREDICTING THE LIFETIME OF A NEAR SATELLITE, by R. Earl Good. Master's thesis. Rept. on Contract AF 19(604)5894. Jan 60, 63p. 21 refs. Technical rept. 418; AFCRC-TN-60-287.
Order from LC mi$3.90, ph$10.80 PB 148 530

The behavior of satellite orbits under the perturbing effect of atmospheric drag is studied in order to determine the lifetime of a satellite. The wide extremes in drag coefficient, velocity, and density that a satellite experiences during one revolution is studied for possible methods of removing uncertainties in the lifetime predictions. By dividing the satellite lifetime into three phases - circularization, spiral decay, and terminal - approximate methods can be developed to estimate the satellite lifetime in each phase. The method developed is based on the law of conservation of energy. It considers a differential loss in energy per revolution through the drag; and then by integrating for N number of revolutions, the total change in the ellipse shape is determined per revolution. The lifetime of the satellite is then the sum of the revolutions in each phase. (Author)

Office of Ordnance Research, Durham, N. C.
TRANSACTIONS OF THE CONFERENCE OF ARSENAL MATHEMATICIANS [NO. 5] HELD AT ROCK ISLAND ARSENAL 3-4 JUNE 1959. May 60, 119p. 10 refs. OORR 60-1. AD-237 914.
Order from LC mi$6.00, ph$18.30 PB 148 218

Contents:
Launcher dynamics
An approach to dimensional analysis applied to the dynamics of a rocket launcher under aerodynamic load
Some results of an α^3 theory applied to the buckling of a shallow spherical shell
Application of the Kronecker product in multivariate interpolation
On the theory and application of finite operators
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Solution of the Euler angle transformation equations
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Oklahoma State U. Research Foundation, Stillwater.
RESEARCH DIRECTED TOWARD THE DESIGN, DEVELOPMENT, AND CONSTRUCTION OF METEORITIC MICROPHONE DETECTORS OF VARIOUS SENSITIVITIES FOR USE IN SATELLITES, by H. E. Harrington. Scientific rept. no. 1 on Contract AF 19(604)5715. 15 Jan 60, 34p. AFCRC TN-60-229; AD-233 737.
Order from LC mi$3.00, ph$6.30 PB 146 319

An electronic system designed for the express purpose of exploiting the data-gathering potential of a specific vehicle in obtaining information regarding the influx of micrometeor material was developed. An acoustic sensing technique is employed, whereby the particulate matter to be detected activates a supersonic microphone device. The resultant electrical signal is amplified to a suitable level, graded as to magnitude, and stored internally by electronic means for subsequent recording and/or telemetering to ground receiving stations by the system inherently available within the chosen vehicle. A brief historical background of the development of the technique is presented, together with details of the specific system evolved for this application. Various design features which are peculiar to this application are presented and discussed. The prototype equipment which resulted from the development program was subjected to a testing program to verify its suitability for the anticipated use, and several sets are currently under construction. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
INVESTIGATION OF SINGLE JATO BOOSTER LAUNCHINGS OF LTV-N-2 TYPE MISSILE, by Willy A. Fiedler and Robert Lusser. Rept. on Proj. TED MTC PA-501.1. 20 Sep 49, declassified. 37p. GSR-11; Technical rept. no. 60.
Order from LC mi$3.00, ph$6.30 PB 148 631

Launching configurations for LTV-N-2 type missiles using one JATO, 2KS-33,000, with either straight or canted nozzle are described. The advantages, possibilities, and special problems of each configuration are discussed, using the LTV-N-2 missile as an example. Two types of launchers for zero- and short-length launching are described. New methods of athwartship firing and jettisoning of the missile in event of emergency are discussed. Storage of two LTV-N-2 missiles in the existing submarine hangar is found practicable. Combined methods of c.g. determination and JATO thrust alignment are described. Studies and calculations indicate that complete reliability can be attained with a single JATO booster in zero- and short-length launchings. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
PTV-N-2 (GORGON IV). Final rept. on Proj. TED MTC PA-503. 14 Dec 48, declassified 12 June 56, 26p. Technical rept. no. 40.
Order from LC mi$2.70, ph$4.80 PB 148 626

This project was established to evaluate the C-20-.85C ramjet power plant as a propulsion unit, utilizing the PTV-N-2 (GORGON IV) as a vehicle. The first five free-flight tests were conducted for the primary purpose of aerodynamic evaluation of the test vehicle. Sufficient data were accumulated during

these tests to make this evaluation. As a flight-test vehicle, PTV-N-2 possessed a high degree of aerodynamic stability in both powered and unpowered flight, but flight durations were limited by equipment failures. Two vehicles were expended for a later ramjet evaluation phase. The performance of the C-20-. 85C ramjet power plant revealed that difficulties would be encountered in securing reliable operation at the designed Mach number of 0. 85. The next phase of the PTV-N-2 flight test program was devoted to investigating the suitability of five vehicles as target P/A.

Picatinny Arsenal, Dover, N. J.
PYROTECHNIC SPOTTING DEVICE FOR THE HONEST JOHN ROCKET SYSTEM, by Ralph B. Wright. July 60, 31p. Technical rept. 2691.
Order from LC mi$3.00, ph$6.30 PB 146 877

This report describes the development of a pyrotechnic spotting device for the Honest John rocket. To meet stringent requirements as to time of functioning, resistance to surface heating, interchangeability of units used to signify different events, and resistance to both vibration and acceleration stresses, a literature study of initiators and compositions, as well as a series of local laboratory experiments and static tests, was necessary before the first complete design could be attempted. As work progressed, requirements were changed, necessitating modifications of existing designs or complete redesigning of the device. Thus, several spotting device designs, designated Types 1, 2, 3, 10, and 13, were completed specifically for the Honest John rocket. The Type 13 design takes into consideration all mandatory requirements for an Honest John rocket spotting device made up to the date of this report. Types 2, 3, 10, and 13 have all been used successfully in Honest John system flights. This work indicated that development of flash charges of various specific light intensities and durations, capable of matching various light, camera, and film conditions, would be useful during future missile test flights employing spotting devices. (Author)

Picatinny Arsenal, Dover, N. J.
USE OF CLOSED BOMB TEST METHODS FOR ASSESSING 81 mm MORTAR PROPELLANT, by Lester Shulman and Louis Bottet. July 60, 11p. 4 refs. Technical rept. 2693.
Order from LC mi$2.40, ph$3.30 PB 147 852

The results obtained from 320 closed bomb firings and 280 proof firings of test samples representing 14 production lots of M5 increment propellant for the 81 mm mortar indicate a high degree of correlation, as shown by the statistical "H" test. On the basis of these results, equations relating flight velocities and mortar tube pressures to closed bomb parameters are derived. With these equations, velocities and pressures for the 81 mm mortar can be predicted within $\pm$2.3% and $\pm$4.9%, respectively. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
EXPERIMENTAL TEMPERATURE DISTRIBUTION IN A HEMISPHERICAL NOSE CONE IN HYPERSONIC FLOW, by S. V. Nardo, John L. Boccio, and others. Rept. on Contract Nonr-839(23). June 59, 56p. 3 refs. PIBAL rept. no. 494; AD-218 655.
Order from LC mi$3.60, ph$9.30 PB 146 581

Results are presented of tests on a hemispherical nose cone in the hypersonic tunnel. The test conditions with respect to Mach number and Reynold's number correspond to Mach numbers in the range of 15 to 20 at altitudes of 85,000 ft and higher. The stagnation temperature was varied from 850° F to 14000°F. Aerodynamic and thermal load data are given in the form of pressures along a meridian of the model and temperature-time histories at various points on the model. Future research will involve the analysis of these data in order to evaluate heat transfer coefficients and the thermal and mechanical stresses within the body. The hemispherical nose cone is made of Type 304 stainless steel, has an outer diameter of 7-3/4 in. and is one in. thick. Instrumentation consists of 13 pressure taps and 40 thermocouples. (Author)

Rock Island Lab., Ill.
THE EFFECT OF VOLATILE CORROSION INHIBITORS ON MIL-B-131 BARRIER MATERIALS, by E. S. Burke. 2 Feb 60, 21p. 10 refs. Rept. no. 60-294; AD-234 721L.
Order from LC mi$2.70, ph$4.80 PB 147 338

MIL-B-131 barrier materials with polyvinyl chloride, polyethylene and metallized polyethylene-polyester heat sealing films, respectively, and unsupported films of these plastics were placed in contact with paper impregnated with dicyclohexyl ammonium nitrite; a mixture of urea, sodium nitrite and monoethanolamine benzoate; dicyclohexylamine caprylate; and an amine carboxylate and exposed to temperature cycling for various periods of time. The effect of these conditions on the water resistance of the seal, moisture vapor transmission rate, delamination of the plastic film and sealability of the barrier material was measured as well as the effect of this exposure on the tensile and elongation properties of the unsupported plastic films.

Rock Island Arsenal Lab., Ill.
WET STRENGTH IN ORDNANCE PACKAGING, by W. F. Garland. 21 Dec 59, 22p. 20 refs. Rept. no. 59-3219; AD-233 868L.
Order from LC mi$2.70, ph$4.80 PB 147 221

This report covers the evaluation of thirteen commercially available wet strength papers of the kraft type, i.e., as used in several Military packaging specifications. Wet strength treatments of these papers included: synthetic rubber latices, formaldehyde resins, fluorochemicals and two treatments not stated. The wet tensile strength and percent wet strength of all materials was considerably greater than that of the two control materials. As a group, the synthetic rubber treated papers showed a higher percent wet strength than the other papers tested. Only one wet strength treated paper was effectively fungus resistant. (Author)

Rome U. (Italy).
ANISOTROPIC COMPOSITE THERMAL STRUCTURES FOR HYPERSONIC FLIGHT, by Luigi Broglio. Technical note no. 1 on Contract AF 61(052)198. Feb 59, 49p. 7 refs. SIARgraph no. 52; AFOSR-TN-59-1015; AD-230 231.
Order from LC mi$3.30, ph$7.80 PB 146 707

The solution is given for the instantaneous source of heat located at a generic point of an anisotropic heterogeneous composite body of whatever shape. The solution satisfies both the differential equation of the heat conduction and the boundary conditions of the specific body. Thus, by using appropriate space integrals of such solution and by leaving all kinds of nonlinearities (such as variation of thermal properties, radiation and so on) to the final timewise integration, a very general solution is found. The solution is introduced for the thermal shock generated by an instantaneous unit timewise temperature step at a generic point of a body of whatever shape. The solution satisfies the differential equations of the dynamic thermal motion and the boundary conditions of the specific body. Here again the most general solution is immediately written as an appropriate space and time integral of the unit solution. By combining the results, the thermal motion generated by an instantaneous heat source located at a generic point is obtained. (Author)

Springfield Armory, Mass.
NONDESTRUCTIVE INSPECTION OF BRAZED CLEVIS ON 7.62mm M60 MACHINE GUN OPERATING ROD GUIDE ASSEMBLY, by R. D. Korytoski and E. H. Abbe. 28 Dec 59, 17p. 3 refs. SA-TR19-1504. AD-237 235.
Order from LC mi$2.40, ph$3.30 PB 147 914

An investigation was made in order to develop a nondestructive test method for the evaluation of brazed joints on the M60 guide assembly operating rod. The ultrasonic resonance method provided a nondestructive test means to evaluate the soundness of brazed areas. Completely brazed areas produced several resonance indications with thickness approximating 0.130 inch. A poorly brazed joint shows a single resonance indication with thickness approximately 0.050 inch. Ultrasonic pulse echo method could not be be practically applied. The ultrasonic resonance method proved most feasible and was used in the development of inspection procedures. (Author)

Watertown Arsenal Labs., Mass.
HYDROSTATIC TESTING OF COLD EXTRUDED 155mm HE SHELL, M107, by C. A. Riddle and E. J. Lemay. Jan 60, 45p. Technical rept. no. WAL TR-763.71/1; AD-233 958.
Order from LC mi$3.30, ph$7.80 PB 147 234

Cold extruded 155MM HE Shell, M107, from six different lots containing exterior surface defects peculiar to the manufacturing process, were internally loaded to destruction with hydrostatic pressure. Surface defects were detectedy by "Magnafluxing" and examination with a crack depth indicator. Strain measurements were recorded. The test results demonstrate that the type of surface defects encountered do not contribute to an increase in the amount of strain in defective surface areas when compared with nondefective areas. (Author)

Watertown Arsenal Labs., Mass.
METALLURGICAL EXAMINATION OF 155mm T387 HE SHELL, by C. A. Riddle. Feb 60, 14p. Technical rept. WAL TR 763.6/1; AD-234 564.
Order from LC mi$2.40, ph$3.30 PB 147 278

Mechanical and metallurgical properties of four 155MM Shell, HE, T387 were determined. The variation of properties throughout the shell length are noted. Improperly seated rotating bands are considered to be a serious defect in manufacture. (Author)

Watertown Arsenal Labs., Mass.
THE RIFLING AND ROTATING BAND DESIGN HANDBOOK. SUPPLEMENT. SECTION 3.2. DETERMINATION OF BAND PRESSURE EXPERIMENTALLY, by Francis I. Baratta and John Campo. Mar 60, 64p. 3 refs. Technical rept. no. WAL TR 760/410-2; AD-234 995.
Order from LC mi$3.90, ph$10.80 PB 147 277

This report is to be incorporated in the "Rifling and Rotating Band Design Handbook," WAL No. 760/410(c). Specifically, some of the results of the "Thick Walled Cylinder Handbook," WAL no. 893/172 (PB 119 941), have been extended and presented here in a different manner so that, by their use, both band pressure as a function of travel as well as band pressure at the maximum radial loading may be readily determined experimentally. Illustrative problems are included to better acquaint both band and gun tube designers with techniques involved in experimental determination of band pressure.

Watervliet Arsenal, N. Y.
ANALYTIC DEVELOPMENT OF DESIRABLE STRESS DISTRIBUTION CHARACTERISTICS IN SEALING RINGS LEADING TO RECOMMENDATION OF RING NO. 5 FOR APPLICATION TO CLOSED BREECH LAUNCHERS, by M. A. Sadowsky. Mar 60, 98p. Technical rept. WVT RR-6006.
Order from LC mi$5.40, ph$15.30 PB 146 215

Laboratory testing of closed breech sealing rings Nos. 1 and 4 and the mathematical analysis of those rings showed that they are prone to elliptic buckling and plastic flow due to stress concentration at the lips. Ring No. 5 was then designed on the basis of mathematical shell theory. It is believed that it will be as nearly free from those faults as possible. It is suggested that Ring No. 5 be produced and evaluated experimentally. (Author)

Sanitation and Safety Engineering

California Inst. of Tech., Pasadena.
STUDY OF THE PROPERTIES OF AEROSOLS, WITH PARTICULAR REFERENCE TO THE NATURE OF THE AIR-PARTICLE INTERFACE, by Alexander Goetz. Final rept. for 1 Jan-31 Aug 58 on Contract SAph-69557. 1958, 104p. 11 refs. Robert A. Taft Sanitary Engineering Center Technical rept. A58-10.
Order from LC mi$5.70, ph$16.80 PB 149 189

Contents:
Part A. The aerosol spectrometer and its application
Part B. The bacteriological irritation analogue (BIA) test

Naval Civil Engineering Lab., Port Hueneme, Calif.
ABC DECONTAMINATION EQUIPMENT FOR PERSONNEL IN THE ARCTIC, by W. R. Nehlsen. Final rept. 8 Mar 60, 17p. 4 refs. NCEL Rept. 072; AD-234 875.
Order from LC mi$2.40, ph$3.30 PB 146 969

A 60 man per hour portable shower unit was designed for decontamination of large numbers of personnel in arctic climates. A shower waste water treatment and recirculation system was included to minimize the effects of critical water shortages expected under arctic conditions. Tests on the shower waste recirculation system showed that satisfactory results could be obtained on atomic and biological agents, but the allowable time interval before starting chemical agent decontamination proved to be so brief that no mass decontamination method could be considered effective. Because of the inherent dangers of the recirculating system, an individual washing kit was devised as an alternative to the shower unit. The individual washing kit is safer and more economical for atomic and biological decontamination, but neither system is suitable for chemical agent decontamination. (Author)

Ship Building

David Taylor Model Basin, Washington, D. C.
COMPARATIVE SEAKEEPING TESTS AT THE DAVID TAYLOR MODEL BASIN, THE NETHERLANDS SHIP MODEL BASIN AND THE ADMIRALTY EXPERIMENT WORKS, by George P. Stefun. May 60, 38p. 13 refs. Rept. 1309.
Order from LC mi$3.00, ph$6.30 PB 148 653

Comparative results are presented of seakeeping tests on a model in waves run at the David Taylor Model Basin (TMB), the Netherlands Ship Model Basin (NSMB), and the Admiralty Experiment Works (AEW). A brief description is given of the test methods used by the three tanks in connection with the test program initiated by the International Towing Tank Conference (ITTC). The results of the wave tests are compared with respect to resistance, shaft rpm, heave amplitude, pitch amplitude, and phase-angle measurement. The comparisons indicate that fair agreement among the three tanks exists for most of the test conditions, but somewhat large discrepancies exist for conditions of low model speeds and for large wave amplitudes. The reasons for discrepancies are discussed together with recommendations for improved correlations for future seakeeping test results. (Author)

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
EFFECT OF APPENDAGE AND HULL FORM ON HYDRODYNAMIC COEFFICIENTS OF SURFACE SHIPS, by Stavros Tsakonas. Rept. on Contract Nonr-263(18). July 59, 66p. 11 refs. Rept. no. 740; AD-220 007.
Order from LC mi$3.90, ph$10.80 PB 147 083

Tests were made to determine the hydrodynamic coefficients in the yaw plane of EET Model 842 (of the Taylor Standard Series) with skegs of varying size, shape and position. Similar experiments were conducted with flat plates having the same profile area and geometry as the various configurations. The static and damping hydrodynamic coefficients were determined for various angles of attack by means of straight-course experiments and by interpolation of rotating-arm data. Comparison of the straight-course results with those derived by linear interpolation of the rotating-arm data show excellent agreement. Investigation of various flat plates reveals a similarity between the hydrodynamic characteristics of a model and those of a corresponding plate. An attempt to study the usefulness of the flatplate coefficients in regard to determining the stability indices for a ship model of the same profile area is included. (Author)

George Washington U., Washington, D. C.
AN APPROACH TO THE PROBLEM OF ALLOWANCE LIST EVALUATION, by Sheldon Haber. Rept. on Contract Nonr-761(05). 20 Aug 59, 32p. 7 refs. Serial T-108/59; AD-226 119.
Order from LC mi$3.00, ph$6.30 PB 148 157

The essential feature of the allowance list problem is the specification, in advance, of the range and quantity of commodities to be stocked on vessels to meet varying demands under conditions of uncertainty, where the supply of commodities is subject to a space restraint as well as other possible restraints. An attempt is made to explore the process of evaluating alternative allowance lists, the commodities of which can be ranked only ordinally. The assumption was that alternative allowance lists are available and the parts with high and low military worth can be distinguished. Criteria of allowance list efficiency used by other investigations are organized into 2 groups: range measures that take into account the number of different parts demanded but not stocked, and depth measures that indicate the extent to which stocked parts are stocked in insufficient quantities. Several measures are proposed to supplement the conventional range and depth measures. These were designed to determine the range of exchange rates between high- and low-worth parts for which one allowance list is preferable to another.

George Washington U., Washington, D. C.
AN EXAMINATION OF CRUISER USAGE DATA, PART 2, by Mina Haskind Gourary. Rept. on Logistics Research Project, Contract Nonr-761(05). 1 Sep 59, 12p. 3 refs. Serial T-110/59; AD-226 364.
Order from LC mi$2.40, ph$3.30 PB 148 586

An examination is made of cruiser electronic parts usage data (Cognizance-N material). Tabulations are presented of the actual demand for electronics materials. These tables provide information on the number of transactions per quarter; on the frequency with which items are demanded during a stated period of time; on the total quantity used during a stated time period of a given item; and on the distribution of usage among the ship itself, shipyards, tenders, and other activities.

George Washington U., Washington, D. C.
SIMULATIONS OF ALTERNATIVE ALLOWANCE LIST POLICIES, by Henry Solomon and Marvin Denicoff. Rept. on Logistics Research Project, Contract Nonr 761(05). 25 May 59, 36p. 4 refs. Serial T-102/59; AD-216 826.
Order from LC mi$3.00, ph$6.30 PB 146 584

A simulation is described to permit an evaluation of alternative policies for constructing allowance lists for naval vessels. The research program, the allowance list test program (ALTP), aims to increase the supply endurance and self-sufficiency of combatant ships through the medium of improved allowance lists. The following factors are considered: endurance loading, the period of support, criteria for selecting the range and depth of insurance items, and the storage limitation of the ships.

Naval Technical Mission in Europe.
GERMAN SUBMARINE DESIGN, 1935-1945, by W. R. Ignatius, H. A. Arnold and others. July 45, declassified 15 Dec 53, 48p. Technical rept. 312-45.
Order from LC mi$3.30, ep$9.30 PB 146 556

This report was released for sale to the public 1 Aug 60.

From strategic considerations the basic offensive weapon of the German Navy in World War II was the submarine, even as it was in World War I. After the long naval holiday between 1918 and about 1935, the German submarine building program started with a clean slate. Numerous types were designed and actual construction ran into almost unbelievable numbers. Many design changes were made during the course of the war. The way ultimately led to the design of an intricate and interesting vessel based upon a new concept of submarine warfare, according to which submarines must remain submerged indefinitely, attain speeds heretofore considered impossible, operate at great depths, and must be highly maneuverable.

Naval Technical Mission in Europe.
LOSS OF THE GERMAN BATTLESHIP TIRPITZ ON 12 NOVEMBER 1944, by T. G. Springer and E. B. Hitchcock. Aug 45, declassified 2 July 59, 31p. 4 refs. Technical rept. 222-45.
Order from LC mi$3.00, ep$7.80 PB 146 552

This report was released for sale to the public 1 Aug 60.

The German Battleship "Tirpitz" while at anchor in Tromsoe Fiord, Norway on the morning of 12 November, 1944 was attacked by two (2) formations of British Lancasters which dropped a total of 29 "Tallboy" bombs. Each of these bombs had a total weight of 12,000 pounds including a 5,200 pound Tropex explosive charge. All bombs evidently landed to port of the ship's centerline. There was one confirmed direct hit and probably two others. At least seven bombs landed in the water within the torpedo net, two or three very close to the ship. There was extensive structural damage on the port side, and a tremendous amount of water swept into and over the ship. Efforts to keep the "Tirpitz" upright were unsuccessful and she capsized about 7 minutes after the first bomb struck. She is now resting on the bottom of Tromsoe Fiord at an angle of about 135 degrees with her superstructure buried in the mud.

Naval Technical Mission in Europe.
PROJECTED BATTLESHIPS OF GERMAN NAVY, CONSISTING OF TWO TYPES KNOWN AS "O" AND "H" AND SOME PROJECTED TYPES KNOWN AS "H" 41, "H" 42, "H" 43, AND "H" 44, by K. S. Brown and C. A. Stuelcken. Oct 45, declassified 2 July 59, 40p. Technical rept. 526-45.
Order from LC mi$3.00, ep$7.80 PB 146 557

This report was released for sale to the public 1 Aug 60.

Data has been assembled on the projected types of battleships to show the overall characteristics and to allow for a brief comment. A virtually complete set of contract plans for type "O" is furnished, as well as an assortment of contract plans and arrangement plans for type "H". Only the principal characteristics of types "H" 41, "H" 42, "H" 43 and "H" 44, are known.

Reed Research, Inc., Washington, D. C.
INVESTIGATION OF HULL-SUPERSTRUCTURE INTERACTIONS. Final rept. on Contract NObs-[72338]. Aug 58, 30p. 14 refs. AD-218 851L
Order from LC mi$2.70, ph$4.80 PB 146 674

Analytical studies and model experiments were made of the stresses induced in a destroyer by longitudinal bending loads, with particular reference to the stresses in the deckhouse and the main deck and the effect on these stresses of providing an expansion joint in the deckhouse. Several theoretical approaches are reviewed and some extensions are developed. Calculations by 4 different methods were made of the longitudinal stresses in the Q-1 deck for the portion of the deckhouse abaft the expansion joint. The loading of the ship, used for the computations, was that proposed for the full-scale test of the DD931 class destroyer. A common assumption in all the calculations was that the deck is infinitely stiff so that there is no vertical movement of the deckhouse relative to the hull.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Office of Technical Services, Dept. of Commerce, Washington, D. C.
FOOD PRESERVATION (EXCEPT BY IRRADIATION) (1950-1960). May 60, 10p. 125 refs. OTS Selective Bibliography SB-412.
Order from OTS $0.10 OTS SB-412

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports are listed in categories as follows: dehydration, freezing, and food preservation, general.

Purdue U. Agricultural Experiment Station, Lafayette, Ind.
THE FEASIBILITY OF UTILIZING IONIZING RADIATION TO INCREASE THE STORAGE LIFE OF POTATOES, by M. Workman, N. K. Ellis, and M. Patterson. Rept. no. 11 (Final) for 1 Nov 56-30 Apr 59 on Contract DA 19-129-qm-789. [1959] 78p. File no. S-557; AD-233 086.
Order from LC mi$4.50, ph$12.30 PB 147 223

The influence of 5 dosages of gamma irradiation on White Sebago, Katahdin, Russet Burbank and Red Pontiac potatoes is described. The dosages used were 5.0, 7.5, 10.0, 12.5, and 15.0 kilorep. The potatoes were given different curing treatments. Storage was at 41°, 47°, and 55°F. Maximum storage period was two years. The influence of decay, weight loss, sprouting, internal discoloration, specific gravity and other factors is considered. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Technical Operations, Inc., Burlington, Mass.
AN EXPERIMENTAL STUDY OF FRETTING AND GALLING IN DENTAL COUPLINGS, by John F. Batter and F. Everett Reed. Final rept. on Contract NObs-72304. June 58, 60p. Rept. no. TO158-20; AD-212 761.
Order from LC mi$3.60, ph$9.30 PB 148 854

Specimens of materials used in dental couplings were tested in a simplified wear test machine which duplicated as closely as possible the actual wear conditions existing in operating couplings. The wear patterns that were obtained by tests of short duration on this machine duplicated those found in service. The results of tests covering the variables, load, speed, duration, amplitude of motion, surface finish and hardness are presented together with discussions of the effects of these variables. (Author)

Engines and Propulsion Systems

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
AN INTRODUCTION TO NUCLEAR PROPULSION, by Kenneth R. Chapman. Apr 60, 49p. 18 refs. AFSWC-TN-60-9.
Order from LC mi$3.30, ph$7.80 PB 148 344

Propulsion of rocket vehicles by means of energy from the nuclear fission process is discussed in nonscientific terms. A single parameter (specific impulse) is used for comparing propulsion schemes. Nuclear and chemical rocket engines are compared; various means of using nuclear energy for rocket propulsion are described; a brief discussion and propulsion requirements in three selected missions is included. Appendixes clarify derivation of some equations used in the text and to introduce some reactor concepts to those readers not familiar with nuclear reactors. (Author)

Besler Corp., Emeryville, Calif.
DESIGN STUDY OF A STEAM POWER SYSTEM FOR A LANDING CRAFT, by William J. Besler and John L. Boyen. Rept. on Contract Nonr-2159(00). 30 Sep 57, 105p. AD-157 190.
Order from LC mi$5.70, ph$16.80 PB 146 571

Design studies were conducted on 775-hp steam-engine power plants. The units are to be quiet, flexible, light, inexpensive, efficient, and dependable for installation in high-performance landing craft. The specifications for the power system are summarized. The plant would be a compound steam engine with a forced-circulation boiler operating at 7400 lb/hr and 1200 psig at 760°F. The speed of the engine at full output would be 2200 rpm. The boiler efficiency would be about 83%, and the engine efficiency would be 76% (percentage of Rankine).

Lockheed Aircraft Corp., Sunnyvale, Calif.
A PROPULSION DEVICE USING AN EXPLODING-WIRE PLASMA ACCELERATOR, by W. L. Starr. Dec 58, 20p. LMSD-418 236.
Order from LC mi$2.40, ph$3.30 PB 147 640

A device that accelerates a plasma derived from an exploding wire to velocities of 8×10^6 cm/sec has been developed. A description of the experimental apparatus used and the results attained is given in this report. The impulse produced is about 10^3 dyne sec and, for a firing rate of 1 sec^{-1}, a thrust of 50 dynes/cm^2 is presently attainable. A brief analysis of the accelerating forces and their dependence on circuit parameters is also presented. Planned improvements should result in increases in both the impulse and propellant velocities. (Author)

Manufacturing Equipment and Processes

Brush Beryllium Co., Cleveland, Ohio.
FABRICATION OF BERYLLIUM WIRE, by A. G. Cross, Jr., R. G. O'Rourke, and W. W. Beaver. Progress rept. no. 2, 16 Dec 58-15 Feb 59, on Contract NOas-59-6030-C. [1959] 14p. 2 refs. AD-215 613.
Order from LC mi$2.40, ph$3.30 PB 149 617

Extensive true-stress - true-strain tensile testing was performed on hot-pressed QMV beryllium. Using analytical expressions, it is estimated that reductions in area at 850°F by wire drawing of at least 35% may be made between stress-relieving treatments. A process consisting of cold compacting canned powder by swaging, sintering the compacts to make extrusion blanks, and warm extruding the blanks to draw stock has been partially investigated. It was found that a critical compact green density existed. Swaging beyond this point destroyed the compact. Initial drawing experiments at 850°F have been made, and these indicate that large reductions in area per pass are more desirable than light reductions from the standpoints of surface and lubrication. (Author)

Naval Research Lab., Washington, D. C.
THE EFFECT OF NEUTRON IRRADIATION ON THE CHARPY V AND DROP-WEIGHT TEST TRANSITION TEMPERATURES OF VARIOUS STEELS AND WELD METALS, by J. R. Hawthorne and L. E. Steele. Final rept. 27 May 60, 28p. 4 refs. NRL rept. 5479.
Order from OTS $0.75 PB 161 448

Charpy V-notch and drop-weight specimens were used to determine changes in transition temperature for various steels and weld metals irradiated in different nuclear and thermal environments to integrated fast-neutron-flux exposures to 1×10^{19} NVT (>1.0 Mev). The Brookhaven Graphite Reactor, the Oak Ridge Low Intensity Test Reactor, and ARCO Materials Testing Reactor were used for the irradiations at temperatures under 200°F and at 575°F. Irradiations to integrated fast-neutron flux levels of 5×10^{18} NVT effected 40° to 100°F shifts in transition temperatures. Increasing the irradiation temperature from 200°F to 575°F significantly decreased the radiation-induced damage. Transition-temperature shifts in the order of 250°F were developed for materials irradiated at temperatures less than 200°F to an integrated fast-neutron flux dosage of 1×10^{19} NVT. Post-irradiation heat treatment revealed that recovery of properties may be obtained by 650°F annealing. Comparison of Charpy V and drop-weight nil-ductility transition temperature shifts for 17 material irradiations demonstrated excellent correspondence in the evaluation of irradiation effects by these two test methods. (Author)

Rodman Lab., Watertown Arsenal, Mass.
EPOXY RESIN DIES FOR INVESTMENT CASTING PATTERNS, by Francis C. Quigley and Eugene DeLuca. Dec 59, 8p. 6 refs. Rept. no. RPL 13/8; AD-234 073.
Order from LC mi$1.80, ph$1.80 PB 147 231

The resin system is compatible with the materials employed in the conventional die-making processes and can readily replace soft metal alloys as a casting medium in the production of wax pattern dies. The plastic die offers definite advantages over its metal counterpart including simplified construction, reduced handling weight, and reduced costs. The surface finish and dimensional reproducibility of wax patterns produced in a resin die parallel those of wax patterns produced in a machined, metal die. (Author)

Rodman Lab., Watertown Arsenal, Mass.
A MACHINING PRODUCTION FUNCTION, by Roy Mennell. Dec 59, 10p. 9 refs. Rept. no. RPL 23/10: AD-233 855.
Order from LC mi$1.80, ph$1.80 PB 147 232

A general production function is derived based on a generalization of machining data to describe all combinations of the inputs - tools and machines - necessary to give any production rate. A method is developed for solving for the minimum cost combination of inputs with the result that optimum number of machines assigned and cutting speed, as well as the resulting cost, are determined. (Author)

Stanford Research Inst., Menlo Park, Calif.
FEASIBILITY STUDY OF PLASMA WELDING OF REFRACTORY METALS, by Jess W. Wilson. Progress rept. no. 3, 1 Nov 59-1 Mar 60, on [Contract NOas-59-6234C] 22 Mar 60, 4p. SRI Proj. SU-2927.
Order from LC mi$1.80, ph$1.80 PB 148 425

The high power density and high heat transfer rate of a plasma jet make it of interest as a possible welding tool for the refractory metals, such as Ta, Mo, Ti, Zr, and W. The possible advantages of such an instrument are less contamination and a smaller heat-affected zone arising from the shorter heating times and consequently higher welding speeds. In this feasibility study the construction and operating characteristics of a small-diameter plasma torch are being studied. (See also PB 145 814)

Transport, Traction and Hoist Facilities

Arctic Aeromedical Lab., Ladd AFB, Alaska.
MODIFICATION OF WEAPONS CARRIER FOR CROSS COUNTRY USE OVER TUNDRA, SNOW AND SAND, by Jack Castle, Jr. Sep 57, 8p. Technical note AAL-TN-57-41.
Order from LC mi$1.80, ph$1.80 PB 146 631

It is recommended that the AC&W squadrons be furnished 3/4 ton vehicles equipped with U.S. Royal Knobby Implement tires 17:00 x 16 for use in unimproved areas, and that the modified vehicles be locked into the 4-wheel drive gear, thereby causing an even pull on all four wheels.

Detroit Arsenal, Center Line, Mich.
M-56 PNEUMATIC COMBAT BOGIE TIRE TESTS, by James K. Matter and Walter O. Perrott. 18 Nov 58, 50p. Rept. no. 4320 (Final).
Order from LC mi$3.30, ph$7.80 PB 146 532

George Washington U., Washington, D. C.
TIME-PHASING RELATIONSHIPS IN DETERMINING MERCHANT SHIP REQUIREMENTS FOR OVERSEAS CARGO LIFT. PART I. THE EXPORT-NO PIPELINE SYSTEM, by Ralph B. Hunt and Erling F. Rosholdt. Rept. on Logistics Research Project, Contract Nonr-761(05). 15 May 59, 92p. Serial T-101/59; AD-217 232.
Order from LC mi$5.40, ph$15.30 PB 146 585

A methodology is presented for determining the number of merchant ships required to transport known but possibly variable monthly quantities of export cargo between the continental United States and overseas ports. It pertains only to the situation where no pipeline or traffic exists and it is necessary to generate a pipeline from the beginning. The contributions to the necessary data made by the schedule of lift requirements and a ship's turnaround are discussed. The concept of notional ship and notional value is explained and a graphic method of analysis of the behavior of the pipeline as a function of turnaround time, delivery period and lift requirement schedule is developed and translated into complete sets of equations for calculating the pipeline build-up. The behavior of an export

shipping pipeline under the conditions of the study is illustrated for the cases of increasing, decreasing and variable monthly lift requirements for a sample group of turnaround times. (Author)

Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DETERMINATION OF VEHICLE SINKAGE PARAMETERS BY MEANS OF RIGID WHEELS. PART I. by T. Czako and M. G. Bekker. May 58, 37p. Rept. no. 33; AD-235 846.
Order from LC mi$3.00, ph$6.30 PB 147 242

The present way of determination of stress-strain parameters in soils by means of rectangular or round loading areas is time consuming and cannot be performed without alternate moving and stopping the measuring device over the terrain under measurement. To provide a quicker and continuous method of operation which would enable one to measure these parameters in a way more susceptible to automation, the use of rigid wheels instead of plates has been proposed. When towing such wheels under varying load, and measuring the corresponding sinkage, this new method of determining the discussed soil parameters was successfully tested in dry and wet sand. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
DEVELOPMENT AND TEST OF SLED TRAIN HOOKUP AND RELEASE DEVICES, by Douglas Taylor Final rept. 26 Jan 60, 41p. 6 refs. Technical rept. 047; AD-233 336.
Order from LC mi$3.00, ph$7.80 PB 146 728

A sled to tractor-or-sled hitch, a sled train safety release, and a drawpole elevating device were developed and tested. The sled to tractor-or-sled hitch could not be used with the tractor winch cable and was unsatisfactory. A torsilastic drawpole support, a modified Otaco drawpole spacer with Neidhart torsional springs at each end, was considered as a substitute for the drawpole elevating device. The tractor hitch with safety release device was mounted on a D2 LGP snow tractor and used by one man to couple and release a sled equipped with the drawpole elevator. These items are recommended for in-service test. (Author)

MATERIALS

Minnesota U., Minneapolis.
THE PLASTIC COEFFICIENTS FOR WORK-HARDENING MATERIALS, by W. H. Warner and P. Mahmoodi. Rept. for June-Oct 58, with revisions Mar-June 59 on Contract AF 33(616)5449. Apr 60, 17p. 8 refs. WADC Technical rept. 59-674.
Order from OTS $0.50 PB 161 886

In the establishment of the form of their generalized stress-strain law for work-hardening inelastic materials, Warner and Handelman did not show how the plastic coefficients could be evaluated in terms of material properties. This report first shows how this can be done, giving the general form of the coefficients for various states of stress. The validity of the assumptions behind this representation must be experimentally tested; comparison with existing results is carried out as far as possible. The conclusion suggests what types of experiments are needed to test the validity of the law, and if they are successful, what further experiments are needed to provide the information necessary to solve various combined stress problems analytically. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
PHOTOGRAPHIC CHEMICALS AND EMULSIONS. June 60, 8p. 112 refs. OTS Selective Bibliography SB-417.
Order from OTS $0.10 OTS SB-417

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations. Reports listed were added to the OTS collection during the period 1950 to July 1960.

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by Herbert B. Ailes. Annual progress rept. no. 2, 15 Mar 56-15 Mar 57, on Contract NOrd-15764. 29 Mar 57, 34p. 4 refs. AD-153 297.
Order from LC mi$3.00, ph$6.30 PB 149 620

Several major variables in the vacuum injection technique of compositing Al and Al-coated glass fibers were studied to obtain improved composite strengths. The best tensile strengths were obtained with 14S or 23S Al matrix alloys. It was possible to increase the glass concentration of a glass reinforced Al composite by heating the composite above the melting point of the Al alloy and allowing the Al to run out of the composite under the force of gravity. A glass reinforced Al bar 0.45 in. in diameter was hot rolled. Reductions of 1.5% pass resulted in a total reduction of 20%. A complete set of physical properties is being compiled on a standard composite of Al reinforced with Al-coated fibers. Composites of glass reinforced Al were made by hot pressing longitudinally oriented Al-coated fibers; measured strengths are presented. Orienting the fibers in 2 perpendicular directions decreased the strength by about 60%. Composites made of Al reinforced with bare glass fibers gave maximum strengths of 10,500 psi at 75°F. Glass reinforced Al tubes 1 in. in diameter made by the vacuum injection technique showed that rim stresses comparable to tensile strengths of the standard composites are feasible. (Author)

Adhesives and Sealants

Naval Weapons Plant, Washington, D. C.
COMPARISON OF ADHESIVE SYSTEMS FOR STRUCTURAL BONDING OF ALUMINUM, by Richard L. Nutt and William Lurie. 27 Apr 60, 9p. NWPW-T-8-60; NAVORD rept. 6953, Part 2.
Order from LC mi$1.80, ph$1.80 PB 148 359

Tensile lap-shear tests, using various combinations of primers and adhesives, were conducted at several temperatures to obtain comparative values for the NWP-developed adhesive system and several alternative systems for structural bonding of aluminum. Of all the systems tested, the NWP-developed system was found to have the best combination of satisfactory strength properties, and uniformity of strength level over the temperature range tested. (Author) (See also PB 148 358)

Naval Weapons Plant, Washington, D. C.
DEVELOPMENT AND EVALUATION OF AN ADHESIVE SYSTEM FOR STRUCTURAL BONDING OF ALUMINUM, by Ruth S. Kobler, William Lurie, and Richard L. Nutt. 20 Apr 60, 24p. 13 refs. NWPW-T-4-60; NAVORD rept. 6953, Part 1.
Order from LC mi$2.70, ph$4.80 PB 148 358

On the basis of a preliminary literature survey covering the field of adhesives and adhesion, an adhesive system formulation and associated fabrication techniques were selected and recommended for use in the developmental fabrication of the aluminum tail assembly of the LITTLE LULU weapon. In order to confirm the conclusions and recommendations derived from the literature survey, an evaluation of this adhesive system and its associated procedures was conducted. Effects of several processing variables were determined. The optimum combination of these variables resulted in average tensile lap-shear values (3728 psi at -67°F, 3736 psi at 83°F, and 2784 psi at 160°F) which were in excess of the requirements established for the system, and also in excess of the requirements of MIL-A-5090C. The peel strength test values obtained (approximately 21 in.-lb./in.) were considerably above those quoted in the literature for the individual constituents of the system. (Author)

Ceramics and Refractories

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF SINTERABLE POWDERS AND PROPERTIES OF BERYLLIA CERAMICS, by James E. Johnson, A. J. Smalley, and Winston H. Duckworth. Rept. for 15 Feb-31 Dec 59 on Electrical and Electronic Materials, Contract AF 33(616)6238. Apr 60, 24p. 5 refs. WADD Technical rept. 60-108.
Order from OTS $0.75 PB 161 891

Information was developed on the effects of processing variables and microstructure on the fracture strength of ceramics made from sinterable oxide powders. The characteristic of high strength being associated with low porosities and small average crystal sizes was observed in ceramics of both MgO and BeO, but no quantitative correlation was found. Highest strengths were obtained when time and temperature of sintering were sufficient for densification above about 96 per cent of theoretical, provided that the sintering time and temperature was insufficient to give crystal sizes larger than the smallest observed, 5-6 microns for BeO ceramics and 10 microns for MgO ceramics. In the case of BeO powder prepared by pyrolysis of high-purity sulfate, calcining to an intermediate temperature (1700-1800°F) gave the powder that densified most readily when compacted and sintered, but one that did not have the greatest tendency toward crystal growth. The lack of quantitative correlations between bulk density, average crystal size, and strength, indicated that strength was affected by some factor or factors other than these two. (Author)

Cornell Aeronautical Lab., Buffalo, N. Y.
AN INVESTIGATION OF THE THEORETICAL AND PRACTICAL ASPECTS OF THE THERMAL EXPANSION IF CERAMIC MATERIALS. VOLUME 2. RESEARCH, by Henry P. Kirchner, Kenneth M. Merz, and Harold T. Smyth. Summary rept. for 1 July 58-31 Aug 59 on Contract NOrd-18419. 31 Aug 59, 49p. 17 refs. Rept. no. PI-1273-M-4; AD-227 766.
Order from LC mi$3.30, ph$7.80 PB 148 739

Attempts were made to predict the thermal expansion coefficient by 2 general methods, one in which an openness-ratio concept is used, the other in which statistical mechanics is applied. The results of these predictions were compared with data from the literature. A crude correlation seemed to exist between the the openness ratio and the thermal expansion coefficient. The thermal expansion coefficient decreased with increasing openness ratio for oxides and silicates. It seems likely that the openness ratio can be used to select low expansion phases from a large group of phases for which the thermal expansion coefficient is not known. This investigation did not result in sufficient experimental data to reach a definite conclusion on this point. The thermal expansion of phases having the sodium chloride structure can be predicted by using a statistical mechanical method. The results of the predictions were good considering the assumptions that were made. It may be possible to eliminate the assumption that the atoms vibrate independently of each other. (See also PB 161 826)

New York State Coll. of Ceramics, Alfred U.
THE HOT PRESSING OF FINE GRAINED CERAMIC OXIDES FOR USE IN THERMAL CONDUCTIVITY STUDIES, by R. K. Francis, J. J. Swica and others. Rept. for 1 Nov 58-31 Oct 59 on Surface and Interface Phenomena of Matter, Contract AF 33(616)3798. Feb 60, 32p. 8 refs. WADC Technical note 59-394.
Order from OTS $1.00 PB 161 851

The relationships between time, temperature, pressure and grain growth in hot pressing were studied using alumina grain to determine the techniques necessary for the production of dense polycrystalline alumina having a grain size in the four to five micron range. It was found that alumina having a density of the order of 95% of theoretical and grain size in the desired range could be produced using a short time at maximum temperature in hot pressing. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
A METHOD FOR THE OBSERVATION OF THE INFRARED SPECTRUM AT HIGH TEMPERATURE VAPORS BY MATRIX ISOLATION. I. THE INFRARED SPECTRUM OF LITHIUM FLUORIDE, by M. J. Linevsky. Rept. on Contract AF 04(647)269. June 60, 18p. 8 refs. Technical Information Series R60SD387.
Order from LC mi$2.40, ph$3.30 PB 148 763

An apparatus has been developed that is capable of obtaining the infrared spectrum of matrix isolated vapor molecules generated by Knudsen effusion. The fundamental vibrational frequency of lithium fluoride has been observed in argon, krypton, xenon, and nitrogen matrices. Shifts in this frequency due to the interactions with the various matrices have been explained on a basis of a semi-classical model. (Author)

Fuels, Lubricants, and Hydraulic Fluids

Aeronautical Engine Lab , Naval Air Material Center, Philadelphia, Pa.
IGNITION CHARACTERISTICS OF SPECIAL JET ENGINE FUELS, by R. R. Ricci. Rept. on TED Proj NAM-PP502. 9 Feb 54, 55p. AEL-1282.
Order from LC mi$3.60, ph$9.30 PB 149 192

It is concluded from the results obtained on the tests conducted under this project that: (a) A correlation exists between fuel flow required for ignition and a definable volatility-viscosity characteristic. (b) Hydrocarbon class or structure, as an independent variable, does not appear to affect the fuel flow required for ignition. (c) At conditions of constant test chamber velocity and constant air and fuel temperature, variation in chamber pressure does not significantly affect the minimum fuel flow required for ignition. (d) At conditions of constant test chamber velocity the ignitable air-fuel ratio range will decrease as air and fuel temperatures decrease. (e) At conditions of constant test chamber pressure and air and fuel temperature the ignitable air-fuel ratio range will decrease with decreasing velocity. (f) The ignition characteristics of fuels must be considered as separate and distinct from the combustion characteristics and must not be interpreted as comparable to engine "starting" performance.

A[ir] F[orce] O[ffice] of S[cientific] R[esearch] Washington, D. C.
AFOSR CONTRACTORS' MEETING NO. 12 ON LIQUID PROPELLANT ROCKET COMBUSTION, MARCH 2-3, 1960, CO-SPONSORED BY PURDUE UNIVERSITY, LAFAYETTE, INDIANA. [1960] 16p. AFOSR-TR-60-37.
Order from LC mi$2.40, ph$3.30 PB 148 234

Contents:
Combustion in gaseous rocket motors
Interactions among burning fuel droplets
Theory of flame propagation
General solution to combustion instability
High frequency oscillatory combustion in rocket motors
Scaling procedures for liquid rockets
Observations of burning propellants in rockets
Acoustic instability in rocket combustion
Tangential instability in rocket chambers
Research on liquid rocket motors
Chemical kinetics
Radiation in rocket motors
Ions in rocket combustion products

Atlantic Research Corp., Alexandria, Va.
FURTHER STUDIES OF PURE AMMONIUM PERCHLORATE DEFLAGRATION, by Raymond Friedman and Joseph B. Levy. Rept. on Contract AF 18(600)1502. 28 Jan 60, 24p. 14 refs. AFOSR-TN-60-209; AD-233 370.
Order from LC mi$2.70, ph$4.80 PB 146 755

The effects of pressure, catalyst, and radiant energy were investigated on the burning rate of rocket propellants containing NH_4ClO_4. A deflagration rate-vs-pressure curve showed that pressed pellets of NH_4ClO_4, 4 mm square and 38 mm long, burned at essentially constant pressure in a nitrogen atmosphere. The lower pressure limit was extended from 45 to 22 atm. Experiments showed that the lower limit is insensitive to sample size and to the substitution of He for N as the ambient atmosphere. Small additions of copper chromite powder increased the lower pressure limit while the large additions decreased it. A radiant heating apparatus was developed to produce conditions which permit steady deflagration at atmospheric pressure. For pure NH_4ClO_4, there is a critical radiation level (10 cal/sq cm-sec) below which only slow sublimation occurs and above which deflagration occurs. The deflagration rate is essentially linear with radiation flux and extrapolates to a finite rate at zero radiant flux. The addition of Cu-0202 catalyst increased the deflagration rate and reduced the threshold flux required for ignition. The chemical composition of the product gases from deflagrating NH_4ClO_4 were investigated at pressures from atmospheric to 2000 psi, both with and without the copper chromite catalyst. The gaseous products were N, N_2O, and O.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.
BIBLIOGRAPHY AND SOURCE MATERIAL ON NITRIC ACID WITH EMPHASIS ON ITS USE AS AN OXIDIZER FOR ROCKET FUELS, by K. Elsas. Rept. on Proj. Loki, Contract W30-069-ORD-4450. 31 Dec 51, declassified, 29p. 188 refs. Rept. no. 515-801; ATI-129 118.
Order from LC mi$2.70, ph$4.80 PB 148 493

The study is concentrated on factors affecting the decomposition of the nitric acid. Also, only very strong nitric acids can be of value as oxidizers for rocket-fuels and therefore references to dilute solutions of nitric acid, and to other non-rocket aspects of nitric acid technology, have been neglected beyond very cursory considerations.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESULTS OF PERFORMANCE CALCULATIONS FOR N_2O_4–N_2H_4 BIPROPELLANT SYSTEM, by G. W. Elverum, Jr. and J. S. Martinez. Rept. on Contract DA 04-495-ORD-18. 3 July 58, 64p. 3 refs. Memo. no. 20-174; AD-211 722.
Order from LC mi$3.90, ph$10.80 PB 147 436

Results are presented for all the performance calculations completed to date at the Jet Propulsion Laboratory on the N_2O_4-N_2H_4 liquid bipropellant system. All the results included were calculated by the constant-entropy method. (Author)

Little, Arthur D., Cambridge, Mass.
HANDBOOK FOR HYDROGEN HANDLING EQUIPMENT, by B. M. Bailey, D. C. Benedict and others. Rept. for 1 May 58-31 July 59 on Contract AF 33(616)5641. Feb 60, 589p. 226 refs. WADC Technical rept. 59-751; AD-235 123.
Order from OTS $7.00 PB 161 835

This handbook provides engineering data concerning the most adequate, safe, and economical procedures and equipment for liquid hydrogen storage, transfer, and ground servicing systems. The engineering data developed centers on the requirements for (1) storage vessels, (2) transfer lines, (3) pumping systems, (4) valves, (5) instruments, and (6) recondensing systems. Results, conclusions and recommendations are reported in separate chapters classified in accordance with the above listed hardware items. (Author)

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by W. C. Schumb and C. N. Satterfield. Quarterly periodic status rept. on Contract Nonr-1841(11). 30 Sep. 59, 9p. AD-228 153.
Order from LC mi$1.80, ph$1.80 PB 148 871

Stability studies: Experiments showed that a definite increase in the decomposition rate of H_2O_2 solutions occurs at low concentrations. The rate is practically constant down to about 10 to 12 wt-% H_2O_2, but triples at 3 wt-% Hydrogen peroxide decomposition flame at sub-atmospheric pressures: The superheater area was increased, and the stopcock and stopcock grease were eliminated so that the apparatus consisted of the boiler flask and superheater in one unit. The burner tube was connected to the superheater by a flexible joint and enclosed in an externally heated Cu tube. The top of the burner tube was connected to the sampling condenser. The vapor coming from the burner tube was ignited by a hot wire. Usable photographs of the flames were obtained. Porous-walled reactor studies: Experiments made in the porous reactory by using CO_2, He, and N as carrier gases confirmed the results previously reported and indicated the strong effect of the diffusivity of H_2O_2 in the carrier gas. Similar experiments in a plain Pyrex reactor of the same size which was operated at 215°C produced rate constants 10 to 100 times lower than those recorded in the porous reactor. Decomposition of H_2O_2 vapor on catalytic surfaces: The modified apparatus failed to produce consistent results. (See also PB 146 281)

Naval Air Rocket Test Station, Lake Denmark, Dover, N. J.
ANALYTICAL PROCEDURES FOR ROCKET PROPELLANTS. VII. MIXED ACID, by John D. Clark. Sep 52, 20p. 4 refs. Rept. no. 24.
Order from LC mi$2.40, ph$3.30 PB 149 185

The conventional method of analyzing mixed acid (nitric acid, approximately 15% sulfuric acid, plus small quantities of water and NO_2) is discussed, and the inherent inaccuracies in the method are pointed out. A new method of analysis of mixed acid, based upon a conductimetric titration of the sulfuric acid after interfering ions have been substantially eliminated, is described. This method is free of the inherent disadvantages of the conventional method, is faster, and appears to be capable of an appreciably higher degree of precision and accuracy. (Author)

Naval Engineering Experiment Station, Annapolis, Md.
A COMPARISON OF THE RELATIVE EFFECTIVENESS OF n-CETANE AND PARAFFINIC GAS OIL IN DIESEL FUEL COMPATIBILITY TESTS, by R. T. Jones. 16 Dec 57, 17p. 3 refs. Research and development rept. 070129E; AD-205 173.
Order from LC mi$2.40, ph$3.30 PB 147 442

Filter-clogging, screen-clogging, and accelerated stability test procedures were used. Data illustrating the mechanism of the type of incompatibility involved were obtained. The gas oil was not equivalent to cetane in detecting incompatibility in the filter- and screen-clogging tests used. With suitable adjustments, the gas oil gave results comparable to those obtained with cetane in the accelerated stability test. However, n-cetane was found to have certain advantages over the gas oil in this test.

Naval Ordnance Test Station, China Lake, Calif.
DIFFUSION IN A TWO-LAYER SLAB WITH TABLES OF CONCENTRATION, by D. R. Cruise and C. J. Thorne. 21 May 59, 403p. 7 refs. NOTS TP 2146; NAVORD rept. 6439; AD-234 065.
Order from LC mi$11.10, ph$62.10 PB 147 250

The linear problem of diffusion between a layer of high concentration and a layer of low concentration in solid rocket propellants is solved and the results tabulated for a substantial range of the parameters involved. (Author)

Naval Research Lab., Washington, D. C.
THE STABILIZATION OF SILICONE LUBRICATING LIQUIDS ABOVE 200°C. PART I. CONVENTIONAL OXIDATION INHIBITORS AND SOME HIGH-SURFACE SOLIDS, by H. R. Baker, F. F. Sullivan, and C. R. Singleterry. Interim rept. 2 June 60, 33p. 16 refs. NRL rept. 5457.
Order from OTS $1.00 PB 161 314

A study of the stabilization of silicone oils at temperatures between 250° and 371°C has shown that the useful life of the commercially available types may be extended from three to five times by the use of certain oxidation inhibitors known to be effective in other systems. The relative value of different inhibitors varies with the temperature and the aromatic content of the oil. The deterioration of silicones in this temperature range is primarily an oxidative process. This oxidation is inhibited by high-surface solids such as Shawanigan black, copper phthalocyanine, and ferric oxide, by conventional inhibitors of the arylamine type, and by dilauryl selenide. Dilauryl selenide was ineffective at 300°C and higher; phenylalphanaphthylamine caused a relatively uniform improvement at 250° and 300°C. The gains from any inhibitor were small at 371°C. The chemical diversity of the effective inhibitors and the relatively high temperatures at which they are effective suggest that the mechanism of inhibition differs from that operating in conventional oils at temperatures below 200°C. The improvements shown with lightly phenylated silicones permit formulation of lubricants having acceptable viscosity characteristics and oxidation stability over the range from -55°C or lower to 305°C. This work has led to the discovery of new

types of inhibitors, specifically for use with silicone liquids, which are an order of magnitude more effective than conventional inhibitors. (Author)

North Carolina State Coll., Raleigh.
LUBRICATION BEHAVIOR OF LIQUID METALS, by Patrick H. McDonald. Rept. for July 58-Sep 59 on The Structure and Properties of Interfaces, Contract AF 33(616)5885. Mar 60, 76p. 16 refs. WADC Technical rept. 59-764.
Order from OTS $2.00 PB 161 888

This report describes the investigation of the lubricating behavior of liquid metals in two categories: hydrodynamic and boundary lubrication. The basic theory of the hydrodynamic study is that of the Reynolds equation. This theory has been extended, after the manner of Christopherson, to a new state of development in this report. An experimental device has been designed and constructed for confirming this theory as it relates to liquid metals. The complex and elaborate aspects of this apparatus are described in detail in the report. The study of a variety of liquid metals with this apparatus is anticipated. A macroscopic theory of the boundary lubrication region has been employed. This theory has been applied to a cylinder-flat combination, and the lubricating behavior has been seen to depend upon the state of contact stress for this configuration. An apparatus for these investigations is also described in the report. (Author)

Ohio State U. Research Foundation, Columbus.
DETONATION INDUCTION DISTANCES IN COMBUSTIBLE GASEOUS MIXTURES AT ATMOSPHERIC AND ELEVATED INITIAL PRESSURES, IV. HYDROGEN-NITRIC OXIDE. V. HYDROGEN-OXYGEN-DILUENT. VI. THEORETICAL ANALYSIS, by Loren E. Bollinger, Michael C. Fong, and Rudolph Edse. Final technical rept. on Contract AF 33(616)5615 continuation on Contract AF 33(616)3913. Aug 59, 86p. 19 refs. WADC Technical rept. 58-591, Pt. IL
Order from OTS $2.25 PB 161 878

Experimental measurements have been made to determine the detonation induction distances in hydrogen-nitric oxide mixtures and in hydrogen-oxygen-diluent mixtures in a 50-mm diameter tube for various diluent concentrations at initial pressures of 1 and 5 atmospheres and an initial temperature of 40°C. Detonation could not be obtained in the 12-foot long tube with any of the hydrogen-nitric oxide mixtures used at initial pressures of 1, 5, or 10 atmospheres. Nitrogen, helium, argon, and carbon dioxide were the individual diluents which were added to a stoichiometric mixture of hydrogen and oxygen. Addition of any of the diluents caused an increase in the detonation induction distance by varying amounts. For a given volume of diluent, carbon dioxide caused the greatest increase in induction distance while the addition of argon resulted in the least increase. A theoretical analysis of the formation of a detonation wave has been made. A correlation function was found which relates the detonation induction distanc to the Reynolds number, the normal burning velocity of the mixture, the sonic velocity of the unburned gas, and the adiabatic combustion temperature of the given mixtures. (See also PB 151 873)

Olin Mathieson Chemical Corp [Baltimore, Md.]
STUDY OF SUPEROXIDIZERS, by F. O. Penzig. Interim rept. for 5 June 58-4 June 59 on Energy Transfer Research, Contract AF 29(600)1667. Feb 60, 21p. 20 refs. AFMDC-TN-60-3; AD-234 301.
Order from LC mi$2.70, ph$4.80 PB 146 633

This report presents the investigation of new methods for the preparation of higher oxides of hydrogen, a study and evaluation of reported techniques for the preparation of higher oxides of hydrogen, and the development and refinement of analytical methods. The methods include the reaction of hydrogen atoms with liquid ozone, irradiation of dilute hydrogen peroxide solutions, reaction of ozone and oxygen with organic and inorganic materials, electrolysis of hydrogen peroxide, and dissociation of water vapor by electric discharge. The reaction of hydrogen atoms with ozone produced a compound containing hydrogen and oxygen in a molar ratio corresponding to H_2O_4 or HO_2. Condensation of dissociated water vapor produced a mixture of H_2O_2, and higher oxides.

Rock Island Arsenal Lab., Ill.
THE EFFECT OF HUMIDITY ON THE CONSISTENCY OF GREASES, by Max T. Fischer. 27 Apr 60, 14p. 2 refs. Rept. no. 60-1309.
Order from OTS $0.50 PB 161 861

When certain nonsoap thickened mineral oil greases exhibited shear breakdown after storage at low humidity, greases of other types were stored at several humidities to determine their effect on storage and shear stability. Worked and unworked quarter scale penetrations in a miniature grease worker cup were obtained on surface and subsurface grease samples stored in four ounce ointment cans at 0, 50 and 100% relative humidities maintained in desiccators for as long as seven months. When storage or use of greases in high or low humidity environments is anticipated, the stability of individual products should be ascertained since moisture stable and unstable greases of some soap and nonsoap thickened types are available. The soap thickened-mineral oil greases are more likely to be stable to the effects of moisture than are the soap thickened synthetic fluid or nonsoap thickened greases.

Leather and Textiles

Bjorksten Research Labs., Inc., Madison, Wis.
DEVELOPMENT OF TEXTILE TYPE VITREOUS SILICA YARNS, by W. Wendall Drummond and Burns A. Cash. Rept. for Feb-Sep 59 on Air Force Textile Materials, Contract AF 33(616)6255. Mar 60, 53p. WADC Technical rept. 59-699.
Order from OTS $1.50 PB 161 845

Experiments were performed leading to development of methods for producing vitreous silica textile yarns from fused quartz canes or rods by means of electrical heating devices. Both induction and resistance furnace devices were used, best performance being obtained from a resistance unit shielded against radiation losses and operating in a protective atmosphere. Power capabilities of available equipment

were insufficient to permit production of a large number of continuous filaments simultaneously, but operation with five filaments was achieved. A limited amount of data on physical properties of filaments and strands was obtained. (Author)

Naval Ordnance Lab., White Oak, Md.
WAFFLE-TYPE CORE MATERIAL FOR SANDWICH CONSTRUCTION, by H. A. Perry, Jr. 7 July 58, 29p. 38 refs. NAVORD rept. 6100; AD-206 315.
Order from LC mi$2.70, ph$4.80 PB 147 222

A fabricated core material is described which consists of a single sheet with symmetrical truncated pyramidal indentations, alike on both sides, resembling the geometry of a waffle. A waffle core of rigid sheet material when bonded between two flat, high strength faces, produces a strong, light-weight structure. Two separate channels exist for the flow of heat-transfer media in the plane of the sheet. The "Waffle" type of sandwich construction appears potentially to be of considerable value in the fabrication of aircraft parts, radomes, a solid blast protective flooring and heat exchangers. It offers a solution to aircraft de-icing and flight cooling problems. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
APPARENT THERMAL DIFFUSIVITY OF FABRICS, by James J. Powers and Francis W. Botsch. Feb 60, 22p. 7 refs. Technical rept. EP-126; AD-233 365 and AD-234 969.
Order from LC mi$2.70, ph$4.80 PB 148 652

The concept of thermal diffusivity is applied to fabrics and fabric systems in order to provide a parameter for the mathematical analysis of the thermal response of clothing to non-uniform boundary conditions. Particular solutions of the Fourier Conduction Equation for unidimensional heat flow are discussed for a thick slab of cloth and for a semi-infinite solid composed of fabric layers. Four experimental methods are applied in the determination of the apparent thermal diffusivity of cloth, using boundary step changes and periodic variations in temperature. The apparent thermal diffusivity of blanket cloth was found to be .0225 in.^{2}/min. and that of Nylon 66 to be .0030 in.^{2}/min. (Author)

Paints and Finishes

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
ALKALINE-ORGANIC MISSILE COMPONENT PAINT REMOVERS, by A. Mankowich. Rept. 1, 10 June 59, 27p. 1 ref. Rept. no. CCL-78; AD-220 378.
Order from OTS $0.75 PB 161 859

Stable, single phase, alkaline-organic paint removers have been developed suitable for stripping paint from missile component parts of aluminum and magnesium. Bench tests indicating improvement in stripping efficiency of 50 to 75 percent over that of the best conventional alkaline aluminum strippers were confirmed by field tests at an Ordnance Depot. The addition of specific high boiling-high flash point glycols and/or triols and hydroxyalkylamines to conventional alkaline aluminum strippers produced the stable, single phase paint removers of improved efficiency. Exploratory tests indicated that certain cationic dispersing agents could replace the fatty acid or rosin soaps of the developed formulations. (Author)

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
RAPID DETERMINATION OF ANTIMONY TRIOXIDE IN FIRE RETARDANT PAINT, by G. G. Esposito. 26 Apr 60, 7p. 1 ref. CCL no. 93.
Order from LC mi$1.80, ph$1.80 PB 146 678

The method presented provides an accurate, rapid volumetric determination of antimony trioxide in the presence of lead chromate by a modification of the iodine process. The method is based upon the reduction of antimony with potassium iodide followed by selective oxidation of the trivalent antimony to the pentavalent form with iodine in the presence of sodium bicarbonate. (Author)

Naval Research Lab., Washington, D. C.
EFFECT OF TEMPERATURE ON THE LUMINANCE OF PHOSPHORESCENT AND FLUORESCENT MATERIAL USED FOR AIDS TO MILITARY ACTIVITY IN THE DARK, by L. J. Boardman. Interim rept. 26 Oct 59, 11p. NRL rept. 5380.
Order from OTS $0.50 PB 161 005

The effect of temperature on the luminance of various types of aids to military activity under covery of darkness has been measured at temperature ranging between -60° and 200°F. The luminance of fluorescent materials appears to have a maximum value near 75°F with very little change between 60° and 80°F and dropping no more than 20 percent at the extreme temperatures. The luminance characteristics of phosphorescent materials were affected markedly by the temperature. For a constant intensity of excitation, phosphorescent materials appear to have a maximum intensity at about 75°F. The luminance-decay rate of both a high initial brightness (HIB) and low initial brightness (LIB) material was increased with increasing temperatures. At higher temperatures, above 75°F, the rate of luminance decay of the HIB material was so rapid that its usefulness was destroyed. Below 75°F the rate of luminance decay was greatly retarded until at -60°F the luminous life for both the HIB and LIB specimens is about equal. Temperature has essentially no effect on the luminance of the radioactive self-luminous materials throughout the range used in this series of measurements (-60° to 150°F). However, at about -60°F the luminance begins to drop appreciably. A comparative measure of the absorbed phosphorescent energy at various temperatures of a constant irradiation was made.

Naval Research Lab., Washington, D. C.
THE PROPERTIES OF PAINTS AS AFFECTED BY ULTRAVIOLET RADIATION IN A VACUUM. PART I, by F. M. Noonan, A. L. Alexander, and J. E. Cowling. Interim rept. 13 July 60, 41p. 10 refs. NRL rept. 5503.
Order from LC mi$3.30, ph$7.80 PB 146 488

The control of temperature is a problem of major concern to the designers of spacecraft. The exchange of energy between a vehicle in space and its surroundings is limited to the radiation process. The idea of using paint on a space vehicle is very attractive, because a properly chosen paint might afford a practical, relatively convenient means of controlling the absorption and emission of radiant energy by the craft, thereby achieving temperature control. This report is concerned with the study of film-forming resins in a high vacuum under the influence of ultraviolet irradiation.

Plastics

Naval Ordnance Lab., White Oak, Md.
AN ADIABATIC CALORIMETER FOR THE DETERMINATION OF THE SPECIFIC HEATS OF CASTING RESINS, by R. W. Warfield, P. Donovan, and M. C. Petree. 8 Mar 58, 31p. 15 refs. NAVORD rept. 6094; AD-162 973.
Order from LC mi$3.00, ph$6.30 PB 148 450

The report describes an adiabatic calorimeter, with temperature controlling and measuring instrumentation, which has been developed for the determination of the specific heat of casting resins as a function of temperature over the range 30°C to 160°C. Results are presented for a number of typical casting resins. In some resins changes in specific heat values are observed which are indicative of second order transitions. (Author)

Oxford U. (Gt. Brit.)
SYMPOSIUM ON PLASTIC CRYSTALS AND ROTATION IN THE SOLID STATE, by J. G. Aston (Pennsylvania State U.) L. A. K. Staveley, and L. E. Sutton. Final rept. on Contract DA 91-591-EUC-1416. 8 Apr 60, 19p.
Order from LC mi$2.40, ph$3.30 PB 147 935

This report summarizes the papers presented, gives the names of invited guests and a partial list of those attending the Symposium on Plastic Crystals. Included also is a summary of the discussion on each paper and of the opportunities for individual discussion.

Resin Research Labs., Inc., Newark, N. J.
STEREOSPECIFIC THERMOSETTING RESINS AND HIGH HEAT RESISTANT ADHESIVES, by P. Esemplare, R. Saltzman and others. Interim rept. no. 4, 1 Feb 59-31 Mar 59, on Contract NOas-58-870-c. 7 Apr 59, 10p. Rept. no. 704; AD-229 178.
Order from LC mi$1.80, EP $3.30 PB 148 388

A statistical study was undertaken to determine the effect of Tergitol NP27 on the standard resin which involved the addition of the micelle former in successively greater percentages to the standard resole formulation. Results indicated that the greater the percentage of Tergitol, the lower the flexural strength. The strength retention was greater for a larger percentage of Tergitol of about 10%. Optimum concentration appeared to be about 12.5%. Two opposing forces appeared to exist. Glass cloth reinforced laminates were prepared, tested, and heat aged. A comparison was made between the standard resole (RRL-39-83) and a commercially available high-heat resistant resin. Both resins were laminated, heat aged for 24 hr at 500°F, and tested similarly. Preliminary results indicated that the standard resole had a strength retention upon heat aging approximately twice that of the commercial resin.

Rubber and Elastomers

Institute of Rubber Research, U. of Akron, Ohio.
STRESS RELAXATION AND STRUCTURE OF HIGH TEMPERATURE ELASTOMERS, by Maurice Morton, V. R. Allen, and R. D. Gates. Technical rept. no. 5, 1 June-31 Aug 59, on Contract Nonr-2573(00). [1959] 28p. 6 refs. AD-228 633.
Order from LC mi$2.70, ph$4.80 PB 148 600

It has been assumed that degradation during press-heating of an extracted vulcanizate is comparable to degradation during vulcanization. Based on this assumption, calculations have been made to correct for the effect of degradation during crosslinking on the sol fraction and the degree of crosslinking. The corrected sol fraction is considerably greater than proposed by theory for natural rubber peroxide vulcanizates. Further, the deviation from theory is dependent on the original molecular weight of the primary chains. The number of chain entanglements per chemical crosslink has then been calculated, assuming that the deviation is attributable to such entanglements. It was proposed that the effectiveness of chain entanglements, i.e., number of apparent physical crosslinks, may be a function of the extent of applied strain on the network. It was found that the number of network chains, as measured by equilibrium swelling, was slightly higher for a good solvent (carbon tetrachloride) than for a poorer solvent (benzene). A sample of Viton A cured with Diak No. 1 exhibited greater resistance to high temperature degradation than did a triethylene tetramine-piperazine cure as evidenced by stress-relaxation studies. With the Diak No. 1 cure, very little change occurred in the stress-relaxation curve when the temperature was raised from 150°C. to 240°C. When raised to 275°C., however, degradation proceeded much more rapidly. (Author) (See also PB 146 230)

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
INFLUENCE OF MOLECULAR STRUCTURE AND SUBSTITUENTS ON THE ANTIZONANT PROPERTIES OF ARYL DIAMINE CHEMICALS, by A. E. Ruff and A. D. Delman. Research and development rept. 4 Mar 57, 25p. 14 refs. Final rept. on Lab Project 5850-A-2.
Order from LC mi$2.70, ph$4.80 PB 149 549

The influence of molecular structure and substituents on the antiozonant properties of fourteen related aromatic diamine chemicals was investigated in terms of their relative effectiveness as inhibitors of ozone-induced polymer degradation. Results, obtained by viscometric techniques, indicate that symmetrical compounds are superior, as antiozonants, to analogous unsymmetrical compounds. In addition, the protective capacities of the antiozonants vary inversely

with the size, number of N-hydrogen substituents, and the distance between the amine groups. The relative effectiveness of the chemicals investigated is correlated with free radical stability, in accordance with the theory of resonance. (Author)

Rock Island Arsenal Lab., Ill.
LOSS OF ANTIOZONANT EFFICACY IN BUTADIENESTYRENE (SBR) RUBBER AFTER SHELF STORAGE, by E. W. Bergstrom. 25 Feb 60, 17p. 2 refs. Rept. no. 60-487; AD-234 723.
Order from LC mi$2.40, ph$3.30 PB 147 339

An investigation was carried out to determine the ozone resistance of (1) antiozonant inhibited SBR vulcanizates which had been stored unstressed indoors and outdoors for various periods of time and (2) vulcanizates prepared from the same inhibited compounds after storage uncured, indoors for various periods of time prior to curing. It was found that vulcanizates inhibited with N-phenyl-N'-cyclohexyl-p-phenylenediamine have excellent ozone resistance in accelerated (25 and 50 pphm) ozone tests when the vulcanizates are stressed and exposed to ozone within three days from the date they are cured. However, the same vulcanizates have no ozone resistance in accelerated ozone tests after being stored (1) unstressed indoors for one week or longer and (2) unstressed outdoors for a period of one month or longer. All antiozonant inhibited SBR vulcanizates which had been stored unstressed for periods up to 24 and 30 months both indoors and out had excellent ozone resistance in outdoor tests.

Rock Island Arsenal Lab., Ill.
OZONE RESISTANCE OF BUTYL VULCANIZATES, by E. W. Bergstrom. 16 May 60, 18p. 11 refs. Rept no. 60-1593.
Order from LC mi$2.40, ph$3.30 PB 148 366

An investigation was carried out to determine the ozone resistance of Butyl (IIR) vulcanizates compounded using formulations recommended by the rubber manufacturer for maximum ozone resistance. These formulations contained high wax loadings. Non-halogenated IIR vulcanizates prepared using these formulations had excellent ozone resistance in accelerated static tests when exposed to 25±3 pphm ozone and in outdoor static tests when exposed at a stress of 20 percent. They had poorer ozone resistance (1) in accelerated static tests when exposed to 50±5 pphm ozone, (2) in dynamic tests and constant load tests when exposed to 25±3 pphm ozone and (3) when exposed outdoors in bent loop fixtures. Chlorinated IIR vulcanizates prepared using the recommended formulations had poor ozone resistance in accelerated static tests when exposed to either 25±3 or 50±5 pphm ozone. The vulcanizates had excellent ozone resistance in outdoor tests, however, when exposed at a stress of 20 percent.

Rock Island Arsenal Lab., Ill.
STYRENE POLYMERIZATION DURING THE MILLING OF DIENE RUBBERS, by H. Wolfgang Jureleit. 28 May 59, 23p. 4 refs. Rept. no. 59-1448; AD-217 043L.
Order from LC mi$2.70, ph$4.80 PB 147 341

A method is described to polymerize styrene during the milling process of an elastomer, such as polybutadiene or a copolymer of butadiene and acrylonitrile. This "mill polymerization" was initiated by finely dispersed sodium and by sodium alcoholate. The developed method does not require any solvents or special apparatus. The experiments were performed on a conventional 2-roll rubber mill. Analysis of the final polymer compositions resulting from the mill polymerization indicates that most probably "graft polymers" are formed by this method. The results also indicate that the milling of uncured elastomers with sodium dispersion might be developed into a new method of vulcanizing without sulfur or sulfur-containing compounds. (Author)

Rock Island Arsenal Lab., Ill.
SYNTHESIS OF STEREOREGULATED HOMOPOLYMERS AND COPOLYMERS OF BUTADIENE AND STYRENE, by Ronald R. Freeman. 5 Jan 60, 28p. 10 refs. Rept. no. 59-3286; AD-233 875L.
Order from LC mi$2.70, ph$4.80 PB 147 230

Results are presented on the homopolymerization of butadiene and styrene and the copolymerization of butadiene with styrene using triethyl aluminum and titanium tetrachloride (Al-Ti) as catalysts.

MATHEMATICS

Aeronautical Research Associates of Princeton, Inc., N. J.
BEHAVIOR OF SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR A COMPLETE CLASS OF THREE-DIMENSIONAL VISCOUS VORTICES, by Coleman duP. Donaldson and Roger D. Sullivan. Rept. on Contract AF 49(638)255. May 60, 32p. 11 refs. AFOSR-TN-60-172.
Order from LC mi$3.00, ph$6.30 PB 148 027

A study has been made of the complete class of solutions of the Navier-Stokes equations wherein the radial, tengential, and axial velocities in cylindrical coordinates (r, ϕ, z) are the forms $u = u(r)$, $v = v(r)$, and $w = zw(r)$. These solutions are found to represent a rather large class of three-dimensional viscous vortex motions. The class of solutions contains Burgers' analytic solution for an unconstrained one-celled vortex as a special limiting case. The solutions obtained show that vortex motions are possible which have more than one "cell". That is, the flow may not simply spiral in toward an axis and out along it as in a one-celled configuration but may have nested regions of successively reversed axial flow. The behavior of the solutions in passing from single to multiple-celled configurations is discussed and the solution for the extremely interesting case of a two-celled analogue to Burgers' unconstrained vortex, which probably occurs quite often in nature, is given in closed form.

Air Force Missile Development Center, Holloman AFB, N. Mex.
FIGURES OF MERIT OF TRANSFER FUNCTIONS AS RATIONAL FUNCTIONS OF THEIR COEFFICIENTS, by Herbert Knothe. Jan 60, 25p. AFMDC TR-60-3; AD-233 558.
PB 146 378

General methods and explicit formulas in terms of the coefficients of a linear differential equation are developed to express figures of merit for the response of a linear system to a step input.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
DYNAMIC INVENTORY POLICY WITH VARYING STOCHASTIC DEMANDS, by Samuel Karlin. Technical rept. no. 15 on Contract Nonr-225(28). 24 Sep 59, 58p. 14 refs. AD-227 373.
Order from LC mi$3.60, ph$9.30 PB 148 894

An extended version of the classical Arrow, Harris, Marschak dynamic inventory process is presented. The case for a single commodity is considered. A sequence of ordering decisions is made at the beginning of a number of periods of equal duration, which result in the buildup of inventories. Stock is depleted by consumption (demand), which is assumed to be an observation of a random variable with a known distribution function. All distribution functions are assumed to possess continuous densities and to belong to nonnegative random variables. A general proof is given for the fact that with a linear ordering and arbitrary independent demand distribution through successive periods, the optimal policy in each period is determinec by a single critical number. With the characterization of the optimal policy known, the main theorem is proved pertaining to comparisons of the critical numbers under the hypothesis that the demand densities are suitably stochastically ordered.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
THE SEQUENTIAL DESIGN OF EXPERIMENTS FOR INFINITELY MANY STATES OF NATURE, by Arthur E. Albert. Technical rept. no. 47 on Contract N6onr-25140. 3 Aug 59, 88p. 9 refs. AD-220 544.
Order from LC mi$4.80, ph$13.80 PB 148 158

The results of Chernoff's sequential design (Ann. Math. Stat. 30: 1959) are extended to the case where the possible states of nature are infinite in number. The assumption is made that there are 2 possible actions (terminal decisions) and a class of available experiments. After each observation, the statistician decides whether or not to continue. If he decides to continue, he must select one of the available experiments; if he decides to stop, he must select one of the 2 terminal actions.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
THREE HYPERBOLIC SURFACES WITH UNUSUAL PROPERTIES, by Robert Osserman. Technical rept. no. 14 on Contract DA 04-200-ORD-704. 19 Feb 60, 14p. 8 refs. OOR rept. 1323.18-M.
Order from LC mi$2.40, ph$3.30 PB 148 436

This paper gives examples of simply-connected surfaces which exhibit various types of unusual behavior. The first example is a polyhedral surface of the form $z = f(x, y)$ over the whole x, y-plane, for which an explicit quasiconformal map is given onto the interior of the unit disk. The second is a complete simply-connected minimal surface which is conformally equivalent to the unit disk. The third is the Riemann surface of the inverse to a function analytic in the unit disk.

Battelle Memorial Inst., Geneva (Switzerland).
THEORETICAL STUDY ON HOMOTOPY THEORY AND DUALITY FOR MODULES AND SPACES. Final and annual technical rept. no. 1. 1 Feb 59-31 Jan 60, on Contract DA 91-591-EUC-1060. 29 Feb 60, 14p. 3 refs. AD-234 398.
Order from LC mi$2.40, ph$3.30 PB 147 255

Homotopy groups of two variables and their duality properties are studied both in the algebraic and in the topological context. On the algebraic side, the theory of these groups and their exact sequences is built up in a most general framework. The results are then applied to special cases and interrelated with known algebraic concepts, primarily for modules over a ring. On the topological side, algebraic topology is shown to be obtainable from the groups, their exact sequences, and the related concepts. The new concepts and results suggested by the duality are investigated. (Author)

California U., Berkeley.
ON SINGULAR PARTIAL DIFFERENTIAL BOUNDARY PROBLEMS, by Frantisek Wolf. Technical rept. no. 7 on Contract Nonr-222(62). June 59, 23p. 7 refs. AD-225 635.
Order from LC mi$2.70, ph$4.80 PB 146 415

Second order partial differential boundary problems are considered. The differential operator is required to be elliptic inside the domain G (not necessarily bounded) and its ellipticity $\sigma(s)$ is allowed to go to zero on the boundary (called singular points of G). The situation is generalized concerning non-self-adjoint operators and general boundary conditions. The operators are compared and the difference of their resolvents are studied by having the operators defined in the same space, $L^2(G)$. The operators are to be the same near the singular points as far as their boundary conditions and curves are concerned. Certain additional boundary curves Σ are added to ∂G in order to remain in $L^2(G)$. These curves may be contained entirely in the interior of G, or divide G in several disconnected subregions G_1, G_2 with different boundary conditions on the 2 sides of Σ. The differential operator is completely reduced by the decomposition $L^2(G) = L^2(G_1) \oplus L^2(G_2)$, where the functions of $L^2(G_1)$ are all zero on G_2, and similarly for $L^2(G_2)$. Proof is presented of the theorem which asserts that the difference of the 2 resolvents is a compact operator.

Columbia U., New York.
ON THE GEOMETRICAL SIGNIFICANCE OF THE MOMENTS OF ORDER STATISTICS AND OF DEVIATIONS OF ORDER STATISTICS FROM THE MEAN IN SAMPLES FROM GAUSSIAN POPULATIONS, by Harold Ruben. Rept. on Contract Nonr-266(59). [1959] 16p. 4 refs. CU-9-59-Nonr-266(59)MS.
Order from LC mi$2.40, ph$3.30 PB 148 577

Let $E = E_{r|n}$ denote the rth largest observation in a random sample of n observations from a normal population with zero mean and unit variance. The distribution is investigated of $E_{r|n}$, the rth order statistic, and that of $E_{r|n} - \bar{E}$, the deviation of the rth order statistic from the sample mean ($\bar{E} = \sum_1^n E_{r|n}/n$), from the point of view of the moment of these distributions. The characteristic function of $E_{r|n} - \bar{E}_{r|n}$ and of $E_{r|n}$ are obtained in a form which enables the geometrical significance of the moments of the 2 statistics to be assessed. Also shown is the fact that the sth moment of $E_{r|n} - \bar{E}$ is equal to the expectation of $n^{-1/2} s H_s(E\sqrt{n})$ in the elementary probability law distribution, where $H_s(x)$ is the $(s+1)$th Tchebycheff-Hermite polynomial, normalized so that the coefficient x^s is unity.

Columbia U., New York.
THE RATE OF INCREASE OF THE SEQUENCE OF MAXIMA, by Herbert Robbins. Rept. on Contract Nonr-266(59). [1959] 6p. CU-3-59-Nonr-266(59)MS; AD-216 577.
Order from LC mi$1.80, ph$1.80 PB 146 414

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
RUNGE-KUTTA-GILL SOLUTION OF FIRST-ORDER DIFFERENTIAL EQUATIONS, by Alexander Edwards. Rept. on Contract DA 20-089-ORD-39246. 20 Apr 60, 19p. 3 refs. Rept. no. RR-23.
Order from LC mi$2.40, ph$3.30 PB 148 522

This report presents an extension for use with Purdue University's Compiler IL The extension solves a system of first-order differential equations of the form $dx_i/dt = f_i(x_i, t)$ using the Runge-Kutta Method as developed by Dr. Stanley Gill, (Cambridge Philosophical Society Proc. 1951, v. 47, p. 96-108). The extension as written is used with Burrough's Datatron 205 Digital Computer with the automatic floating-point unit, Model 360. The program is written in machine language. The approximate running time per solution is calculated by the expression: $T_{\Delta t} = (.34 + .6n) + 4t_f$ where $T_{\Delta t}$ = time in seconds for each interval Δt, n = number of equations and t_f is the time required to evaluate the functions $f(x_i)$. The accuracy is of the order $(\Delta t)^5 x_i$. (Author)

Connecticut U. [Storrs]
ON ORTHONORMAL SERIES AND DENSITY OF INTEGERS, by Richard P. Gosselin. Rept. on Contract AF 49(638)608. May 60, 17p. 3 refs. AFOSR-TN-60-555.
Order from LC mi$2.40, ph$3.30 PB 148 402

This note considers the convergence implications of hypotheses on the coefficient sequence of orthonormal series of the type $\sum_{n \geq 1} (\log n)^b |a_n|^2 < \infty$, $0 \leq b < 2$. The results are stated in terms of the almost everywhere convergence of subsequences of the full sequence of partial sums whose indices satisfy specified density conditions. (Author)

Electronics Research Lab., Northeastern U., Boston, Mass.
A BIBLIOGRAPHY OF PUBLICATIONS IN THE THEORY OF GAMES, by H. Stephen Schloss. Scientific rept. no. 1, 1944-1959, Contract AF 19(604)4573. 23 Oct 59, 96p. 1474 refs. AFCRC-TN-59-797; AD-234 153.
Order from LC mi$5.40, ph$15.30 PB 146 648

This bibliography was compiled primarily by examining the issues of The Mathematical Reviews from 1944 to the present, Operations Research, Annals of Mathematical Statistics, existing bibliographies in works by J. C. C. McKinsey, D. Blackwell and M. A. Girshick, Abraham Wald, R. D. Luce and H. Raiffa, and the comprehensive listing in Contributions to the Theory of Games IV, Annals of Mathematics Studies, no. 40, Princeton University Press. Other entries were found during general reading in this field. While some articles are not readily available they have been included, since the titles will indicate the aspect of game theory in which the particular writer is interested.

Electronics Research Lab., Northeastern U., Boston, Mass.
A BIBLIOGRAPHY OF RECENT PUBLICATIONS IN QUEUING THEORY, by Samuel M. Giveen. Scientific rept. no. 2, 1955-1959, on Contract AF 19(604)4573. 15 Dec 59, 17p. 128 refs. AFCRC-TN-60-103; AD-234 152.
Order from LC mi$2.40, ph$3.30 PB 146 647

This bibliography is designed to cover the literature on queuing theory for the period from 1955 to 1959. The present bibliography is concerned basically with the mathematical theory of the subject, and articles involving applications have been included where they seem to have a direct bearing on the mathematical equations of the theory. Purely descriptive articles have in general been omitted.

[Illinois U., Urbana]
THE EASIER WARING PROBLEM IN ALGEBRAIC NUMBER FIELDS, by Rosemarie Margarete Stemmler. Thesis. Technical rept. on Contract Nonr-1834(18). 1959, 38p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 146 318

Contents:
Determination of v(2;K) for all algebraic number fields
Upper bounds for v(q;K) when q is an odd prime
Upper bounds for v(m;K) when m is composite
Existence of algebraic number fields K for which $v(m;K) \angle v(m)$
Relation of v(m;K) to g(m;K) in totally complex fields

Institute for Advanced Study, Princeton, N. J.
ASYMPTOTIC DECAY OF SOLUTIONS OF DIFFERENTIAL INEQUALITIES, by Paul J. Cohen and Milton Lees. Rept. on Contract AF 49(638)253. May 60, 18p. 2 refs. AFOSR-[TN]-60-568.
Order from LC mi$2.40, ph$3.30 PB 148 328

An investigation is made of the maximum rate of decay at infinity of solutions of certain differential inequalities. Two types of differential inequalities are considered: abstract differential inequalities in a Hilbert space and concrete parabolic differential inequalities. (Author)

Institute for Advanced Study, Princeton, N. J.
AN EXACT SEQUENCE IN DIFFERENTIAL TOPOLOGY, by Morris W. Hirsch. Rept. on Contract AF 49(638)253. May 60, 4p. 4 refs. AFOSR-[TN]-60-544.
Order from LC mi$1.80, ph$1.80 PB 148 326

An exact sequence... $\rightarrow \Gamma^n \rightarrow \theta^n \rightarrow \Lambda^n \rightarrow \Gamma^{n-1} \rightarrow \ldots$ is described, relating certain abelian groups of interest in differential topology. (Author)

Institute for Advanced Study, Princeton, N. J.
AN INITIAL VALUE PROBLEM FOR POSITIVE SYMMETRIC HYPERBOLIC SYSTEMS, by Milton Lees. Rept. on Contract AF 49(638)253. Dec 59, 13p. 3 refs. AFOSR [TN]-60-30; AD-232 920.
Order from LC mi$2.40, ph$3.30 PB 146 316

An initial value problem for a symmetric hyperbolic system of partial differential equations is investigated by the method of finite differences. The assumption is made that the matrices of the system are symmetric and positive-definite. The initial value problem posed is distinct from the Cauchy problem. The existence and uniqueness of a solution is proved for all sufficiently smooth data. An approximate numerical procedure is described.

Institute for Advanced Study, Princeton, N. J.
ON A COLORING PROBLEM, by E. Asplund and B. Grunbaum. Rept. on Contract AF 49(638)253. Dec 59, 12p. 2 refs. AFOSR [TN]-60-29; AD-232 951.
Order from LC mi$2.40, ph$3.30 PB 146 317

A problem, posed by A. Bielecki (Colloq. Math. 1:33, 1948) is solved by the following theorem: Each family of rectangles in the plane, with horizontal and vertical edges, and such that no 3 have a common point, may be decomposed into 6 subfamilies consisting of mutually disjoint recetangles. Some related problems and results are discussed. (Author)

Institute for Advanced Study, Princeton, N. J.
ON EMBEDDING DIFFERENTIABLE MANIFOLDS IN EUCLIDEAN SPACE, by Morris W. Hirsch. Rept. on Contract AF 49(638)253. May 60, 10p. 10 refs. AFOSR-[TN]-60-545.
Order from LC mi$1.80, ph$1.80 PB 148 327

Recent results on combinatorial manifolds are applied to obtain embedding theorems for differentiable manifolds. It is shown that if M is a differentiable n-manifold, M can be embedded in Euclidean q-space R^q, where (a) $q = 2n-1$ if M is non-closed; (b) $q = n+2$ if M is contractible and n is odd; (c) $q = n+1$ if M is contractible and n is even. Various other results are obtained by assuming special conditions, e. g. M is parallelizable, or M is highly connected. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
GREEN'S FUNCTIONS FOR MONATOMIC SIMPLE CUBIC LATTICES, by A. A. Maradudin, E. W. Montroll and others. Rept. on Contracts AF 18(600)1315 and AF 49(638)399. Nov 59, 34p. 28 refs. Technical note BN-188; AFOSR-TN-60-202; AD-234 104.
Order from LC mi$3.00, ph$6.30 PB 146 416

A tabulation to six significant figures of the Green's functions for monatomic simple cubic lattices which are defined by the integral $I(a, b, c; \alpha; \beta) = \frac{1}{\pi^3} \int_0^{\pi}\int_0^{\pi}\int_0^{\pi} \frac{\cos ax \cos by \cos cz}{(2+\alpha)\beta - \cos x - \cos y - \alpha \cos z}\, dx\,dy\,dz$ is presented for the following ranges of the parameters: $\mu = \beta^{-1} = 0.00(0.01)1.00$; $\alpha = 1, 2, 4, 8, 16$; and $0 \leq a^2 + b^2 + c^2 \leq 15$. The recurrence formula satisfied by this integral, closed form expressions for the integral for special values of the parameters, asymptotic expressions valid in different ranges of the parameters, and examples of the applications of these tables are presented. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
AN OPTIMAL POINCARE INEQUALITY FOR CONVEX DOMAINS, by L. E. Payne and H. F. Weinberger. Rept. on Contract AF 49(638)228. Feb 60, 15p. 6 refs. Technical note BN-193; AFOSR-TN-60-248; AD-233 371.
Order from LC mi$2.40, ph$3.30 PB 146 754

The second (first non-zero) eigenvalue μ_2 of the free membrane problem $\Delta v + \mu v = 0$ with $\partial v/\partial n = 0$ on the boundary for an n-dimensional convex domain of diameter D is shown to satisfy $\mu_2 \geq \pi^2 D^{-2}$. Equality is approached for a thin parallelepiped. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
POTENTIALS WITH ZERO SCATTERING PHASE, by H. E. Moses and S. F. Tuan. Rept. on Contract AF 19(604)4555. Nov 58, 20p. 48 refs. Research rept. no. CX-36; AFCRC TN-58-636.
Order from LC mi$2.40, ph$3.30 PB 138 248

The Gelfand-Levitan equation is used to construct potentials which, for a given angular momentum, yield scattering phases which are identically zero for all energies. The technique used herein gives all such potentials which belong to the class of potentials for which f(k) is analytic in the lower half-plane.

Iowa State U., Iowa City.
TREATMENT ERRORS IN COMPARATIVE EXPERIMENTS, by George Zyskind and Oscar Kempthorne. Rept. on Contract AF 33(616)5599. Apr 60, 83p. 45 refs. WADC Technical note 59-19.
Order from OTS $2.25 PB 161 874

The present report investigates a representative number of alternative experimental schemes in which explicit allowance is made for the fact that application of intended amounts of treatments may be subject to error. It is shown how the question of treatments subject to error may structurally be incorporated into a broader overall approach to experimental designs. When certain sets of structural conditions are satisfied the expected values of mean squares in the analyses of variance tables have simple and easily specifiable forms. These conditions have been verified to hold in all of the examples discussed. If treatment errors are operative then repeated independent attempts at realizing the preassigned amounts of treatments are to be desired since without them partial or total confounding of treatment amounts and treatment errors will result. The presence of treatment errors tends to decrease the sensitivity of tests of significance for treatment effects. The presence of interactions involving treatment errors tends not only to further decrease the sensitivity of tests but also to introduce negative bias both into tests of significance for treatments and into the estimation of the treatment component of variation; but the presence of these interactions tends to overestimate the average variance of estimates of treatment differences. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE FACTORIZATION OF TRINOMIALS OVER GF(2) by Solomon W. Golomb, Lloyd R. Welch, and Alfred Hales. Rept. on Contract DA 04-495-ORD-18. 14 July 59, 21p. 7 refs. Memo. no. 20-189; AD-225 598.
Order from LC mi$2.70, ph$4.80 PB 148 648

The factorization of trinomials over GF(2) is investigated, and tables of factors of trinomials through degree 45 are included. Up to degree 36, the trinomials are factored completely. Detailed information on the periods of the trinomials and their factors is presented. (Author)

Kansas U., Lawrence.
CHARACTERISTICS AND CAUCHY PROBLEM FOR NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER, by Jacek Szarski. Technical rept. no. 21 on Studies in Eigenvalue Problems, Contract Nonr-58304. 1959, 102p. 17 refs. AD-225 054.
Order from LC mi$5.70, ph$16.80 PB 148 173

The theory of Cauchy characteristics is investigated for the equation of the form: $z_x = f(x, y_1, \ldots, y_n, z, z_{y_1}, \ldots, z_{y_n})$. The Cauchy problem is also studied for z_x and for systems of equations of the form: $z^i_x = f^i(x, y_1, \ldots, y_n, z^1, \ldots, z^m, z^i_{y_1}, \ldots, z^i_{y_n})$, $z^i_{x_v} = p^{iv}(x_1, \ldots, x_p, z^1, \ldots, z^m)$, and $z^i_{x_v} = f^{iv}(x_1, \ldots, x_p, y_1, \ldots, y_n, z^1, \ldots, z^m, z^i_{y_1}, \ldots, z^i_{y_n})$, where $i = 1, 2, \ldots, m$ and $v = 1, 2, \ldots, p$. Partial differential inequalities of the first order are considered, and also the uniqueness of the solution of the Cauchy problem for z_x and for z^i_x. The classical theory of characteristic strips of first order is treated for z_x together with recent results obtained by A. Plis. Characteristic strips of second order are considered for z_x, and existence theorem are studied for z_x and z^i_x. Also considered are the uniqueness and existence theorems for p^{iv} and f^{iv}.

Kansas U., Lawrence.
THEORY OF BESSEL POTENTIALS. PART I, by N. Aronszajn and K. T. Smith. Technical rept. no. 22 on Studies in Eigenvalue Problems, Contract Nonr-58304. 1959, 120p. 27 refs. AD-226 343.
Order from LC mi$6.00, ph$18.30 PB 148 585

A basis is presented for a treatment of differential eigenvalue and boundary value problems. The general theory of functional spaces and functional completion previously developed is applied to special spaces which are of importance in the study of differential problems, especially of the elliptic type. Potentials are considered which are based on the kernels: $G_\alpha(x) = \frac{1}{2^{(n+\alpha-2)/2}\pi^{n/2}\Gamma(\frac{\alpha}{2})} K_{\frac{n-\alpha}{2}}$ times $(|x|)|x|^{(\alpha-n)/2}$, where $K_{(n-\alpha)/2}$ is the modified Besel function of the third kind. All corresponding potentials are called Bessel potentials of order α. The theory of potentials of order α in the whole space R^n is given. The classes of potentials P^α are considered in the subdomains of R^n (especially in bounded domains), and also on differentiable and Riemannian manifolds.

Liège U. (Belgium).
ASYMPTOTIC REPRESENTATION OF THE SPECTRAL FUNCTION OF SELF-ADJOINT ELLIPTIC OPERATORS OF THE SECOND ORDER WITH VARIABLE COEFFICIENTS, by F. J. Bureau. Technical (scientific) note no. 2 on Contract AF 61(052)86. Nov 59, 80p. 21 refs. AFOSR-TN-59-1182; AD-232 050.
Order from LC mi$4.50, ph$12.30 PB 146 716

Let $L_x \equiv a^{ij}(x)\frac{\partial 2}{\partial x^i \partial x j} + b^i(x)\frac{\partial}{\partial x} + c(x)$, $(i, j = 1, \ldots, n)$ be a self-adjoint elliptic operator with analytic coefficients and $u_{tt} - L_x u = 0$ the totally hyperbolic equation associated with L_x. The connection between the elementary solutions of L_x and the hyperbolic equation is described. The solution of the Cauchy problem for the hyperbolic equation is written with classical symbols only. Then the asymptotic behavior is considered of the spectral function $\Theta(x, y; \lambda)$ of $L_x v + \lambda v = 0$, $x \in D$, and $v = 0$ on D, where λ a parameter, D a bounded simply connected domain of R^n with boundary D.

Maryland U., College Park.
CONTINUOUS DEPENDENCE AND UNIQUENESS IN CAUCHY'S PROBLEM FOR FIRST ORDER, NONLINEAR, PARTIAL DIFFERENTIAL EQUATIONS,

by Avron Douglis. Rept. on Contract AF 49(638)590. June 60, 16p. 9 refs. AFOSR-TN-60-572.
Order from LC mi$2.40, ph$3.30 PB 148 363

The C' solutions of a non-linear, first order, sufficiently regular, partial differential equation $U_t + F(x, t, U, U_x) = 0$ are known to depend continuously upon their initial data. Continuous dependence for solutions not of class C' is considered in this paper. (Author)

Maryland U., College Park.
ON THE UNIQUENESS OF GENERALIZED SOLUTIONS OF FIRST ORDER, QUASILINEAR PARTIAL DIFFERENTIAL EQUATIONS, by Avron Douglas. Rept. on Contract AF 49(638)590. June 60, 8p. AFOSR-TN-60-571.
Order from LC mi$1.80, ph$1.80 PB 148 362

A simple proof is presented of the theorem of Oleinik that the generalized solutions of partial differential equations of the form $u_t + (F(x, t, u))_x + G(x, t, u) = 0$ are uniquely determined by their Cauchy data. (Author)

Maryland U., College Park.
AN ORDERING PRINCIPLE FOR CONSERVATION LAWS IN TWO VARIABLES, by Avron Douglis. Rept. on Contract AF 49(638)590. June 60, 7p. 2 refs. AFOSR-TN-60-570; AD-238 073
Order from LC mi$1.80, ph$1.80 PB 148 361

If $F_{uu}(x, t, u) \geq 0$, the generalized solutions of the conservation law $u_t + (F(x, t, u))_x = 0$ are partially ordered like their initial data. (Author)

Massachusetts Inst. of Tech., Cambridge.
SINGULAR INTEGRAL EQUATIONS, BOUNDARY VALUE PROBLEMS AND THE RIEMANN-ROCH THEOREM, by Walter Koppelman. Technical note on Contract AF 49(638)42. [1959] 46p. 24 refs. AFOSR Technical note 60-587.
Order from LC mi$3.30, ph$7.80 PB 148 538

Naval Weapons Lab., Dahlgren, Va.
ON THE STABILITY OF UNIQUELY DEFINED INTEGRALS OF PARTIAL DIFFERENTIAL EQUATIONS, by E. W. Schwiderski. 13 May 60, 25p. 14 refs. NWL rept. no. 1700.
Order from LC mi$2.70, ph$4.80 PB 148 655

The Hadamard definition of the above is reformulated so that the new stability concept takes account of the intrinsic properties of the uniquely defined integral. A mathematical and physical justification of the new concept is given. A definition of the stability of constructive methods is given in general and discussed in detail by means of finite difference equations. (Author)

Nebraska U., Lincoln.
A STUDY OF THE BOUNDARY VALUE PROBLEM FOR NONLINEAR SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS, by Lloyd Jackson. Rept. on Contract AF 49(638)506. 15 Apr 60, 42p. 10 refs. AFOSR-[TN]-60-491.
Order from LC mi$3.30, ph$7.80 PB 148 413

The boundary valued problem for the equation $y'' = f(x, y, y')$ is studied by subfunction methods. A generalized solution is obtained. (Author)

Northwestern U., Evanston, Ill.
AN INTEGRAL TRANSFORM RELATED TO THE HILBERT TRANSFORM, by Richard R. Goldberg. Rept. on Contract AF 49(638)383. Mar 60, 6p. 2 refs. AFOSR TN-60-197; AD-233 956.
Order from LC mi$1.80, ph$1.80 PB 146 418

The following basic results are established concerning the transform $f^*(x) = \frac{1}{\pi}\int_0^\infty \frac{f(x+t) - f(x-t)}{t} \cdot \frac{\sin t}{t} dt$ for arbitrary $f \in L^2$: an inversion formula, an explicit expression for f^* in terms of the Hilbert transform of f, an explicit expression for the Hiblert transform of f in terms of f^*, and an expression for f^{**} in terms of f. (Author)

Northwestern U., Evanston, Ill.
WATSON TRANSFORMS ON GROUPS, by Richard R. Goldberg. Rept. on Contract AF 49(638)383. Mar 60, 7p. 1 ref. AFOSR TN-60-198; AD-233 957.
Order from LC mi$1.80, ph$1.80 PB 146 417

The theory of general transforms of $L^2(0, \infty)$ is extended to groups. If G is any locally compact abelian group then, on $L^2(G)$, a set of integral transforms is constructed each of which gives rise to a unitary transformation on $L^2(G)$. With appropriate specialization these integral transforms become the classical Watson transforms. (Author) (See also PB 146 418)

Purdue Research Foundation, Lafayette, Ind.
A NOTE ON NON-NEGATIVE MATRICES, by C. R. Putnam. Technical note no. 10 on Commutators on a Hilbert Space, Contract AF 18(603)139. Mar 60, 7p. 6 refs. PRF 1421; AFOSR-TN-59-692; AD-233 512.
Order from LC mi$1.80, ph$1.80 PB 146 377

Results on non-negative matrices previously obtained are extended. (Author)

Purdue Research Foundation, Lafayette, Ind.
A NOTE ON TOEPLITZ MATRICES AND UNITARY EQUIVALENCE, by C. R. Putnam. Technical note no. 11 on Commutators on a Hilbert Space, Contract AF 18(603)139. Mar 60, 6p. 9 refs. PRF 1421; AFOSR-TN-60-28; AD-233 511.
Order from LC mi$1.80, ph$1.80 PB 146 362

A generalization is obtained of a condition assuring the unitary equivalence of a Toeplitz matrix (c_{j-k}) to a certain function of the matrix belonging to the quadratic form of $2\sum_1^\infty x_n x_{n+1}$. (Author)

RIAS, Baltimore, Md.
A DISCUSSION OF DIFFERENTIAL EQUATIONS ON PRODUCT SPACES, by Jack K. Hale and Arnold Stokes. Rept. on Contract AF 49(638)382. Jan 60, 21p. 8 refs. Technical rept. 60-3; AFOSR-TN-59-1283; AD-233 044.
Order from LC mi$2.70, ph$4.80 PB 146 721

RIAS, Baltimore, Md.
ON CERTAIN NON-LINEAR OPERATORS AND PARTIAL DIFFERENTIAL EQUATIONS, by Gertrude I. Heller (Johns Hopkins U.). May 60, 83p. 3 refs. Technical rept. 60-14; AFOSR-TN-60-474.
Order from LC mi$4.80, ph$13.80 PB 148 659

RIAS, Baltimore, Md.
ON THE METHOD OF KRYLOV-BOGOLIUBOV-MITROPOLSKI FOR THE EXISTENCE OF INTEGRAL MANIFOLDS OF PERTURBED DIFFERENTIAL SYSTEMS, by J. K. Hale. Rept. on Contract AF 49(638)382. Jan 60, 19p. 15 refs. Technical rept. 60-1; AFOSR-TN-59-1293; AD-233 806.
Order from LC mi$2.40, ph$3.30 PB 146 365

Some important results of N. Bogoliubov and Y. Mitropolski [Asymptotic methods in the theory of nonlinear oscillations, (Russian) Moscow (1955) Rev. 1958] on the existence of integral manifolds of differential systems are discussed. The results are stated in terms of a particular problem, but the proofs of these results apply to a much larger variety of questions. Only those generalizations are mentioned which are essential to make an association with some recent results of various authors in this country, and postpone a more complete discussion of the generalizations to a later paper. (Author)

RIAS, Baltimore, Md.
PERIODIC ORBITS ON TWO MANIFOLDS, by Bruce L. Reinhart. Rept. on Contract AF 49(638)382. Jan 60, 13p. 3 refs. Technical rept. 60-2; AFOSR-TN-59-1282; AD-233 043.
Order from LC mi$2.40, ph$3.30 PB 146 722

Given any vector field V on an oriented 2 manifold, an integer I(V, C), defined by an integral, is assigned to any curve C. On the other hand, to any C with everywhere nonzero tangent vector, an integer called the winding number of C can be assigned. By comparing these 2 integers, necessary conditions for C to be a periodic orbit may be obtained. These ideas are discussed and applied to a problem on the solid torus. A certain class of vector field is shown to always admit a periodic orbit.

RIAS, Baltimore, Md.
SOME EXTENSIONS OF LIAPUNOV'S SECOND METHOD, by J. P. LaSalle. Rept. on Contract AF 49(638)382. [1960] 38p. 8 refs. Technical rept. 60-5; AFOSR-TN-60-22; AD-233 805.
Order from LC mi$3.00, ph$6.30 PB 146 363

In studying the stability of a system it is never completely satisfactory to know only that an equilibrium state is asymptotically stable. As a practical matter, it is necessary to have some idea of the size of the perturbations the system can undergo and still return to the equilibrium state. It is never possible to do this by examining only the linear approximation. The effect of the nonlinearities must be taken into account. Liapunov's second method provides a means of doing this. Mathematical theorems underlying methods for determining the region of asymptotic stability are given, and the methods are illustrated by a number of examples. (Author)

Statistical Lab., Case Inst. of Tech., Cleveland, Ohio.
ORDER STATISTICS AND ESTIMATORS FOR THE WEIBULL DISTRIBUTION, by F. C. Leone, Y. H. Rutenberg, and C. W. Topp. Rept. on Contract AF 49(638)361. Mar 60, 25p. 14 refs. AFOSR-TN-60-489.
Order from LC mi$2.70, ph$4.80 PB 147 747

The first part of this paper is devoted to an expository discussion of the properties of the generalized Weibull Distribution $F(x) = 1 - \exp[-((x-a)/b)^c]$. This is followed by a discussion of the order statistics from the distribution. In the second part, properties of the distributions of the smallest and largest order statistics are studied. The third part deals with problems of estimation of parameters.

Syracuse U., N. Y.
THE DIFFERENTIABILITY OF TRANSITION FUNCTIONS, by Donald Ornstein. Research rept. 24 on Contract AF 49(638)265. Oct 59, 9p. 4 refs. AFOSR-TN-1265; AD-233 105.
Order from LC mi$1.80, ph$1.80 PB 146 732

Syracuse U., N. Y.
A GENERAL ERGODIC THEOREM, by R. V. Chacon and D. S. Orstein. Research rept. 26 on Contract AF 49(638)265. Oct 59, 13p. 6 refs. AFOSR-TN-59-1267; AD-233 107.
Order from LC mi$2.40, ph$3.30 PB 146 734

The following theorem is proved: Let T be a positive linear operator on L_1 of a positive measure space (S, G, μ) and let T have L_1 norm less than or equal to one. Then if f and p are functions in L_1 and if p is non-negative, the limit $\lim_{n\to\infty} \frac{\sum_{k=0}^n T^k f}{\sum_{k=0}^n T^k p}$ exists and is finite almost everywhere on the set $A = \{s: T^k p > 0$ for some $k \geq 0\}$.

Syracuse U., N. Y.
ON LAST EXIT TIMES, by K. L. Chung. Research rept. 23 on Contract AF 49(638)265. Oct 59, 19p. 5 refs. AFOSR-TN-59-1264; AD-233 092.
Order from LC mi$2.40, ph$3.30 PB 146 730

The last exit time from a given state before a given time is studied. Its properties related to the analytic properties of the transition matrix and the reversed nonstationary chains are also discussed. (Author) (See also AD-233 105)

Syracuse U., N. Y.
ON THE ANALYTIC STRUCTURE OF MARKOV PROCESSES, by W. B. Jurkat. Research rept. 25 on Contract AF 49(638)265. Oct 59, 7p. AFOSR-TN-59-1266; AD-233 106.
Order from LC mi$1.80, ph$1.80 PB 146 733

A general solution to the backward Kolmogorov equation is constructed under the hypothesis of a finite number of exits. (Author)

Syracuse U., N. Y.
ON THE ANALYTIC STRUCTURE OF SEMI-GROUPS OF POSITIVE MATRICES, by W. B. Jurkat. Research rept. 22 on Contract AF 49(638)265. Oct 59, 33p. 12 refs. AFOSR-TN-59-1263; AD-233 135.
Order from LC mi$3.00, ph$6.30 PB 146 731

The dual of the first entrance formula is obtained from which general differentiability properties are deduced. (Author)

Syracuse U., N. Y.
ON THE MAXIMUM NUMBER OF DEFICIENT VALUES OF CERTAIN CLASSES OF FUNCTIONS, by Albert Edrei and Wolfgang H. J. Fuchs (Cornell U.). Rept. on Contract AF 49(638)571. Apr 60, 40p. 15 refs. AFOSR-TN-60-402.
Order from LC mi$3.00, ph$6.30 PB 148 414

Let f(z) be meromorphic and let m(r, f) and T(r, f) be the quantities which play a fundamental role in Nevanlinna's theory. The authors show that

$$\liminf_{r \to \infty} \frac{m\left(r, \frac{f}{f'}\right)}{T(r,f)} = 0$$

provided f(z) has its zeros and poles distributed on a finite number of radii passing through the origin and its order is either infinite or finite, but not too small.

Virginia Agricultural Experiment Station, Blacksburg.
BIBLIOGRAPHY ON SEQUENTIAL ANALYSIS, by J. Edward Jackson. Technical rept. no. 6 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). May 59, 51p. 313 refs.
Order from LC mi$3.60, ph$9.30 PB 146 350

The references are listed alphabetically by author and also broken down into fourteen subject categories.

Virginia Agricultural Experiment Station, Blacksburg.
THE COMPARISON OF THE SENSITIVITIES OF SIMILAR EXPERIMENTS: MODEL II OF THE ANALYSIS OF VARIANCE, by D. E. W. Schumann and R. A. Bradley. Technical rept. no. 3 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Nov 58, 19p. 3 refs. AD-212 145.
Order from LC mi$2.40, ph$3.30 PB 146 473

Comparisons of the sensitivities of experiments are considered based on the Model II of the analysis of variance (with random effects). Extended and new tables are included. (Author)

Virginia Agricultural Experiment Station, Blacksburg.
INTRA- AND INTER-BLOCK ANALYSIS FOR FACTORIALS IN INCOMPLETE BLOCK DESIGNS, by R. A. Bradley, R. E. Walpole, and C. Y. Kramer. Technical rept. no. 7 (Final) on The Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). June 59, 42p. 22 refs. AD-219 182.
Order from LC mi$3.30, ph$7.80 PB 146 406

An extension was made on the recent work of Kramer and Bradley [Ann. Math. Stat. 28:349-361, 1957] to the use of factorials in the several suitable classes of two-associate class, partially balanced incomplete block (p. b. i. b.) designs not previously considered. A second objective is to complete the earlier work through utilization of inter-block information in combined intra- and inter-block estimators. Considered specifically are the recovery of inter-block information in group divisible designs, both intra- and inter-block analyses for Latin-square, sub-type L_2 designs and Latin-square, sub-type L_3 designs, and discuss other p. b. i. b. designs with two associate classes. In each situation tests of significance and estimators of factorial effects are obtained along with efficiencies of contrasts. (Author)

Washington U., Seattle.
FINAL REPT. ON CONTRACT NONR-477(22). [1959] 4p.
Order from LC mi$1.80, ph$1.80 PB 148 139

One problem which was solved concerned topological properties of Banach spaces under their weak topologies. Some metrization theorems have been proved which greatly simplify some known proofs for metrization theorems for compact spaces.

Washington U., Seattle. Div. of Counseling and Testing Services.
TRIANGULAR FACTORING OF A SYMMETRIC MATRIX, AN IBM TYPE 650 PROGRAM, by Harold Burk and Glenn E. Roudabush. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). Sep 59, 7p. 2 refs. AD-229 936.
Order from LC mi$1.80, ph$1.80 PB 148 869

Washington U., Seattle. Div. of Counseling and Testing Services.
A PROGRAM FOR CALCULATING RAW SCORE REGRESSION WEIGHTS, MULTIPLE CORRELATION COEFFICIENTS, AND AVERAGE SQUARED ERROR OF PREDICTION ON THE IBM TYPE 650, by Dennis E. Hamilton and Glenn E. Roudabush. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). July 59, 21p. 6 refs. AD-229 937.
Order from LC mi$2.40, ph$4.80 PB 147 273

A program was constructed to provide certain basic statistical parameters associated with the classical multivariate linear regression model. Treating standard regression weights derived by any of several methods, the program supplies 2 measures of comparison and effectiveness: (1) the multiple correlation coefficient and (2) the average squared error of prediction. In addition, raw score regression weights, or b weights, are provided which may be utilized in predicting the dependent (criterion) variable of the model. The additive constant of the raw score model is also calculated. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
A STOCHASTIC METHOD OF SOLVING PARTIAL DIFFERENTIAL EQUATIONS USING AN ELECTRONIC ANALOG COMPUTER, by Kuei Chuang, Louis F. Kazda, and Thomas Windeknecht. Rept. on Project Michigan, Contract DA 36-039-sc-78801. June 60, 53p. 8 refs. 2900-91-T.
Order from LC mi$3.60, ph$9.30 PB 148 524

This report presents an analog-computer method for solving a general class of two-dimensional boundary-value problems in which only a small number of operational amplifiers is required. The method simulates the boundary-value problem under consideration as a stochastic model by a technique commonly designated the "Monte Carlo method." In this case, the stochastic method becomes a tool for the numerical analysis of the partial differential equation. Although the Monte Carlo method of digital-computer solution of partial differential equations has been extensively studied, its application to the analog computer is believed to be new.

Wisconsin U., Madison.
ON SOME BANACH SPACE OF ANALYTIC FUNCTIONS OF SEVERAL COMPLEX VARIABLES, by D. B. Lowdenslager. Preliminary rept. on Contract N7onr-285(07). [1959] 12p. 13 refs. AD-225 105.
Order from LC mi$2.40, ph$3.30 PB 148 875

Computing Devices

Air Force Cambridge Research Center, Bedford, Mass.
INTERPRETIVE ROUTINE FOR QUADRUPLE-PRECISION NUMBERS, by Murray E. Sherry. Mar 59 9p. Cambridge Computer Series no. 3; AFCRC-TN-59-155; AD-233 828.
Order from LC mi$1.80, ph$1.80 PB 146 331

For programming purposes, the Cambridge computer contains 2000 registers numbered 0000 to 1999, each of which will accomodate a 10 decimal digit number with sign. Registers 0000 to 0099 and 0900 to 1999 are used for the quadruple-precision routine. Registers 0100 to 0899 are for general programming use. The quadruple-precision routine enables the programmer to deal with numbers containing 37 decimal digits. The exponent of the number is the written exponent (mod 500). Numbers are stored in memory in 4 successive registers. A number is referred to by the location of the first register. The correct sign of the number must be carried in all 4 memory locations. (Author)

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DIGITAL COMPUTER PROGRAM FOR FUEL CONSUMPTION: TRACKED VECHILES (BATTLEFIELD DAY AND NORMAL CONVOY), by Mary Archambault. Rept. on Contract DA 20-089-ORD-39246. May 60, 42p. Rept. no. RR-24.
Order from LC mi$3.30, ph$7.80 PB 148 759

This report presents a Digital Computer program for determining fuel consumption of track vehicles under Battlefield Day and Normal Convoy conditions, together with the necessary fuel tank capacity requirement and the radius of action limits for convoy, highway, secondary road, and cross country operation. (Author)

Digital Computer Lab., U. of Illinois, Urbana.
THE DECISION AND SYNTHESIS PROBLEMS IN SEMI-MODULAR SWITCHING THEORY, by James H. Shelly. Doctoral thesis. Rept. on Contract Nonr-1834(27). 20 May 59, 98p. 41 refs. Rept. no. 88; AD-219 323.
Order from LC mi$5.40, ph$15.30 PB 146 603

The decision and synthesis procedures are investigated for semi-modular circuits, a sub-class of asynchronous switching circuits. This includes a characterization of such circuits by means of properties of a set of numerical vectors and an application of these results to the synthesis problem. The synthesis procedure studied assumes that the description of the circuit to be synthesized is in the form of a set L of n-dimensional vectors of non-negative integers. The object of the synthesis is to produce a semi-modular circuits C whose C-state lattice coincides with L. Another aspect of the synthesis problem is that the description of the circuit is often in a flow chart form, rather than as a lattice of vectors. (Author)

Electronics Research Lab., U. of California, Berkeley.
AN OPTIMAL STRATEGY FOR A SATURATING SAMPLE-DATA SYSTEM, by Charles A. Desoer and Jack Wing. Rept. on Contract AF 18(600)1521. 15 Dec 59, 42p. 6 refs. Series no. 60, issue no. 262; AFOSR-TN-60-67; AD-233 739.
Order from LC mi$3.30, ph$7.80 PB 146 361

The problem of finding, proving, and implementing the optimal strategy for the sampled-data servo is discussed. A second-order linear servomechanism is considered. The optimal control signal for this system may be obtained by a simple method using standard analog computer techniques. A formulation is presented of the problem that requires the minimum number of parameters. The set of all possible initial states is partitioned into sets, R_N, in terms of the minimum number of sampling periods required to reach equilibrium. Theorems are presented which establish the exact shape of these sets. The optimal strategy is shown to be unique for special initial states. The optimality of the proposed strategy is established and implemented. The relationship between the optimal strategy for the sampled system and the optimal relay solution for the corresponding continuous system is discussed.

Institut d'Optique, Paris (France).
DESIGN OF A COMPUTER ESPECIALLY ADAPTED TO THE STUDY OF THE PROPERTIES OF THIN FILMS. Final technical rept. no. 1, 1 Mar 59-1 Mar 60, on Contract DA 91-591-euc-1080. [1960] 33p. AD-235 138.
Order from LC mi$3.00, ph$6.30 PB 147 252

A study is summarized of the design of the logical scheme of a digital computer especially adapted to the study of the properties of thin films. The study of thin films leads to operations which, from the computer point of view, were classified under 2 categories: (1) elementary operations such as algebraic sums and multiplications; and (2) interpretive operations as division, square root, sine, cosine, and exponential functions. The following special features for optical calculations were developed: (1) a double address system which rules the connections between the memory and the arithmetic unit; (2) a novel complement-type of performing algebraic sums within the arithmetic unit; (3) a novel conversion from fixed, point to floating-point notation, to operate automatically when required within a running program; and (4) jump and return transfers to and from subroutines.

International Telemeter Corp., Los Angeles, Calif.
CONVENTIONS REGARDING LOGICAL ARRANGEMENT OF INFORMATION ON DISC. Technical rept. no. 13 [on Contract AF 30(602)1566] 20 Oct 57, 13p. RADC-TN-57-384; AD-131 380.
Order from LC mi$2.40, ph$3.30 PB 146 723

Consideration was given to the following: (1) the representation and ordering of information, (2) punched paper tape, (3) flexowriter punching, (4) the tape-to-tape unit, (5) the tape-to-film unit, (6) the film-to disk unit, and (7) the desk reader unit.

Michigan U. Research Inst., Ann Arbor.
APPLICATION OF LOGIC TO THE DESIGN OF COMPUTING MACHINES, by A. W. Burks, H. Wang, and J. Holland. Final rept. on Contract AF 18(603)72. Aug 59, 13p. 2512-4-F; AFOSR-TR-59-106; AD-226 604.
Order from LC mi$2.40, ph$3.30 PB 146 390

The results previously obtained on fixed automata are summarized. Results obtained on growing automata are reviewed. A universal computer is described which is capable of simultaneously executing an arbitrary number of sub-programs. The number of such sub-programs vary as a function of time under program control or as directed by input to the computer. Three features of the computer are: (1) the structure of the computer is a 2-dimensional modular (or iterative) network; (2) each sub-program is spatially organized, thus facilitating the simulation of highly parallel systems having many points or parts; and (3) the computer's structure and behavior can, with simple generalizations, be formulated so as to make it a useful abstract tool for investigating problems in automata theory. (Author)

New York U. Coll. of Engineering, N. Y.
SAMPLED-DATA CONTROL SYSTEMS WITH TWO DIGITAL PROCESSING UNITS, by James C. Hung. Rept. on Contract AF 49(638)586. Jan 60, 29p. 8 refs. Technical rept. 400-2; AFOSR-TN-60-18; AD-232 461.
Order from LC mi$2.70, ph$4.80 PB 146 714

The theory and the procedure are presented for designing the sampled-data control system having a digital processing unit in the forward line and another digital processing unit in the feedback loop to response to inputs as well as to neutralize the disturbance of a deadbeat system. The examples using the proposed design procedure are given, and their root-loci are plotted and discussed. (Author)

MECHANICS

Stanford U., Calif.
A THEORY OF SMALL DEFORMATIONS OF SOLID BODIES, by J. F. Besseling. Rept. on Contract AF 49(638)223. Feb 59, 112p. 42 refs. SUDAER no. 84; AFOSR-TN-59-605; AD-217 172.
Order from LC mi$6.00, ph$18.30 PB 148 754

An attempt is made to present a theory that is capable of giving a mathematical description of the following phenomena observed in the deformation and heating of solid bodies: thermal stresses, thermoelastic damping of vibrations, dynamic and static moduli, Bauschinger effect and other anisotropic hardening phenomena in plastic deformation, primary creep preceding the secondary stage of steady creep under constant stress, creep recovery and stress relaxation. The variational principles of thermoelasticity, creep and of the theories of plasticity are all derived from one thermodynamic variational principle which is formulated with the aid of the entropy displacement field introduced by Biot. Thermoelastic damping of bending vibrations of beams and creep damping of pure shear vibrations are considered in some detail. (Author)

Technion Research and Development Foundation, Ltd. (Israel).
THE EFFECT OF AXIAL CONSTRAINT ON THE INSTABILITY OF THIN CIRCULAR CYLINDRICAL SHELLS UNDER EXTERNAL PRESSURE, by Josef Singer. Technical note no. 1 on Contract AF 61(052)123. Sep 59, 21p. 9 refs. AFOSR-TN-60-165; AD-232 083.
Order from LC mi$2.70, ph$4.80 PB 146 711

The effect of axial elastic restraint on the instability of a circular cylindrical shell under hydrostatic pressure or under uniform lateral pressure, is analysed by a Rayleigh Ritz approach. For the case of hydrostatic pressure the effect is calculated for a wide range of parameters and design curves are presented for the percentage increase in critical pressure. The analysis is carried out for restraints which are active from the beginning of loading and for such which come into action only at the onset of buckling, and the difference between these 2 types of restraint is shown to be very small. (Author)

Yale U., New Haven, Conn.
POINTED VERTICES IN THE YIELD SURFACE, by Aris Phillips. Technical rept. no. 7 on Contract Nonr-609(12). Sep 59, 26p. 9 refs. AD-228 393.
Order from LC mi$2.70, ph$4.80 PB 148 568

Tests were described in which thin-walled tubes of annealed commercially pure aluminum (2S-0) were loaded under combined tension and torsion. The paths of loading in those tests had, at regular intervals, very abrupt changes in the direction of the stress increment vector. These abrupt changes in the direction of the stress increment vector were found to produce small abrupt changes in the direction of the plastic strain increment vector. Such results imply the existence of pointed vertices in the yield surface and specifically imply that the loading path carries a pointed vertex with it. The evaluation of these tests is continued. The loading path is shown conclusively to carry a pointed vertex with it. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
SIMPLIFIED VIBRATION ANALYSIS OF ELASTIC SANDWICH PLATES, by Yi-Yuan Yu. Technical note no. 5 on Contract AF 49(638)453. Aug 59, 25p. 6 refs. AFOSR-TN-59-1082; AD-234 221.
Order from LC mi$2.40, ph$4.80 PB 146 639

In a sequence of 3 recent papers by the author, a new flexural theory of elastic sandwich plates was developed, and, on the basis of the theory, the flexural vibration of sandwich plates was analyzed. The theory is good for a very wide frequency range that is of practical interest, but vibration analysis on the basis of the theory will in general be complicated due to the high order of the equations. For low frequency ranges simplified treatment of the vibration problem becomes possible and is discussed. Simpler equations of motion of sandwich plates are introduced, and their accuracy is determined by comparing with the previous more complete equations. (Author)

Stanford U., Calif.
BUCKLING OF A THIN CIRCULAR CYLINDRICAL SHELL HEATED ALONG AN AXIAL STRIP, by D. W. Hill. Rept. on Contract AF 49(638)223. Dec 59, 99p. 19 refs. SUDAER no. 88; AFOSR-TN-59-1250.
Order from LC mi$5.40, ph$15.30 PB 148 504

The problem considered is that of a thin circular cylindrical shell heated along a narrow strip in the axial direction. The restraint of the cooler portion causes compressive axial stresses in the heated strip, and if these stresses are sufficient in magnitude the cylinder can buckle into waves along the heated strip. The problem is solved using the Ritz method, assuming for the displacements Fourier series modified by a shape factor chosen to magnify the solution in the vicinity of the heated strip. The convergence rate of the solution is greatly increased by the shape factor. In the analysis of the stress distribution, the cylinder is assumed to be simply supported on its ends so that the radial and circumferential displacements there are the range $0 \leqslant E\alpha V/\sigma_y \leqslant 5$ and the particular case $E\alpha V/\sigma_y \to \infty$. Detailed solutions are given for $E\alpha V/\sigma_y = 1, 2, 3, 4, 5$ and ∞. (Author)

Stanford U., Calif.
IDEALIZED COLUMNS, by N. J. Hoff. Rept. on Contract AF 49(638)223. Aug 58, 27p. 18 refs. SUDAER no. 82; AFOSR-TN-60-381.
Order from LC mi$2.70, ph$4.80 PB 148 752

Graphic methods and simple analytic formulas are presented for the determination of the quantities of greatest interest in the elastic, plastic and creep buckling of columns. The results are rigorously valid only for columns of idealized I section but they represent good approximations in the case of extruded and built up sections. (Author)

Stanford U., Calif.
MECHANICS APPLIED TO CREEP TESTING, by N. J. Hoff. Rept. on Contract AF 49(638)223. Dec 58, 88p. 49 refs. SUDAER no. 83; AFOSR-TN-59-39.
Order from LC mi$4.80, ph$13.80 PB 148 753

The non-linearity of the creep laws governing the inelastic deformations of structural materials at high temperatures makes it difficult for the engineer to interpret correctly the results of creep tests and to predict the effect of small changes in the parameters upon the strain rates. It is the purpose of this paper to present information on the basis of which these tasks can be performed a little more easily. The causes of the large scatter in the results of creep tests, the effect of creep on the stress distribution, the interaction between linear elasticity and non-linear creep, and the difficulties encountered in the determination of the primary phase of creep are discussed with the aid of the principles of applied mechanics. The paper closes with a brief survey of instability phenomena. (Author)

Stanford U., Calif.
THE STRESSES IN AN ELASTO-PLASTIC BAR SUBJECTED TO A SUDDEN CHANGE OF SURFACE TEMPERATURE, by E. W. Parkes. Rept. on Contract AF 49(638)223. Jan 60, 21p. 8 refs. SUDAER no. 89p AFOSR-TN-60-321
Order from LC mi$2.70, ph$4.80 PB 148 505

An analysis is given for the stress history in an elasto-plastic bar subjected to a sudden change of surface temperature. The type of behavior is found

to depend on the ratio of thermal strain (αV) to yield strain (σ_y/E). For $E\alpha V/\sigma_y < 1$, the stresses are entirely elastic. For $1 < E\alpha V/\sigma_y < 2.04$ there are two transient zones of compressive yielding. For $2.04 < E\alpha V/\sigma_y < 4.4$ there are two transient zones of compressive yielding and two enduring zones of tensile yielding. For $E\alpha V/\sigma_y > 4.4$ there are two transient zones of compressive yielding, one transient zone of tensile yielding, and two enduring zones fo tensile yielding. The investigation is restricted to zero, but the axial displacements and end rotations are not restricted. In the calculation of the stability, a simplified thermal stress distribution is assumed which is the one prevailing in the middle of the cylinder. The stresses are assumed to vary around the circumference but to be constant in the axial direction. Expressions are given relating the physical parameters of the cylinder, the temperature distribution, and the magnitude of the temperature causing buckling.

Stanford U., Calif.
SUMMARY OF RESEARCH IN ELASTICITY, ELASTIC STABILITY, ELASTIC WAVE PROPAGATION 1948-1958, by J. N. Goodier. Rept. on Contract Nonr-225(29). 31 Aug 59, 39p. 29 refs. Div. of Engineering Mechanics technical rept. no. 121.
Order from LC mi$3.00, ph$6.30 PB 148 183

Contents:
Investigations in linear and non-linear elastic stress and deformation, analytical and experimental
Investigations in elastic buckling of bars, plates and sandwich panels, analytical and experimental
Investigations in elastic wave propagation, analytical and experimental
Other investigations

Stanford U., Calif.
A SURVEY OF THE THEORIES OF CREEP BUCKLING, by N. J. Hoff. Rept. on Contract AF 49(638)223. June 58, 66p. 50 refs. SUDAER no. 80; AFOSR-TN-60-382.
Order from LC mi$3.90, ph$10.80 PB 148 751

A survey is presented of the theories of buckling of structural elements whose materials is subject to creep deformations. Two fundamentally different approaches to the solution of the buckling problem are discussed. In one, the structural element is assumed to be perfect and perfectly centered under the loads and buckling is initiated by a disturbance in the configuration. In the second, the creep deformations begin in consequence of the deviation of the unloaded centerline or median plane of the structural element from the line of load application. In both cases the element has a finite lifetime. A critical time of creep buckling is defined beyond which the element cannot be used to carry the prescribed loads. (Author)

Stanford U., Calif.
A THEORY OF ELASTIC, PLASTIC, AND CREEP DEFORMATIONS OF AN INITIALLY ISOTROPIC MATERIAL SHOWING ANISOTROPIC STRAIN-HARDENING, CREEP RECOVERY, AND SECONDARY CREEP, by J. F. Besseling. Rept. on Contract AF 49(638)223. Apr 58, 41p. 10 refs. SUDAER no. 78; AFOSR-TN-60-384.
Order from LC mi$3.30, ph$7.80 PB 148 749

Stress-strain relations are given for an initially isotropic material, which is macroscopically homogeneous, but inhomogeneous on a microscopic scale. An element of volume is considered to be composed of various portions, which can be represented by subelements showing secondary creep and isotropic work hardening in plastic deformation. If the condition is imposed that all subelements of an element of volume are subjected to the same total strain, it is demonstrated that the inelastic stress-strain relations of the material show anisotropic strain-hardening, creep recovery, and primary and secondary creep due to the non-uniform energy dissipation in deformation of the subelements. Only quasi-static deformations under isothermal conditions are considered. The theory is restricted to small total strains. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE STABILITY OF A CIRCULAR CYLINDER UNDER FINITE EXTENSION AND TORSION, by A. E. Green and A. J. M. Spencer. Technical rept. no. 12 for Sep 55-Jan 57 on Application of Invariance Principles in Continuum Mechanics, Contract DA 19-020-ORD-3487. Mar 57, 39p. 10 refs. Rept. DA-3487/12; OOR rept. 1271.16M.
Order from LC mi$3.00, ph$6.30 PB 138 003

A circular cylinder of isotropic, homogeneous elastic material is deformed by finite extension and torsion. The stability of the resulting equilibrium position is investigated by using the equations of the theory of small elastic deformations superposed on finite elastic deformations as the equations of neutral equilibrium of the body. These equations are formulated in terms of a general strain-energy function for the body, but in order to solve them the strain-energy function is specialized to the Neo-Hookean form.

Florida U. Engineering and Industrial Experiment Station, Gainesville, Fla.
LINE LOADINGS ON FINITE LENGTH CYLINDRICAL SHELLS: SOLUTION BY THE FINITE FOURIER TRANSFORM, by William A. Nash and T. F. Bridgland, Jr. Interim technical rept. no. 3 on Application of Shallow Shell Theory to Equilibrium and Buckling Phenomena, Contract DA 01-009-ORD-671. Mar 60, 10 refs. OOR rept. 2028.3-E.
Order from LC mi$2.70, ph$4.80 PB 148 438

The linear equations due to Flügge for the thin elastic circular cylindrical shell are solved by the use of the finite Fourier transform for two general cases of radial line loadings on a finite length shell. The loadings considered are: (a) an arbitrary line load acting along a generator and (b) an arbitrary line load applied around the circumference. The solution presents the orthogonal displacement components of the middle surface in the form of rapidly converging series. (Author)

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
ON THE GRIFFITH-IRWIN FRACTURE THEORY, by J. Lyell Sanders, Jr. Technical rept. no. 6 on Contract Nonr-1866(02). Sep 59, 7p. 3 refs. AD-226 049.
Order from LC mi$1.80, ph$1.80 PB 148 567

A new and simple mathematical formulation is given of the stability criterion for crack propagation according to the Griffith-Irwin theory (J. Appl. Mechanics, Sept. 1957). The derivation is made for the case of a crack in a plate where the plane stress theory applies, but it may be generalized easily to other cases (three-dimensional elasticity, shells, etc.). (Author)

Illinois Inst. of Tech., Chicago.
COMPARISON OF YIELD CONDITIONS FOR CIRCULAR CYLINDRICAL SHELLS, by Antonio Sawczuk and Philip G. Hodge, Jr., Rept. on Contract Nonr-1406(04). May 59, 16p. 6 refs. DOMIIT rept. no. 1-7.
Order from LC mi$2.40, ph$3.30 PB 146 589

The yield condition for a rigid-plastic circular cylindrical shell subjected to axially symmetric loading is described in terms of the circumferential hoop stress n and the axial bending moment m. Different yield conditions are obtained depending on whether the shell is of homogeneous of ideal-sandwich construction and on whether the shell material satisfies Tresca's or Mises' yield condition. Previous work has been limited to Tresca's yield condition.

Institute of Engineering Research, U. of California, Berkeley.
ON THE GENERAL PROBLEM OF ELASTOKINETICS IN THE THEORY OF SHALLOW SHELLS, by P. M. Naghdi. Technical rept. no. 5 on Contract Nonr-222(69). Aug 59, 37p. 9 refs. Series no. 131, issue no. 5; AD-227 106.
Order from LC mi$3.00, ph$6.30 PB 148 192

Nonlinear, as well as linear, elastokinetic problems of thin shallow shells are investigated. The case of cylindrical shells is also included and treated separately. It is shown that the elastokinetic problems of shallow shells may be characterized by a system of simultaneous nonlinear partial differential equations involving the axial displacement and a stress function. These equations are exact withing the scope of the theory of shallow shells. Through a suitable order of magnitude analysis and upon certain approximations, two other systems of equations are deduced; the latter, which neglects the effects of longitudinal inertia terms, reduces to the previously know results for transverse vibrations. Three systems of equations are also deduced for dynamical problems of circular cylindrical shells in terms of radial displacement and a stress function. The first of these is such that upon linearization it becomes equivalent to Donnell's equations. Wave propagation is discussed in an infinite cylindrical shell according to the linearized differential equations. (Author)

Mellon Inst., Pittsburgh, Pa.
RECENT RESULTS IN THE CONTINUUM THEORY OF VISCOELASTIC FLUIDS, by Bernard D. Coleman and Walter Noll (Carnegie Inst. of Tech.) Rept. on Contract AF 49(638)541 and National Science Foundation Grant NSF-G 5250. May 60, 85p. 28 refs. AFOSR-TN-60-606; AD-239 077.
Order from LC mi$4.80, ph$13.80 PB 148 527

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  Compressible fluids
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AER, Inc. [Pasadena, Calif.]
RESPONSE OF MECHANICAL SYSTEMS TO RANDOM EXCITING FORCES, by Henry J. Stumpf. Rept. on Contract N123(60530)18702A. 1 Dec 59, 255p. 15 refs. Technical rept. 116; NOTS TP-2365; NAVORD rept. 7010; AD-234 535.
Order from LC mi$11.10, ph$39.60 PB 146 989

A brief discussion of linear vibrating systems is given, with special emphasis on multidegree-of-freedom systems. The reason that real normal modes do not exist unless the damping is of a special form is presented. A method for obtaining complex normal modes is reviewed. The problem of random exciting forces is considered, and the general techniques of the Fourier Series and Fokker-Planck methods are developed. Several detailed examples are given for both stationary and nonstationary inputs.

Avco-Everett Research Lab., Mass.
THEORY OF RADIATION FROM LUMINOUS SHOCK WAVES IN NITROGEN, by Peter Hammerling, J. Derek Teare, and Bennett Kivel. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. June 59, 31p. 14 refs. Research rept. 49; AFBMD-TR-59-3; AD-220 509.
Order from LC mi$3.00, ph$6.30 PB 146 651

The physical properties behind a normal shock in nitrogen are calculated as a function of time. These include the variation of temperature, composition, ionization, and the intensity of radiation from the N_2^+ first negative band system. A particular case is considered for which experimental data are available, and regions sensitive to particular rates are indicated. A discussion of a method of determining the dissociation rate constants from measurements of the tails of radiation intensity profiles is appended. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
ON THE FLEXURE OF PLASTIC PLATES, by Samuel Lerner and William Prager. Technical rept. no. 50 on Contract Nonr-562(10). Sep 59, 7p. 9 refs. C11-50; AD-226 258.
Order from LC mi$1.80, ph$1.80 PB 148 579

The purpose of the present note is to draw attention to a simple test that provides a direct check on the fundamental assumptions of the theory, when the two principal bending moments have opposite signs.

Brown U. Div. of Engineering, Providence, R. I.
DESIGN AND OPERATION OF AN OSCILLATING-BODY VISCOMETER FOR GASES AT HIGH PRESSURES, by J. Kestin and W. Liedenfrost. Technical rept. no. 12 on Contract AF 18(600)891. Mar 60, 82p. 24 refs. AF 891/12; AFOSR-TN-60-375.
Order from LC mi$4.50, ph$13.80 PB 148 818

Satisfactory results could be obtained only with an oscillating system consisting of a flat, circular disk oscillating between two flat plates a small distance apart. Oscillating systems involving a free disk or a free sphere suffer from instabilities and do not yield satisfactory reproducibility. Oscillating systems involving concentric spheres with small gaps suffer from a large systematic error whose origin was not fully explored. (Author)

Aerodynamics and Pneumatics

Arnold Engineering Development Center, Tullahoma, Tenn.
BOUNDARY LAYER SEPARATION EFFECTS ON THE STATIC STABILITY OF A FLARED-TAIL MISSILE CONFIGURATION AT M = 2 TO 5, by J. Don Gray. Rept. on ARO, Inc., Contract AF 40(600)800. June 60, 24p. 4 refs. AEDC-TN-60-103.
Order from LC mi$2.70, ph$4.80 PB 148 100

Force and pressure measurements with a blunt-cone, cylinder-frustum configuration at M = 2 to M = 5 were made over a wide Reynolds number range to investigate the effects of boundary layer separation on the static stability parameters, C_{N_α} and x/l. Laminar boundary layer separations upstream of the flared tail produced stability parameters which were equal to or greater than those obtained when transition occurred far upstream of the flare (essentially no flow separation). Distributed roughness on the model nose essentially eliminated the variation of C_{N_α} and x/l with Reynolds number when $Re \geq 0.2 \times 10^6$, based on centerbody diameter. At Mach numbers of 4 and 5, an effect of model scale was present in the initial, normal-force curve-slope results for smooth models, whereas the center-of-pressure data were closely correlated by the free-stream Reynolds number. The test Reynolds number range was 0.06×10^6 to 3.3×10^6, based on centerbody diameter. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
AN INVESTIGATION OF SUPPORT INTERFERENCE ON AGARD CALIBRATION MODEL B, by C. J. Schueler. Rept. on ARO, Inc. Contract AF 40(600)800. Feb 60, 25p. 9 refs. AEDC-TN-60-35; AD-233 041.
Order from LC mi$2.70, ph$4.80 PB 146 569

Tests were conducted in the 12-in supersonic wind tunnel to determine the critical sting length for AGARD Calibration Model B with a sting-to-body diam ratio of 0.3. The tests were made at Mach numbers 2, 3, and 4 and covered a Reynolds number range of 3.5×10^6 to 13.5×10^6 based on the body length. The results indicate that the sting had no significant influence on the model surface pressure even when interference on base pressure was maximum. Over the Mach number and Reynolds number range of the tests, negligible interference was introduced by the windshield for sting length to model diameter ratios greater than 2.5. (Author)

Avco-[Everett] Research Lab., Mass.
AERODYNAMIC DISSIPATION, by H. E. Petschek. June 57, 22p. 8 refs. Research rept. 23; AD-201 438.
Order from LC mi$2.70, ph$4.80 PB 147 193

An attempt is made to re-examine the derivation of the basic aerodynamic flow equations in order (1) to discuss dissipation in a completely ionized gas in the presence of a magnetic field, and (2) to demonstrate that the basic microscopic dissipation mechanism is appreciably different.

Avco-Everett Research Lab., Mass.
AN EXPERIMENTAL AND THEORETICAL STUDY OF QUARTZ ABLATION AT THE STAGNATION POINT, by Mac C. Adams, William E. Powers, and Steven Georgiev. Rept. on Contract AF 04(647)278. June 59, 41p. 10 refs. Research rept. 57.
Order from LC mi$3.30, ph$7.80 PB 147 203

The ablation characteristics of fused quartz are determined experimentally utilizing an air arc wind tunnel. It is shown that opaque quartz will effectively absorb about 4000 Btu/lb and will radiate the aerodynamic heating, with negligible ablation, for a satellite trajectory.

Avco-Everett Research Lab., Mass.
EXPERIMENTAL STUDIES OF SHOCK WAVES IN NITROGEN, by John C. Camm and James C. Keck. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. June 59, 23p. 4 refs. Research rept. 67, supersedes Research note 140; AFBMD-TN-59-9; AD-227 525.
Order from LC mi$2.70, ph$4.80 PB 147 209

Radiative relaxation behind shock waves in pure N is being studied to determine rate constants for recombination of N atoms. The radiation was measured as a function of wavelength for conditions corresponding to $T = 6000^oK$ with $\rho = 0.018\,\rho_o$ and $T = 6300^oK$ with $\rho = 0.12\,\rho_o$. The most prominent radiation in the wavelength interval studied is associated with the $N_2^+(1-)$ and $N_2(1+)$ bands. The intensity histories exhibit strong overshoot in the shock front for both bands and the peak to equilibrium intensity ratio was measured. Preliminary analysis of the final approach to equilibrium indicates that at 6400^oK the recombination rate constant for N atoms is $< 0.3 \times 10^{-32}$ cm^6/sec when N_2 is the catalyst and 2.4×10^{-32} cm^6/sec when the N is the catalyst. (Author)

Avco-[Everett] Research Lab., Mass.
HEAT TRANSFER TO SATELLITE VEHICLES RE-ENTERING THE ATMOSPHERE, by N. H. Kemp and F. R. Riddell. Rept. on Contract AF 04(645)18. Oct 56, 32p. 8 refs. Research rept. 2 (formerly Research note 21).
Order from LC mi$3.00, ph$6.30 PB 146 655

A recently developed theory of heat transfer at high velocities and high altitudes is applied to the problem of a satellite vehicle entering the atmosphere. Circular re-entry orbits are considered for bodies under the influence of gravity and drag forces. Numerical results are presented which can be used to determine the conditions under which the survival of such a satellite may be expected. In addition, an analysis is made of the value of exerting a lift force on the re-entering vehicle as a means of preventing its destruction. (Author)

Avco-[Everett] Research Lab., Mass.
HYPERSONIC CONICAL SHOCKS FOR DISSOCIATED AIR IN THERMODYNAMIC EQUILIBRIUM, by Saul Feldman. May 57, 13p. 3 refs. Research rept. 12; AD-150 841.
Order from LC mi$2.40, ph$3.30 PB 147 190

Effort is made to solve the cone problem. The Taylor-Maccoll equation is set up for a dissociating gas in thermodynamic equilibrium. Solution of the conical shock equation is analyzed for an incompressible fluid downstream of the shock. A comparison of the pressure coefficients calculated from the exact solution and the approximate incompressible one shows very good agreement.

Avco-[Everett] Research Lab., Mass.
AN INVESTIGATION OF STAGNATION POINT HEAT TRANSFER IN DISSOCIATED AIR, by Peter H. Rose and F. R. Riddell. Rept. on Contract AF 04(645)18. Apr 57, 18p. 12 refs. Research rept. 7 [formerly Research note 32] AD-150 550.
Order from LC mi$2.40, ph$3.30 PB 147 189

Theoretical and experimental results are presented for laminar heat transfer at the stagnation point of a blunt body in hypersonic flow. Results are presented for air at temperatures up to 8000^oK with up to 50% dissociation. In all cases the wall is relatively near room temperature. The experiments were performed in a shock tube and new experimental techniques are described. The data are compared with theoretical calculations including the effects of new physical phenomena, particularly dissociation, associated with high temperature air. (Author)

Avco-Everett Research Lab., Mass.
THE LARGE HIGH PRESSURE ARC PLASMA GENERATOR: A FACILITY FOR SIMULATING MISSILE AND SATELLITE RE-ENTRY, by P. Rose, W. Powers, and D. Hritzay. Rept. on Contracts AF 04(645)18 and AF 04(647)278. June 59, 35p. 12 refs. Research rept. 56; AFBMD-TR-59-6.
Order from LC mi$3.00, ph$6.30 PB 146 649

The development of an arc wind tunnel capable of stagnation pressures in the excess of twenty atmospheres and using as much as fifteen megawatts of electrical power is described. It is capable of reproducing the aerodynamic environment encountered by vehicles flying at velocities as great as satellite velocity. By the addition of a high capacity vacuum system, this facility can be used to produce the low density, high Mach number environment needed for simulating satellite re-entry, as well as hypersonic flight at extreme altitudes.

Avco-Everett Research Lab., Mass.
A NUMERICAL COMPARISON BETWEEN EXACT AND APPROXIMATE THEORIES OF HYPERSONIC INVISCID FLOW PAST SLENDER BLUNT-NOSED BODIES, by Saul Feldman. Rept. on Contract DA 19-020-ORD-4765. June 59, 21p. 13 refs. Research rept. 71; AD-226 728.
Order from LC mi$2.70, ph$4.80 PB 147 210

Calculations have been made of the flow field past a blunt body moving at hypersonic speeds through the atmosphere to include large distances downstream from the nose. Detailed profiles of the equilibrium thermodynamic functions and flow streamlines are presented for a hemisphere-cylinder moving through air at 60,000 ft. altitude at 17,500 ft/sec. A comparison is made between exact and approximate theories of the flow past slender blunt-nosed bodies, and it is shown that the second order blast wave theory could be used for the purpose of finding shock shape and the body pressure distribution. The present calculations could be used as an estimate of the inviscid wake left by a short blunt body in hypersonic flight. (Author)

Avco-Everett Research Lab., Mass.
ON ABLATING HEAT SHIELDS FOR SATELLITE RECOVERY, by Steven Georgiev, Henry Hidalgo, and Mac C. Adams. Rept. on Contract AF 04(647)278. July 59, 33p. 16 refs. Research rept. 65; AFBMD TR-59-7; AD-226 327.
Order from LC mi$3.00, ph$6.30 PB 147 207

Ablation is considered as a means of heat protection for recoverable satellites and a simple theory is presented for the energy absorbed per unit mass of ablated material. Experimental results, obtained in an air arc wind tunnel under simulated re-entry conditions, are presented for Teflon and Fiberglas. The results are shown to be in good agreement with the theory. Finally the insulation requirements for various types of heat shields are discussed and it is shown that a low temperature ablating heat shield is superior to both the heat sink and radiating heat shields. (Author)

Avco-[Everett] Lab., Mass.
ON THE INSTABILITY THEORY OF THE SOFT OR MELTED SURFACE OF AN ABLATING BODY WHEN ENTERING THE ATMOSPHERE, by Saul Feldman. Rept. on Contract AF 04(645)18, Aug 58, 41p. 11 refs. Research rept. 34; AD-205 515.
Order from LC mi$3.30, ph$7.80 PB 147 398

Some ablating bodies entering the atmosphere will melt or soften. Under deceleration, the soft or melted surface will tend to develop instabilities of the Lamb-

Taylor type. Two situations involving viscous incompressible fluids are investigated here: one where the liquid layer has constant viscosity and finite thickness, and the other, where the viscosity increases exponentially with distance away from the interface, and the layer is semi-infinite in extent.

Avco-[Everett] Research Lab. [Mass.]
PHYSICAL GAS DYNAMICS RESEARCH AT THE AVCO RESEARCH LABORATORY, by P. H. Rose. Rept. on Contract AF 04(645)18. July 57, 55p. 32 refs. Research rept. 9, formerly Research note 37; AD-150 790.
Order from LC mi$3.60, ph$9.30 PB 146 658

Physical gas dynamic problems associated with the high temperatures involved in flight at hypersonic Mach numbers are being studied. The central concept of this study is that the important elements of the environment anticipated can be duplicated in shock tubes. Several investigations, conducted in shock tubes, into critical gas dynamic problems associated with the high temperature are described. Heat-transfer measurements in the laminar, dissociated, boundary layer at the stagnation point are discussed. Measurements of the radiative emissivity and electrical conductivity of high-temperature air are described. Preliminary studies of magnetohydrodynamics are summarized.

Avco-Everett Research Lab., Mass.
RADIATION FROM HOT AIR AND STAGNATION HEATING, by Bennett Kivel. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. Oct 59, 29p. 16 refs. Research rept. 79; AFBMD-TR-59-20; AD-232 836.
Order from LC mi$2.70, ph$4.80 PB 147 214

The radiation heating of the stagnation region for flight speeds up to 50,000 ft/sec is investigated using experimental shock tube data supplemented by theoretical estimates. Non-equilibrium effects which modify the radiation predictions at high altitudes (≥30 mi) are pointed out. The radiation is compared with aerodynamic heating and is found to be important at high velocities (≥30,000 ft/sec) and low altitudes (≤25 mi). For this flight regime the dominant radiation results from the capture of electrons by nitrogen. (Author)

Avco-Everett Research Lab., Mass.
RADIATIVE TRANSPORT WITHIN AN ABLATING BODY, by Leo P. Kadanoff. Rept. on Contract AF 04(647)278. July 59, 39p. 7 refs. Research rept. 61; AFBMD TN-59-12; AD-220 505.
Order from LC mi$3.00, ph$6.30 PB 147 204

A method was developed for the calculation of net radiative flux and temperature distribution within a semi-infinite body which emits, absorbs, and scatters radiation and which allows some radiation to escape from its surface. This method was applied to the problem of calculating temperature distributions within bodies in steady state ablation.

Avco-[Everett] Research Lab., [Mass.]
STAGNATION POINT HEAT TRANSFER MEASUREMENTS IN DISSOCIATED AIR, by P. H. Rose and W. I. Stark. Rept. on Contract AF 04(645)18. Apr 57, 47p. 21 refs. Research rept. no. 3; AD-150 547.
Order from LC mi$3.30, ph$7.80 PB 146 656

The results of an experimental investigation of the laminar heat transfer at the stagnation point of a blunt body in partially dissociated air are presented and are compared to the theoretical treatment of Fay and Riddell. Heat transfer results are presented for air temperatures as high as 8000°K where more than 50% of the molecules are in the dissociated state. The experiments were performed in a shock tube and the new experimental techniques and principles are discussed briefly. Simulation of flight stagnation conditions at velocities up to satellite velocity 26,000 ft/sec. is shown to be possible in shock tubes and data has been obtained over a large altitude range at these velocities. (Author)

Avco-Everett Research Lab., Mass.
A THEORY OF ABLATION OF GLASSY MATERIALS FOR LAMINAR AND TURBULENT HEATING, by Henry Hidalgo. Rept. on Contract AF 04(647)278. June 59, 33p. 16 refs. Research rept. 62; AFBMD TN-59-13; AD-227 993.
Order from LC mi$3.00, ph$6.30 PB 147 205

The steady state equations of motion for a thin layer of an incompressible, glassy material on the surface of an ablating and radiating blunt body are reduced to a first order ordinary differential equation which is integrated numerically. This solution is coupled with the solution of the air boundary layer for both laminar and turbulent heat transfer with or without mass vaporization of the ablating material. The distribution of the effective energy of ablation around the body is thus obtained for a cone cylinder with a hemispherical cap that re-enters the atmosphere at hypersonic flight speeds, and has quartz as the ablating material. This solution of the equations of motion at the stagnation point was verified by arc wind tunnel experiments. The present state of development of the arc wind tunnel does not permit its use for experimental investigations of ablation around blunt bodies under turbulent heating. However, the complete understanding of the ablation process at the stagnation point coupled with the current knowledge of the turbulent heating rates provides solid grounds for the validity of this ablation theory around blunt bodies. (Author)

Avco-Everett Research Lab., Mass.
TRAILS OF AXI-SYMMETRIC HYPERSONIC BLUNT BODIES FLYING THROUGH THE ATMOSPHERE, by Saul Feldman. Rept. on Contract DA 19-020-ORD-4765. Dec 59, 94p. 12 refs. Research rept. 82; AD-233 703.
Order from LC mi$5.40, ph$15.30 PB 147 215

The trail left in the atmosphere by a body moving at hypersonic speeds is the subject of a theoretical treatment, in which the trail is divided into 2 regions: (1) the expansion-controlled trail, which treats the behavior of the wake behind the body up to a point,

along the direction of flight, where the pressure decays to the free stream value and cooling is principally controlled by the expansion of the flow; and (2) the conduction-controlled trail, where the trail cools mainly by diffusion of heat away from the high temperature core. Results of calculations that assume thermodynamic equilibrium of the flow field give the values of the thermodynamic variables in the trail of a sphere, axial distributions of emitted thermal radiation and maps of electron density distribution. Viscous effects in blunt body trails are of small importance and the cooling of the conduction-controlled trail is essentially due to conduction of heat. This portion of the trail does not widen as one proceeds downstream. Flight velocities considered vary between 15,000 and 35,000 ft/sec and altitudes range between 100,000 and 250,000 ft. (Author)

Avco-[Everett] Research Lab., Mass.
TURBULENT HEAT TRANSFER THROUGH A HIGHLY COOLED PARTIALLY DISSOCIATED BOUNDARY LAYER, by Peter H. Rose, Ronald F. Probstein, and Mac C. Adams. Rept. on Contract AF 04(645)18. Jan 58, 58p. 15 refs. Research rept. 14; AD-159 548.
Order from LC mi$3.60, ph$9.30 PB 147 191

The problem of heat transfer from high temperature air through a turbulent boundary layer to a cold surface is considered both analytically and experimentally. Heat transfer data obtained in shock tubes are presented and correlated by a semi-empirical theory which includes the effect of atomic diffusion. The distinguishing characteristics of turbulent boundary layers with dissociation and large cooling are considered. It is shown that the equations governing such flow, after certain approximations, can be represented in a form similar to the classical equations for a turbulent boundary layer.

Avco-Everett Research Lab., Mass.
VISCOUS AERODYNAMIC CHARACTERISTICS IN HYPERSONIC RAREFIED GAS FLOW, by Ronald F. Probstein and Nelson H. Kemp. Rept. on Contract AF 04(647)278. Dec 59, 71p. 26 refs. Research rept. 48 (Rev.); AFBMD-TR-59-2.
Order from LC mi$4.50, ph$12.30 PB 146 652

This paper considers the problem of calculating viscous aerodynamic characteristics of blunt bodies at hypersonic speeds and at sufficiently high altitudes where the appropriate mean free path becomes too large for the use of familiar boundary layer theory but not so large that free molecule concepts apply.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INTERFEROMETRIC STUDY OF THE BLUNT BODY PROBLEM, by R. Sedney and G. D. Kahl. Apr 60, 37p. 15 refs. Rept. no. 1100.
Order from LC mi$3.00, ph$6.30 PB 148 744

An experimental investigation of the flow fields around spheres in free flight was made using the optical interferometer. Data were taken for Mach numbers approximately 5 in argon, nitrogen, and air. For the temperatures existing behind the shock in nitrogen, vibrational excitation should occur but is not found. This is explained by the long relaxation path length compared to the scale of the experiment. If relaxation occurs at all it will be confined to a thin layer contiguous to the body. Evidence of molecular vibrations is found for the air test but slightly more than would be expected assuming that the oxygen is excited and the nitrogen frozen. A method of obtaining all flow variables, given the density is explained; it uses only the principles of conservation of mass and energy. (Author)

Combustion [Aerodynamics] Lab., Harvard U., Cambridge, Mass.
THE PROPAGATION OF TURBULENCE INTO A LAMINAR BOUNDARY LAYER, by Morton Mitchner. Interim technical rept. no. 3 on Contract DA 19-020-ORD-1029. June 52, 175p. 30 refs. AD-11 945.
Order from LC mi$8.10, ph$27.30 PB 149 269

The following topics are discussed: propagation of turbulence in open channel flow, experimental procedure, propagation of turbulence in a boundary layer, mechanism for the propagation of turbulence, and some considerations on the growth and decay of vorticity. A calculation for the minimum value of the jump height ratio, and the induced velocity for bounded regions are discussed in appendixes.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
HYPERSONIC RESEARCH SUMMARY, by G. J. Fabian. Rept. on Contract AF 18(603)141. June 60, 28p. 17 refs. Rept. no. AD 1118-A-11; AFOSR-TR-60-58.
Order from LC mi$2.70, ph$4.80 PB 148 357

Various research areas investigated are reported in summary, giving reference to the different publications generated. The program areas include early work on the wave superheater and related research on chemical nonequilibrium in high-temperature gas flows, a radiation probe, sound propagation in an excited or dissociated gas, boundary layer phenomena in high-temperature gas flows, and molecular interaction at high-temperatures. (Author)

David Taylor Model Basin, Washington, D. C.
PRESSURE FLUCTUATIONS ON THE WALL ADJACENT TO A TURBULENT BOUNDARY LAYER, by Mark Harrison. Dec 58, 14p. 7 refs. Rept. 1260; AD-209 434.
Order from LC mi$2.40, ph$3.30 PB 148 033

A fully developed turbulent boundary layer with a zero pressure gradient has been studied in a subsonic wind tunnel. The pressure fluctuations on the wall of the wind tunnel were measured by small flush-mounted microphones. Data for the dimensionless spectral density of the pressure fluctuations, $P(f)/\rho^2 U_o^3 \delta^*$, as a function of the frequency parameter $f\delta^*/U_o$ are presented; $P(f)$, ρ, U_o, δ^*, and f are respectively the spectral density, fluid density, free stream velocity, boundary layer displacement thickness, and frequency. Data for the coefficient $(\overline{p^2})^{1/2}/\frac{1}{2}\rho U_o^2$ are also presented. The transverse cross correlation for the pressure fluctuations was studied by using two flush mounted microphones.

Rather than the longitudinal cross correlation, the longitudinal cross spectral density was studied, yielding a measure of the coherence of the pressure fluctuations at two points as a function of fx/U_C, where x is the longitudinal spacing of the two points and U_C is the effective convection velocity of the spatial pattern. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
A KINETIC THEORY DESCRIPTION OF RAREFIED GAS FLOWS, by Lester Lees. Rept. on Hypersonic Research Proj., Contract DA 04-495-ORD-19. 15 Dec 59, 89p. 44 refs. Memo no. 51; AD-233 618.
Order from LC mi$4.80, ph$13.80 PB 147 240

An approach to the kinetic theory of gas flows is developed which starts with Maxwell's original integral equations of transfer, rather than with the Maxwell-Boltzmann equation for the velocity distribution function itself. The advantage of this method is that relatively simple distribution functions are utilized which contain a small number of unknown functions to be determined by applying the conservation laws, plus several additional higher moments. For simplicity a 2-stream Maxwellian is employed, which is a natural extension and generalization of Mott-Smith's function for a normal shock, but differs from it in certain essential respects. This technique is now being applied to some typical non-linear rarefied gas flows. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
MAGNETOHYDRODYNAMIC SIMPLE WAVES, by J. D. Cole and Y. M. Lynn. Rept. on Contract AF 49(638)476. Dec 59, 54p. 9 refs. AFOSR Technical note 59-1302; AD-234 739.
Order from LC mi$3.60, ph$9.30 PB 148 688

A study is made of simple wave flows of an infinitely conducting perfect gas (polytropic) in the presence of an arbitrarily oriented magnetic field. From group theoretic considerations the problem is reduced to the solution of a first-order differential equation which is integrated numerically. Properties of solutions and examples are discussed. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
STABILITY OF THE COMPRESSIBLE LAMINAR BOUNDARY LAYER, by Eli Reshotko. Rept. on Hypersonic Research Proj., Contract DA 04-495-ORD-19. 15 Jan 60, 168p. 21 refs. Memo. no. 52; AD-233 619.
Order from LC mi$7.80, ph$25.80 PB 147 239

As a result of a study of the stability of the compressible laminar boundary layer, it was concluded that neutral stability is achieved when the net energy transferred from the mean flow to the disturbance flow by the action of Reynolds stress is exactly dissipated. However, the relative importance of the various mechanisms changes with Mach number, so that the neutral stability diagram for a hypersonic flow might not be recognized in terms of its incompressible counterpart. Among the changes are the following: (1) The rate of conversion of energy from the mean flow to the disturbance flow through the action of the viscosity in the vicinity of the wall increases with Mach number; (2) Instead of being nearly constant across the boundary layer, the amplitude of inviscid pressure fluctuations for Mach numbers greater than 3 decreases markedly with distance outward from the plate surface, and (3) At Mach numbers less than about 2, dissipation effects are minor, but they become extremely important at higher Mach numbers, since for neutral disturbances, they must compensate for the generally destabilizing effects of items 1 and 2 above. (Author)

Institute of Engineering Research, U. of California, Berkeley.
DESIGN, FABRICATION, AND EVALUATION OF AXISYMMETRIC NOZZLES, by Larry L. Lynes. Master's thesis. Rept. on Contract Nonr-222(45). 10 Sep 59, 50p. 9 refs. Technical rept. HE-150-174; Series no. 20, issue no. 132; AD-226 224.
Order from LC mi$3.30, ph$7.80 PB 148 616

The pumping capacity of the no. 3 wind tunnel was increased in 1954 in order to accommodate a Mach 6 nozzle of a usable test section size. This increased capacity left the previous nozzles still usable in their own range, but with a smaller test section size than would have been available with the increased capacity. Since it is most desirable to have as large a test section as possible, it is necessary to have the nozzles designed at maximum capacity. Scaling procedures are given for increasing the size of the existing nozzles to meet the increased capacity. This was accomplished by application of scaling laws to a Mach 4 nozzle, followed by fabrication and experimental evaluation of the resulting nozzle. (Author)

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
ON THE EXISTENCE OF INFINITE ACCELERATION POINTS IN TRANSONIC FLOWS AROUND AIRFOILS WITH FINITE CURVATURE, by Silvio Nocilla. Technical note 11 on Contract AF 61(514)1124. Dec 58, 20p. 6 refs. AFOSR-TN-59-197; AD-211 474.
Order from LC mi$2.40, ph$3.30 PB 147 445

The problem is investigated of the formation of shock waves around airfoils with finite curvature in transonic flow. As a suitable criterion for the theoretical interpretation of the appearance of such a shock wave it is assumed the appearing of a point with infinite acceleration on the physical plane. The conditions which must be fulfilled on the hodograph plane in order that such a point exists, and the properties which must possess the corresponding stream function are studied. The theory is then applied to airfoils with constant curvature. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME I, PART ONE: FLUID MECHANICS. Technical rept. for Jan 59-Jan 60. Jan 60, 334p. 80 refs. LMSD-288139.
Order from LC mi$11.10, ph$51.60 PB 148 399

Contents:
The effect of body forces on melting ablation at a stagnation point
Radiant energy transfer in gaseous flow
A numerical method of solution for heat conduction In composite slabs with a receding surface
On mass transfer and shock-generated vorticity
The effect of shock-generated vorticity, surface slip, and temperature jump on stagnation-point heat-transfer rates
Hypersonic flow around bodies of revolution which are generated by conic sections
Kinematic formulation of rotational gas flow
Hypersonic flow around blunt bodies of revolution whose shock waves are generated by conic sections
A model of turbulence displaying autonomous oscillations (LMSD-48 446)
(See also PB 148 399-3)

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME II: MECHANICS OF DEFORMABLE BODIES. Technical rept. for Jan 59-Jan 60. Jan 60, 456p. 111 refs. LMSD-288139.
Order from LC mi$11.10, ph$69.60 PB 148 399-2

Contents:
Buckling of a cylindrical shell of arbitrary length under a circumferential band of pressure (LMSD-49 798)
Prebuckling deflection stresses in a circular cylinder subjected to a saddle-type load (LMSD-288 007)
Approximate analysis of damped, linear vibrations
Large deflection and buckling analysis of circular cylindrical shells (LMSD-48 393, rev.)
Approximate buckling loads by energy methods (LMSD-480 068)
On determing biaxial stress yield and fracture criteria for hot pressed beryllium at room and elevated temperature (LMSD-49 756)
Stresses in spherical pressure vessels (LMSD-288 109)
A statistical analysis of axially loaded cylinder buckling data (LMSD-49 741)
Shock response of a nonlinear missile suspension system
Elasto-plastic analysis of shells of revolution subjected to heating and external loads
Spring characteristics of long tubular air cushions (LMSD-49 729)
The initial response of an elastic spherical shell to a step pressure wave
The effect of residual stresses on the critical crack length predicted by the Griffith theory
Stresses generated by suddenly introducing a moving crack into a stretched elastic sheet (See also PB 148 399-1)

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME IV: MATHEMATICS AND STATISTICS. Technical rept. for Jan 59-Jan 60. Jan 60, 172p. 32 refs. LMSD-288139; AD-234 999.
Order from LC mi$8.10, ph$27.30 PB 148 399-4

Contents:
Interval analysis I (LMSD-285 875)
Convergence of approximate eigenvectors in Jacobi methods
Word correlation study (LMSD-311 696)
Efficient estimation of regression parameters
For second order stationary processes (LMSD-288 079)

Massachusetts Inst. of Tech., Cambridge.
ESTIMATION OF UNSTEADY AIRLOADS ON BLUNT BODIES IN A HYPERSONIC STREAM. PART I. THEORY, by Haim Kennet. Rept. on Contract AF 49(638)160. Oct 59, 55p. 19 refs. Fluid Dynamics Research Group rept. no. 59-6; OSR Technical note no. 59-1273; AD-232 606.
Order from LC mi$3.60, ph$9.30 PB 146 335

A theoretical method is developed for estimating aerodynamic loads on symmetric blunt-nosed bodies, at zero angle of attack, performing small-amplitude harmonic oscillations in a main hypersonic stream. Time dependent effects are introduced as small perturbations superimposed on an approximate steady field. A power series solution yields the perturbation pressure distribution on the body. Shock amplitude and phase angle are also obtained. The results are applied to a spherical cap, in which the case the leading terms of the series solution are evaluated. (Author)

Mississippi State U. [State College].
FLIGHT RESEARCH INVESTIGATION OF LAMINAR SEPARATION OF A HIGH LIFT BOUNDARY LAYER CONTROL AIRPLANE, by Dezso Gyorgyfalvy. Research rept. no. 25 on Contract Nonr-978(01). 26 June 59, 74p. 8 refs. AD-225 178.
Order from LC mi$4.50, ph$12.30 PB 147 450

A study was made of a technique for calculating and measuring laminar separation in connection with a flight research investigation of the droop nose as an aid in delaying the leading edge stall. The calculation of laminar separation by means of the Holstein-Thwaites method proved to be unsatisfactory; but the simple relation $U_{sep}/U_{max} = 0.94$, was found to be a good approximation. The droop nose proved to be advantageous. However the attainable gain in maximum lift was not more than about 20%. (Author)

National Research Labs., Ottawa (Canada).
STRUCTURAL ANALYSIS OF MULTI-HINGED CONTROL SURFACES, by E. Kosko. Mar 60, 174p. Aeronautical rept. LR-276.
Order from LC mi$8.10, ph$27.30 PB 148 519

An elastic small-deflection analysis is presented of a control surface supported on a structure by means of three or more hinges. Effects of sympathetic flexure, of local bracket flexibility and of angular deflection are taken into account. The existence is shown of an elastic hinge moment, quadratically dependent on the external loading. Application of the method is illustrated by numerical examples, which show that some secondary effects may become more critical than those of direct loading. (Author)

Naval Ordnance Lab., White Oak, Md.
MAGNUS MOMENT ON PURE CONES IN SUPERSONIC FLIGHT, by John D. Nicolaides and John J. Brady. 20 Jan 59, 42p. 15 refs. NAVORD rept. 6183; AD-219 843.
Order from LC mi$3.30, ph$7.80 PB 148 451

By aeroballistic range techniques, the Magnus moment is measured on 20° pure cones at M = 2. The results indicate that the Magnus moment may be critically dependent, in both size and sign, on the nature of the boundary layer (i.e., laminar, turbulent, or mixed). The normal force and damping moment are also found to be significantly dependent on the nature of the boundary layer. The characteristics of the boundary layers are revealed in the spark shadowgraphs of the aeroballistic range technique and its transient and sometimes chaotic character noted. Criteria for specifying the general nature of the boundary layer are evolved and used to correlate the coefficient data. The experimental force and moment coefficients are compared with theoretical values obtained from various suggested physical models of the flow. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
THE EFFECTS OF ELEVATED TEMPERATURES ON AIRCRAFT STRUCTURES: AN OUTLINE OF SOME PROBLEMS AND RESULTS, by Frederick V. Pohle. Rept. on Contract Nonr-839(23). Aug 59, 24p. 67 refs. PIBAL rept. no. 495.
Order from LC mi$2.70, ph$4.80 PB 148 176

This report outlines some problems and results in heat transmission in the structure, in thermal stresses due to external heating, and in thermal buckling.

Polytechnic Inst. of Brooklyn, N. Y.
ON A NEW APPROACH FOR THE SOLUTION OF NON-SIMILAR BOUNDARY LAYER PROBLEMS, by Luigi G. Napolitano and Antonio Ferri. Rept. on Contract AF 49(638)217. Mar 60, 39p. 3 refs. PIBAL rept. no. 507; AFOSR-TN-59-356.
Order from LC mi$3.00, ph$6.30 PB 148 557

A new method of solution for non-similar dissipative flow fields is proposed which is essentially based on the description of such flow fields by means of "inner" and "outer" profiles jointed along a continuous "matching" line lying within the field itself. The inner and outer profiles are single-parameter profiles derived from the solution of a total differential equation upon which not all the pertinent physical conditions are necessarily imposed. The "inner" profiles are in fact the inner part of solutions for which the conditions of boundness at infinity have not been imposed. The "outer" profiles are the outer part of solutions which do not satisfy the true physical similarity requirements at the wall.

Polytechnic Inst. of Brooklyn, N. Y.
RECENT DEVELOPMENTS CONNECTED WITH THE HYPERSONIC FACILITY OF THE POLYTECHNIC INSTITUTE OF BROOKLYN. PART I. TESTS OF THE COMPRESSION HEATER. PART II. ASPECTS OF THE DESIGN, CONSTRUCTION, AND INSTALLATION ON A MULTIPLE-OUTLET COLLECTION FOR THE CONVECTION HEATER, by Sergio R. Panunzio. Rept. on Research on Utilization of the Hypersonic Wind Tunnel, Contract AF 33(161)3978. Oct 59, 29p. 11 refs. WADD Technical rept. 60-94.
Order from OTS $0.75 PB 161 882

Two recent developments are described in this report. The first pertains to tests of the compression heater; these were carried out in order to evaluate the utility of the compression heater for hypersonic testing. The results of the tests indicate that there is a substantial air leakage past the piston of the heater, causing unsatisfactory heater performance. This leakage occurs in both directions during various phases of the compression cycle. Alterations in the design of the diaphragm are clearly required before improved performance can be anticipated. The second development discussed in this report pertains to the design and installation of a collector which permits the operation of several wind tunnels as well as of the compression heater from the convection heater. This collector increases to a considerable degree the capabilities of the hypersonic facility. In this report the design considerations and analysis of the collector are outlined and the pertinent construction details discussed. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
TRANSIENT TEMPERATURE DISTRIBUTIONS IN A SPHERE DUE TO AERODYNAMIC HEATING, by Frederick V. Pohle and John L. Boccio. Rept. on Contract Nonr-839(23). Sep 59, 32p. 10 refs. PIBAL rept. no. 553; AD-225 844.
Order from LC mi$3.00, ph$6.30 PB 148 891

The 2-dimensional transient heat condition problem for a solid sphere with constant properties was solved for the case of rotational symmetry and a surface temperature that varied with time and latitude. For given surface conditions this solution can be used to determine the heat input at the surface; these results were compared with similar values computed from a one-dimensional insulated plug experiment. In addition the experimentally determined internal temperatures were compared with those predicted by the 2-dimensional theory. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
TURBULENT HEAT TRANSFER ON BLUNT-NOSED BODIES IN TWO-DIMENSIONAL AND GENERAL THREE-DIMENSIONAL HYPERSONIC FLOW, by Roberto Vaglio-Laurin. Rept. on Aerodynamic Research, Contract AF 33(616)3265. Sep 58, 49p. 22 refs. WADC Technical note 58-301; AD-206 050.
Order from LC mi$3.30, ph$7.80 PB 149 283

Recent results obtained for three-dimensional laminar boundary layers are extended to the turbulent case. It is shown that in the presence of highly cooled surfaces and of moderate Mach numbers of the outer stream, the crossflow and the pertaining Reynolds stresses in a general three-dimensional turbulent boundary layer are negligible even for large transversal pressure gradients. The demonstration assumes that Reynolds analogy is satisfied by the flow in the streamline direction; subsequently, the validity of this assumption is established by extending a correlation due to Mager between two-dimensional compressible and incompressible turbulent boundary layers. From a study of the transformation and of its implications, a rapid method for the analysis of the boundary layer flow under the subject conditions is established. In the absence of general three-dimensional data, a comparison with experiments and with

the predictions of other known analyses is presented for several axisymmetric configurations; the results of the method proposed here exhibit good agreement with the data. The equations governing the mean motion in a general compressible three-dimensional turbulent boundary layer are derived in an appendix. (Author)

Princeton U., N. J.
HYPERSONIC VISCOUS FLOW PAST A BLUNT BODY WITH AN APPLIED MAGNETIC FIELD. PART II, by Ching-Sheng Wu. Rept. on Contract AF 49(638)465. Aug 59, 28p. 10 refs. Rept. no. 443; AFOSR-TN-60-210. AD-235 786.
Order from LC mi$2.70, ph$4.80 PB 148 347

The main purpose of the present investigation is to study how much the skin friction and heat transfer rate will be reduced by the presence of hydromagnetic interaction. In fact, the present analysis has simplified the physical model considerably.

Research Labs. for the Engineering Sciences, U. of Virginia, Charlottesville.
FREE MOLECULE COUETTE FLOW BETWEEN ROTATING CYLINDERS, by J. H. Bodine and A. R. Kuhlthau. Rept. on Contract NOrd 18211. Mar 60, 19p. 2 refs. Rept. no. AST-2849-102-60U.
Order from LC mi$2.40, ph$3.30 PB 148 389

It is the purpose of this paper to present a detailed theoretical analysis of the free-molecule flow which is amenable to experimental check and thus may provide a means for a more careful estimate of the numerical value of the reflection parameter.

Rome U. (Italy).
TRANSIENT TEMPERATURES AND THERMAL VIBRATIONS IN SPACE STRUCTURES, by Luigi Broglio. Technical note no. 2 on Contract AF 61(052)198. June 59, 58p. 4 refs. SIARgraph no. 53; AFOSR-TN-59-1014; AD-230 271.
Order from LC mi$3.60, ph$9.30 PB 146 708

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
APPROXIMATE THEORY OF GROUND INTERFERENCE ON SLENDER ROCKET SLEDS OF ARBITRARY CROSS SECTION WITH APPLICATION TO THE CONFIGURATION ROCKETDYNE RS-2 SLED, by Rudolf Hermann and Walter L. Melnik. Rept. on Contract AF 29(600)2102. Jan 60, 34p. 7 refs. AFMDC-TR-60-1; AD-234 280.
Order from LC mi$3.00, ph$6.30 PB 146 379

The pressure distribution on slender rocket-propelled sled bodies moving along the ground is computed for subsonic and moderate supersonic Mach numbers. The flow about a slender body of arbitrary cross section is approximated by superposition of locally tangent conical fields along the axis of the body and its image. This method is used to calculate the pressure distribution on configuration Rocketdyne RS-2 sled for M= 0.7, 0.8, 1.5, 2.0, and 2.4. The normal force loading and lift coefficient are obtained from an integration of the pressure distribution. Comparison with the lift coefficient measured by AEDC at M = 2 on a model of this sled configuration having zero nose droop indicates very good agreement with theory. (Author)

Rosemount Aeronautical Labs., U. of Minnesota Minneapolis.
EXPERIMENTAL AERODYNAMIC INVESTIGATION OF BASIC ROCKET SLED CONFIGURATIONS M = 1.5 TO M = 3.0, by Rudolf Hermann, Frederick Moynihan, and Howard Peterson. Rept. on Contract AF 29(600)2003. Oct 59, 63p. 3 refs. RAL-RR-167; AFMDC-TR-59-41; AD-233 789.
Order from LC mi$3.90, ph$10.80 PB 146 380

Wind tunnel measurements of the drag, lift, center of pressure location and pitching moment for some basic sled shapes and orientation parameters under the influence of ground effects are presented and discussed. Sled models were mounted on a simulated Holloman track cross section. Mach number range is from 1.5 to 3.0. Sled geometric variables include nose shape and angle on a circular cross-section sled, and body width on a rectangular cross-section sled. Sled orientation variables include height above the trough and angle of attack. Presence of the ground has little effect on the sled drag if it is mounted above the level of the rails. However, the ground effect caused positive lift loads which for many configurations were in the order of, or larger than the drag.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
RESEARCH ON EVAPORATIVE FILM COOLING OF A MACH NUMBER 7 CONTOURED WIND TUNNEL NOZZLE IN THE ROSEMOUNT AERONAUTICAL LABORATORIES' HYPERSONIC FACILITY, by Rudolph Hermann, Walter L. Melnik, and Janis O. A. Stankevics. Rept. for 1 Oct 58-30 Sep 59 on Contract AF 33(616)6077. May 60, 63p. 38 refs. WADD Technical rept. 60-251.
Order from OTS $1.75 PB 161 885

An experimental research program on evaporative film cooling of a Mach Number 7 Laval nozzle was conducted in the 12 x 12-inch test section of the hypersonic blow-down wind tunnel. Cooland (water) was injected through a thin strip of porous stainless steel plate located upstream of the nozzle throat where the average Mach number was 0.10. The object of this investigation was to analyze the influence of evaporative film cooling on the potential flow area available for model testing. For this purpose, a transverse pitot pressure and total temperature survey was performed in the uniform flow region of the test section. Impact pressure and total temperature measurements were made in the turbulent boundary layer on the wall at the nozzle exit where M 7 with stagnation temperatures up to 2040°R. The results are compared to a former investigation of evaporative film cooling in a throat section of a hypersonic nozzle. Results of a simplified theoretical analysis of evaporative film cooling showed good agreement with wall temperatures measured at the throat of the nozzle. Concentration and total enthalpy profiles across the boundary layer were obtained from a simi-

larity analysis of the binary turbulent boundary layer with evaporative film cooling using some experimental data. (Author)

Southwest Research Inst., San Antonio, Tex.
AN ALTERNATIVE FORMULATION OF THE PROBLEM OF FLUTTER IN REAL FLUIDS, by Wen-Hwa Chu and H. Norman Abramson. Technical rept. no. 2 on Contract Nonr-2470(00). 29 Aug 58, 20p. 10 refs. AD-204 388.
Order from LC mi$2.40, ph$3.30 PB 147 160

The potential theory of a harmonically oscillating thin airfoil is generalized by discarding the conventional Kutta-Joukowski condition at the trailing edge and introducing a generalized equivalent condition. The bound vorticity distribution is expressed in a form of the Birnbaum-Glauert formula and the resulting equation is solved by application of Glauert's series method. The lift and moment, which depend upon the trailing edge singularity, are found to contain two complex semi-empirical parameters which may be evaluated from experimental data. The implications of these results in various applications are discussed.

Technische Hochschule, Vienna (Austria).
CONDUCT THEORETICAL RESEARCH ON THE STRENGTH OF VORTICES PRODUCED BEHIND A SHOCK WAVE IN THE BOUNDARY LAYER FOR SUPERSONIC FLOW, by Rudolf Bruniak. Technical final rept. on Contract AF 61(052)78. [1960] 15p. AFOSR-TR-60-18; AD-232 069.
Order from LC mi$2.40, ph$3.30 PB 146 710

The present paper undertakes to investigate vortices appearing behind a shock wave in the boundary layer as to their strength and their influence on the thickness of the boundary layer.

Technische Hochschule, Munich (West Germany).
LINEAR SUPERSONIC FLOW PAST COMBINATIONS OF A CYLINDRICAL BODY AND TRIANGULAR WINGS, by Ferdinand Peischl and Hans J. Stetter. Technical note. no. 11 on Contract AF 61(514)1080. 24 Nov 59, 28p. 13 refs. AFOSR-TN-59-1160; AD-233 274.
Order from LC mi$2.70, ph$4.80 PB 146 737

The normalized pressure-distribution was computed for wing-body combinations consisting of an infinite (rotational) cylindrical body and plane delta-wings with supersonic leading edges. Linear supersonic theory was used without further approximations. After an introduction of quasi-cylindrical wing-body interference theory and the statement of the problem, the non-trivial second step of the procedure is solved analytically. This solution is Fourier-analyzed numerically to yield the boundary data for the third step the computations of which were described previously. The pressure distribution is shown in several graphical representations and a discussion of the results is given. All computations were made on the PERM electronic computer. (Author)

Texas Engineering Experiment Station, College Station.
WIND TUNNEL STUDIES OF PRESSURE AND VELOCITY DISTRIBUTION, by Edwin S. Holdredge and Bob H. Reed. Summary rept. no. 2 for 1 Sep 56-21 Aug 57. [1957] 52p. AD-148 336.
Order from LC mi$3.60, ph$9.30 PB 148 229

The scope of this report is limited to the investigation and results of studies on single obstacles having rectangular shapes. Most of the previous work on the velocity around objects has dealt with problems related to windbreaks. Since the windbreak is long compared to its height the air flows in a vertical plane. The present studies are of three dimensional objects and the flow is three dimensional.

University of Southern California, Engineering Center, Los Angeles.
REDUCTION OF THE BOUNDARY LAYER THICKNESS IN A HYPERSONIC NOZZLE, by Serge A. Waiter. Rept. on Contract AF 18(603)95. 20 May 60, 28p. 3 refs. USCEC rept. 56-213; AFOSR-TN-60-514.
Order from LC mi$2.70, ph$4.80 PB 148 355

The reduction of the boundary layer thickness in a hypersonic nozzle can be realized by cooling the walls: in this way, an important heat transfer from the flow is created, increasing the density in the boundary layer. The integration of the mass flow equation will show the influence of the wall temperature on the boundary layer thickness. Applications to specific cases are proposed for a given nozzle. The following results are observed: (1) the power needed for cooling the nozzle is low, (2) this power varies slowly with the wall temperature (if $T_w < 200^oK$) but decreases with the Reynolds number and the stagnation temperature for a given Mach number. Charts are given for $8 \leq M \leq 18$ and for stagnation temperature $T_s \leq 2000^oK$. For higher temperatures, dissociation and ionization appear so the problem must be solved for each special case: the general heat transfer equation is given and its application is easy if the stagnation conditions and the local Mach number are known. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis.
THE ST. ANTHONY FALLS HYDRAULIC LABORATORY GRAVITY-FLOW FREE-JET WATER TUNNEL, by Edward Silberman and John F. Ripkin. Rept. on [Contract Nonr-710(24)]. Aug 59, 49p. 5 refs. Technical Paper no. 24, Series B.
Order from LC mi$3.30, ph$7.80, PB 148 166

A unique facility for studying cavitation phenomena has been developed at the St. Anthony Falls Hydraulic Laboratory of the University of Minnesota in the form of a gravity-flow free-jet water tunnel which makes use of the 50-ft drop in the Mississippi River at the Falls where the Laboratory is situated. The tunnel is an outgrowth of projects sponsored by the Office of Naval Research and is used for experimental

studies of cavities under an exceptionally wide range of conditions, especially at small cavitation numbers Both axially symmetric and two-dimensional test sections have been provided. The facility differs from customary water tunnels in that the test jet is surrounded by a gas-filled chamber in which the pressure can be lowered to nearly vapor pressure of the liquid stream. Operation is entirely by gravity flow; no pumps are required either for actuating the stream or producing vacuum in the test chamber. The test jet is vertical, 40 in. long, and flows at speeds up to 50 fps. The axially symmetric jet is 10 inches in diameter, while the alternate two-dimensional jet is 5 in. thick between rigid walls and of adjustable width from 6 to 15 in. between free boundaries.

St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis.
EXPERIMENTAL STUDIES OF PNEUMATIC AND HYDRAULIC BREAK-WATERS, by Lorenz G. Straub, C. E. Bowers, and Zal S. Tarapore. Rept. on Contract Nonr-710(10). Aug 59, 58p. 28 refs. Technical Paper no. 25, Series B.
Order from LC mi$3.60, ph$9.30 PB 148 167

Experimental studies were conducted on two similar models of both pneumatic and hydraulic breakwaters, having a length ratio of 4.5:1. Tests of the pneumatic system indicated that the horsepower requirements for a given percentage of attenuation depended only on the wave length, the submergence of the manifold, and the depth of water. Multiple-manifold breakwaters with different spacing between manifolds were tried and found to be of no particular advantage over the one-manifold system. An intermittent bubbler device was also tested very briefly, showing very little difference from the one-manifold data. Test of the hydraulic system indicated that power requirements varied with wave steepness as well as wave length. Orifice area was a very important parameter as this affected the discharge requirements and the required size of supply piping. The power requirements of the pneumatic system are somewhat less than the hydraulic for average values of wave steepness, but the maximum attenuation achieved was less than the hydraulic. (Author)

Princeton U., N. J.
OBSERVATIONS ON LIQUID SHEETS FORMED BY COLLIDING VERTICAL JETS, by R. M. Koros, J. M. Deckers, and M. Boudart. Rept. on Contract AF 49(638)[32]. [1960] 61p. 14 refs. AFOSR-TN-60-234.
Order from LC mi$3.90, ph$10.80 PB 147 918

When two opposed vertical jets collide, a stable liquid sheet is formed. By measurements of conductivity, it was found that the thickness of the sheet at a distance from the jet axis is inversely proportio. to L. Thus, the cross-sectional area to liquid flow and also the momentum of the liquid stay constant as the sheet spreads outward. There is, however, a loss of momentum of the fluid in the region of formation of the sheet. This loss is reflected by some mixing of the jets taking place in this region. Such liquid sheets have been used previously to study surface tension of freshly formed surfaces. The present work confirms the validity of the technique in the case of liquids with low viscosity.

Naval Ordnance Test Station, China Lake, Calif.
THEORETICAL LIFT AND DRAG ON VENTED HYDROFOILS FOR ZERO CAVITY NUMBER AND STEADY TWO-DIMENSIONAL FLOW, by Andrew G. Fabula. 4 Nov 59, 47p. 7 refs. NOTS TP-2360; NAVORD rept. 7005; AD-235 285.
Order from LC mi$3.30, ph$7.80 PB 146 988

Linearized, plane cavity-flow theory for steady, two-dimensional flow is used to predict lift and drag on hydrofoils with forced ventilation by gas exhaust on one side. Conditions assumed include cavity pressure equal to free-stream pressure, smooth separation of the free stream-lines, and infinite cavity length. Lift and drag coefficients are calculated versus exhaust point for several basic profile shapes, and formulas for lift, drag and moment coefficients are given for arbitrary profile.

Naval Ordnance Test Station, China Lake, Calif.
A METHOD FOR THE PRODUCTION OF UNIFORM BEADS OF CONTROLLED DENSITY IN THE DENSITY REGION CLOSE TO UNITY, by Arnold Adicoff. 8 Aug 59, 15p. NOTS TP 2308; NAVORD rept. 6580; AD-226 899.
Order from LC mi$2.40, ph$3.30 PB 148 448

A technique for the production of small spheres has been developed which consists primarily of forming the spheres in liquid nitrogen from a rubber latex, then coagulating these spheres in an ice-salt-acetic acid bath. The density of the spheres can be carefully controlled by the addition of a solid, more dense component to the latex prior to its coagulation. (Author)

Naval Ordnance Test Station, China Lake, Calif.
BASE-VENTED HYDROFOILS, by T. G. Lang. 19 Oct 59, 35p. 6 refs. NOTS TP-2346; NAVORD rept. 6606; AD-234 838.
Order from LC mi$3.00, ph$6.30 PB 146 987

Lift-producing hydrofoils that operate with a portion of the surface vented with gas were analyzed. The gas-covered surface is defined as the base. Results of the analysis show that a large number of different types of base-vented hydrofoils exist, some of which may have greater cavitation resistance and higher efficiency than the best of the fully wetted hydrofoils, provided, of course, that sufficient gas is available for venting. Other results show that a cambered base-vented hydrofoil having a parabolic cross section can operate near the surface without vapor cavitation, at speeds as much as 50% greater than those of fully wetted hydrofoils, and with little sacrifice in efficiency. Experimental tests on base-vented hydrofoils are needed to verify the results of this analysis (Author).

David Taylor Model Basin, Washington, D. C.
TESTS OF A PLANING BOAT MODEL WITH PARTIAL HYDROFOIL SUPPORT, by Peter Sherman. Aug 58, 25p. 7 refs. Rept. 1254; AD-205 320.
Order from LC mi$2.70, ph$4.80 PB 147 257

A model of a planing boat was equipped with two horizontal submerged hydrofoils which were designed to carry part of the weight of the craft. The foils were located forward of the center of gravity. Smooth-water resistance tests were made with foils at various fore-and-aft positions and various angles of attack to determine the optimum arrangement. Tests were also made of the foils alone. It was found that an appreciable scale effect on foil performance existed at Reynolds numbers below about 5×10^5. The data from the tests of the hull with foils, when corrected for scale effect on foil performance, indicated that the resistance of a planing boat can be decreased when such foils are added by as much as 27 1/2 percent. The best result was attained with the foils located at 28 percent of the hull length aft of the bow, and with the foil chord line at an angle of -3.5 deg with respect to the hull baseline. (Author)

METALLURGY

North American Aviation, Inc., Downey, Calif.
ELECTRODEPOSITION OF ALUMINUM ON MAGNESIUM, by E. W. Cooke and S. Kritzer. Rept. for 1 June 58-31 Mar 59 on Materials Applications, Contract AF 33(616)5854. Nov 59, 30p. 5 refs. WADC Technical rept. 59-465; AD-232 138.
Order from OTS $0.75 PB 161 892

This report describes detailed tests made to electrodeposit aluminum directly onto magnesium, using a modification of the non-aqueous bath developed by the National Bureau of Standards. The report shows that good adhesion is not obtained and a reaction occurs between the electroplating solution and magnesium. However, the report indicates that by using a zinc immersion intermediate coating, satisfactory adhesion is obtained. The purity of the aluminum deposited in this manner is greater than 99.8%, with low porosity. Good adhesion is also obtained on copper and steel. These coatings can be satisfactorily anodized. (Author)

Northwestern Technological Inst., Evanston, Ill.
SUBLIMATION OF SMALL SODIUM CHLORIDE SPHERES INTO ARGON, by D. H. Whitmore and J. B. Moser. Rept. on Contract AF 49(638)436. 15 Apr 60, 21p. 24 refs. AFOSR-TN-60-526.
Order from LC mi$2.70, ph$4.80 PB 148 210

The rate of vaporization of sodium chloride into an argon atmosphere was investigated over the temperature range 726° to 770°C using a hot-stage method to follow the change of radius of a small, subliming sodium chloride sphere. An integrated rate expression was derived for the present experimental conditions which showed the square of the radius of the volatile particle to be directly proportional to the time, the proportionality constant being both pressure and temperature dependent. In general, the pressure and temperature behavior of the empirical rate data is consistent with the proposed model which assumes that the vaporization rate is controlled by molecular diffusion of sodium chloride vapor away from the outer edge of a thin boundary layer adjacent to the surface of the sphere undergoing sublimation. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
METAL COATINGS (1950-1960). May 60, 20p. 441 refs. OTS Selective Bibliography SB-409.
Order from OTS $0.10 OTS SB-409

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports are arranged in sections as follows: metal coatings, general; electroplating; electropolishing; vapor deposition and vacuum deposition; phosphate coatings; plating.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
SINTERING ATMOSPHERES FOR BRASS COMPACTS, by R. A. Powell and F. I. Zaleski. Dec 59, 27p. Rept. R-1526; AD-233 880.
Order from LC mi$2.70, ph$4.80 PB 147 238

The highest tensile properties (26,000 psi tensile strength; 4 to 5 percent elongation) were obtained with 70-30 brass compacts sintered in covered boats with atmospheres that contained 80 to 100 percent hydrogen. The best tensile properties (18,000 psi tensile strength; 2 percent elongation) for the uncovered boat condition were obtained with the brass compacts sintered in atmospheres that contained 40 to 100 percent hydrogen. The zinc losses of the brass compacts decreased. Sintering in air or carbon monoxide resulted in high zinc losses and very low tensile properties.

Ferrous Metals

Battelle Memorial Inst., Columbus, Ohio.
THE MECHANISM OF HARDENING IN 17-7PH STAINLESS STEEL, by E. E. Underwood, A. E. Austin and others. Rept. for 15 May 59-14 May 60 on Kinetics of Internal Structural Changes, Contract AF 33(616)6521. June 60, 54p. 19 refs. WADD Technical rept. 60-236.
Order from OTS $1.50 PB 161 850

The unique hardening found in precipitation-hardening stainless steels was investigated both in commercial sheet alloys of 17-7PH and high-purity ferrite single crystals of Fe-17Cr-7Ni-2Al. Profuse precipitation of needle-shaped particles was responsible for maintaining the high hardness level in the aged crystals. Ordering was not detected by X-ray diffraction in severely quenched single crystals in which precipitation was suppressed. However, aged crystals displayed superlattice reflections from chromium and nickel on the bcc lattice, suggesting that the particles are ordered. Neutron-diffraction data indicate that the precipitate has an ordered bcc structure with iron on one sublattice and chromium, nickel, and aluminum distributed on the other sublattice. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
EVALUATION OF CAST ALLOYS FOR USE AT HIGH TEMPERATURES, by John Salvaggi. Final rept for 11 Dec 56-15 Dec 57 on Contract NObs-72224. [1958] 13p. 2 refs. Rept. no. KB-1137-M-4; AD-207 503.
Order from LC mi$2.40, ph$3.30 PB 148 242

Austenitic stainless steel compositions containing 17-20% chromium, 12-20% nickel, 2.5-5% molybdenum and 0.27-0.48% carbon were modified by additions of minor quantities of titanium, boron, columbium and tungsten and cast into test bars using the shell mold process. Several of these compositions displayed excellent high temperature strength properties, with 100-hour rupture stress values in the 24,000 psi range at 1500°F and 14,500 psi range at 1600°F being recorded. These high strengths were accompanied by adequate ductility values. Several ferritic heats were also prepared in the same manner and tested at 1200°F. The 100-hour rupture strength values obtained were comparable to those reported in the literature for several commercial stainless steels. However, extremely low ductility would make these alloys virtually unusable in their present condition. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
IMPROVEMENT OF Cr-Ni-Mo IRON BASE ALLOYS BY VACUUM MELTING AND CASTING, by Franklin J. Gillig. Final rept. on Contract NObs-77019. 30 Sep 59, 16p. 6 refs. Rept. no. KA-1289-M-6.
Order from LC mi$2.40, ph$3.30 PB 148 243

The objective of this program was to investigate the effects of minor changes in composition and vacuum melting on the high temperature mechanical properties of iron base alloys containing 20 Cr- 20 Ni-5 Mo and various minor additions of Cb, W, Ti, B and Al. Twenty-one heats were cast with varying compositions. The 100-hour rupture strength at 1500°F was used as the basis for rating the elevated temperature strength. The strength of the base line heat was not surpassed by any appreciable amount but equivalent strengths were obtained with several compositions that are leaner in alloying elements. (Author)

Illinois U., Urbana.
ON THE CRYSTALLOGRAPHY OF MARTENSITE: THE "{225}" TRANSFORMATION IN ALLOYS OF IRON, by C. M. Wayman, J. E. Hanafee, and T. A. Read. Rept. on Contract AF 49(638)420. [1960] 33p. 25 refs. AFOSR-TN-60-525.
Order from LC mi$3.00, ph$6.30 PB 148 874

For an accurate study of the transformation it is necessary that the martensite habit plane and orientation relationship for a single plate be determined. These observations are especially needed for the "{225}$_A$" transformation for which this determination had not previously been made. The presence of martensite sideplates was observed. The nature of these plates is uncertain at present. The findings point to the need for a microscopic examination of the austenite-martensite inferface.

Light Metals

Alloyd Corp., Cambridge, Mass.
RESEARCH ON TECHNIQUES FOR THE PRODUCTION OF ULTRA-PURE BERYLLIUM, by Malcolm Basche and Laurence M. Schetky. Rept. for 1 July 58-30 June 59 on Metallic Materials, Contract AF 33(616)5300. Mar 60, 55p. 18 refs. WADC Technical rept. 58-457, Pt. II.
Order from OTS $1.50 PB 161 877

Three techniques for making high purity Be were investigated: zone purification in moderate vacuum, distillation under high vacuum, purification through halide reduction of $BeCl_2$. Zone purification in vacuum proved to be impractical as a result of high Be vapor pressure. Distillation under high vacuum showed promise. Purification through halide reduction produced Be 99.6% and showed promise for improvement. (Author) (See also PB 151 878)

New York U. Coll. of Engineering, N. Y.
DEVELOPMENT OF A SINTERED TITANIUM POWDER BY VAPOR PHASE REACTION, by F. Ermanis, H. Margolin, and P. Herasymenko. Final rept. on Contract NOa(s) 58-101-d. 1 Dec 59, 15p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 147 256

A method for the production of sintered titanium composed of ductile titanium metal or its alloys and of a fine dispersion of insoluble titanium compounds. At present only a limited number of compounds are known which are insoluble in solid titanium at elevated temperatures. The most promising compounds appeared to be titanium phosphide with a solubility in α-titanium of less than .07% at 790°C, and titanium sulphide whose solubility in α-Ti is about .015% at 888°C.

New York U. Coll. of Engineering, N. Y.
THE TITANIUM ALUMINUM PHASE DIAGRAM, by E. Ence and H. Margolin. Final rept. on Contract DA 30-069-ORD-2164. July 59, 34p. 21 refs. OOR rept. 1939. 2-ORD-Met.
Order from LC mi$2.40, ph$3.30 PB 148 428

Rodman Lab., Watertown Arsenal, Mass.
SOME PROPERTIES OF TITANIUM PROCESSED BY POWDER METALLURGY METHODS, by Francis S. DeLacey. Dec 59, 14p. 7 refs. Technical rept. no. RPL 41/10; AD-233 979.
Order from LC mi$2.40, ph$3.30 PB 147 233

The effect of compacting pressure and firing temperature variations on the tensile and shrinkage properties of titanium powder metal compacts was investigated. The effects of increasing the magnitude of compacting pressure were as follows: the tensile yield strength increased from 32,600 psi to 57,800 psi; the reduction of area increased from 3.2 to 18.6% and the volume shrinkage decreased from 4.86 to 1.99%.

Watertown Arsenal Labs., Mass.
AN ENGINEERING EVALUATION OF NOTCH SENSITIVITY IN HIGH STRENGTH SHEET MATERIALS. PHASE I. NOTCH TESTING. PHASE II. HYDRAULIC-BULGE TESTING, by George M. Orner and Carl E. Hartbower. Mar 60, 98p. 20 refs. Technical rept. no. WAL TR 405.1/1; AMC TR-60-7-662; AD-233966L
Order from LC mi$5.40, ph$15.30 PB 147 235

The most economical test for notch sensitivity in high-strength sheet, in tough and moderately tough materials in thicknesses greater than about 0.040 inch, is the standard Charpy impact test. Commercially available annealed titanium sheet has good notch toughness properties at strength levels in the range 118 to 147 ksi. The feasibility of using an underwater spark discharge technique for bulge testing high-strength sheet materials at impact strain rates was investigated. Small bulges were produced in thin sheet materials; however, the electrical-mechanical efficiency of the system was too low to test sheet in heavier gages.

Watertown Arsenal Labs., Mass.
THE TRUE-STRESS TRUE-STRAIN PROPERTIES OF TITANIUM AND TITANIUM ALLOYS AS A FUNCTION OF TEMPERATURE AND STRAIN RATE, by Thomas S. DeSisto. Mar 60, 44p. 7 refs. Technical rept. no. WAL TR 405.2/4; AD-234 827.
Order from LC mi$3.30, ph$7.80 PB 147 276

True-stress true-strain properties of commercially pure titanium, Ti-7%Mn, Ti-5%Al - 2.5%Sn, and Ti-6%Al-4%V were obtained at temperatures of 800°F to -319°F at strain rates of 0.001, 0.01, and 0.1 inch per minute. For all materials tested, the flow stress increases with decreasing temperature and increasing strain rate, and the strain at fracture decreases with decreasing temperatures. The strain at maximum load decreases with increasing strain rate and decreasing temperature. An exception is shown by the commercially pure titanium where the strain at maximum load and fracture strain increase sharply with decreasing temperature. (Author)

Nonferrous (except light) Metals

Horizons, Inc., Cleveland, Ohio.
RATE OF DIFFUSION OF CARBON IN ALPHA AND IN BETA TITANIUM AS A FUNCTION OF THE TEMPERATURE AND CONCENTRATION, by Eugene Bucur and F. C. Wagner. Final technical rept., 12 Dec 52-1 July 54, on Contract DA 36-034-ORD-1157(RD). 24 Sep 54, 70p. 13 refs. WAL rept. no. 401/169-16.
Order from LC mi$3.90, ph$10.80 PB 148 039

The diffusion rates of carbon in titanium were determined over a range of temperature from 736°C to 1150°C. The activation energies were obtained by application of the Arrhenius type equation, $D = D_o e^{\frac{-Q}{RT}}$ and from a logarithmic plot of the diffusion coefficients versus the reciprocal of the absolute temperature; the values obtained for the alpha and beta temperature range are 43,500 cal/mole and 48,400 cal/mole respectively. By substituting the respective D_o value and Q value for the alpha or beta temperature range in the Arrhenius type equation the diffusion coefficient for a specific temperature can be calculated directly. The rate of diffusion of carbon in titanium is independent of concentration, or at most, very slightly dependent on concentration.

Naval Research Lab., Washington, D. C.
LOW TEMPERATURE DEPENDENCE OF THE ELECTRICAL RESISTIVITY AND THERMOELECTRIC POWER OF PALLADIUM AND PALLADIUM NICKEL ALLOYS CONTAINING ABSORBED HYDROGEN, by A. I. Schindler and R. J. Smith. Final rept. 3 June 60, 7p. 4 refs. NRL rept. 5481.
Order from LC mi$1.80, ph$1.80 PB 146 217

Electrical resistivity and thermoelectric power measurements have been made on a series of hydrogen-containing palladium and nickel-palladium alloys. It is known that a two-phase region exists at a hydrogen to palladium atom ratio of less than 0.6 while above this hydrogen concentration only a single-phase region exists. A resistivity maximum and, relative to pure palladium, a thermoelectric power minimum has been found at T = 50°K for the palladium-hydrogen samples containing $H/Pd \geq 0.58$. In addition a resistivity minimum has been found for these samples at approximately 90°K. At temperatures less than 80°K, the absolute thermoelectric power for Pd-H falls off rapidly as a function of composition in the vicinity of H/Pd = 0.6. However, at temperatures greater than 90°K a maximum is found in the absolute thermoelectric power at H/Pd = 0.6. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
COLUMBIUM AND TANTALUM. June 60, 14p. 237 refs. OTS Selective Bibliography SB-414.
Order from OTS $0.10 OTS SB-414

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed cover columbium and tantalum metals and alloys; carbides and compounds.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
MOLYBDENUM AND TUNGSTEN. June 60, 18p. 390 refs. OTS Selective Bibliography 415.
Order from OTS $0.10 OTS SB-415

A bibliogrphy of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed cover molybdenum and tungsten metals and alloys; carbides and compounds. These were added to the OTS collection during the period 1945 to July 1960.

Watertown Arsenal Labs., Mass.
THE CHROMIUM-COLUMBIUM BINARY SYSTEM, by John A. Misencik (Massachusetts Inst. of Tech.). Master's thesis. Mar 60, 45p. 5 refs. Technical rept. no. WAL TR 805.5/1; AD-234 510.
Order from LC mi$3.30, ph$7.80 PB 147 279

The complete binary system chromium-columbium has been developed, using metallographic, X-ray diffraction and thermal analysis techniques. The existence of beta-chromium has been confirmed and a eutectoid reaction, in the high chromium portion of the diagram, has been found at 1550°C, in addition to the eutectic reaction at 1660°C. The maximum solubility of columbium in chromium at 1500°C is 5 weight percent. The maximum solubility of chromium in columbium is 12 weight percent at 1500°C. The intermetallic compound at the stoichiometric ratio ($CbCr_2$) has been confirmed. (Author)

Structural Metallurgy and Corrosion

Arkansas U. Graduate Inst. of Tech., Little Rock.
POLARIZATION CAPACITANCE DETERMINATIONS OF SURFACE ROUGHNESS, by M. K. Testerman. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)5541. Apr 60, 39p. 24 refs. WADD Technical rept. 60-97.
Order from OTS $1.00 PB 161 847

Polarization capacitances of metallic surfaces are investigated in aqueous (0.5N KCl) and non-aqueous (0.18M KI-CH_3OH, 0.38M KI-$C_3H_5(OH)_3$, and 0.25M KI-$HCONH_2$) electrolytic systems. These systems are evaluated according to their general applicability for the determination of surface roughnesses. A pretreatment procedure is described for preparing an apparently deoxidized aluminum surface. Polarization capacitances obtained for copper, stainless steel, titanium, amalgamated copper, and pretreated aluminum surfaces are compared in the non-aqueous 0.25M KI-$HCONH_2$ system. Curves of capacitance versus applied polarizing potentials are depicted which indicate a high degree of dependency of double-layer capacitance on polarization potentials. Description of experimental procedure and apparatus is accompanied by explanatory figures and tables. (Author) (See also PB 151 268)

Arkansas U. Graduate Inst. of Tech., Little, Rock.
USE OF RADIOACTIVE IODINE VAPOR FOR DETERMINING SURFACE ROUGHNESS, by M. K. Testerman. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)5541. Dec 59, 48p. 25 refs. WADC Technical rept. 59-659.
Order from OTS $1.25 PB 161 844

Several relative roughness factors of gold, brass, and aluminum surfaces, exhibiting varying degrees of surface roughness, have been determined by utilizing I^{131} vapor as an adsorbate. Polished gold foil, possessing a high degree of purity, was used as a reference surface. A roughness factor of one was chosen arbitrarily for this reference surface, and all roughness factors contained herein are relative to this value. The roughness factors obtained for brass were decidedly higher than those obtained for other metals. Hence, it was concluded that a chemical combination resulted from the adsorbed layer of I^{131} on the brass surface accounting for the higher specific activity obtained. Figures and illustration describing the experimental equipment are given, as well as data tables and other information pertinent to the previously-mentioned roughness factors. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
OBSERVATIONS OF THE DEFORMATION OF ALUMINUM SUBJECTED TO IMPULSIVE LOADS OF CONSTANT MAXIMUM AMPLITUDE AND VARIABLE IMPULSE, by G. Moss and C. Glass. Apr 60, 11p. 3 refs. Technical note no. 1310.
Order from LC mi$2.40, ph$3.30 PB 148 514

A study was made of the strain of four crystallographically identical aluminum samples, each of which had been subjected to an impulsive load applications were cylindrically symmetrical so that strictly hydrodynamic behavior of the aluminum during plastic deformation would have resulted in craters with round cross sections. Actually, the craters developed were as nearly square as they were round. Hence, it was concluded that aluminum deforms by the usual mechanisms even when subjected to the extreme stress levels used in this work, i. e. 270 kilobars. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
STUDIES OF THE DEFORMATION MECHANICS OF AN IMPULSIVELY LOADED COPPER SINGLE CRYSTAL, by G. Moss and C. Glass. Apr 60, 15p. 4 refs. Memo. rept. no. 1257. AD-237 578.
Order from LC mi$2.40, ph$3.30 PB 148 512

A copper single crystal which had been internally loaded with an explosion was recovered, and the mechanism by which it deformed at the metal-explosion interface was established as slip on {111} planes, probably in <110> directions. This is the mechanism by which copper commonly deforms when stressed with nonimpulsive loads. Hence, it is concluded that the final deformation of copper due to explosively applied loads with initial pressures of approximately 400 kilobars is influenced by the metal strength and structure. This is in contrast with the usual treatments of explosively induced strain, which are based on the assumptions that metal strength is negligible relative to the explosive load and that deformation can be treated as an entirely hydrodynamic process. (Author)

Cornell Aeronautical Lab., Buffalo, N. Y.
EFFECTS OF CONCENTRATED HYDROGEN PEROXIDE ON MECHANICAL AND CORROSION PROPERTIES OF STRUCTURAL ALUMINUM ALLOYS, by Franklin J. Gillig. Final rept. on Contract NObs-72258. 16 Feb 59, 64p. Rept. no. KC-1164-M-11; AD-214 856.
Order from LC mi$3.90, ph$10.80 PB 148 376

Nine wrought and three cast aluminum alloys were exposed to commercial 90% H_2O_2 as manufactured and 90% H_2O_2 with 3 grams per liter chloride ion and 4 grams per liter nitrate ion added. The majority of the exposures were of 6 months duration. Some of the specimens had to be removed prematurely due to

severe corrosion or rapid deterioration of the peroxide. Evaluation tests included mechanical properties, stress corrosion, metallographic examination and chemical analyses of the peroxide in order to determine its deterioration. The presence of chloride ion was found to accelerate corrosion greatly in all of the alloys. Wrought alloys 5254 and 3003 were found to be the most compatible and B-214 was the best cast alloy. (Author)

Crucible Steel Co. of America, Pittsburgh, Pa.
CORROSION OF SUPERALLOYS BY SELECTED FUSED SALTS, by A. Moskowitz and L. Redmerski. Rept. for 15 Mar 59-15 Feb 60 on Finishes and Materials Preservation, Contract AF 33(616)6196. Mar 60, 84p. 30 refs. WADD Technical rept. 60-115.
Order from OTS $2.25 PB 161 848

The corrosion of Inconel X, Inconel 702, Rene 41, M-252, and Haynes 25 by potassium chloride and lithium fluoride at 1600 to 1900 F was studied. Thin coatings of the salts (1.5 mg/cm^2) caused severe corrosion of the alloys in air, which resulted in accelerated failures of thin sheet specimens in creep-rupture testing. Rankings for the alloys based on creep-rupture tests were similar for uncoated and salt-coated materials: Haynes 25, Rene 41, and M-252 best, Inconel 702 poorer, and Inconel X poorest. The corrosion products consist of oxides and spinels and only very little corrosion, if any, occurs without oxygen. The presence of the salt prevents the normal formation of a protective oxide film. X-ray diffraction studies showed differences between the normal oxidation products and the oxide corrosion products produced with salt present. The corrosion occurs as severe surface attack with consequent eroding away of metal, as intergranular penetration, and as internal voids formed in the alloy. All of the alloys were susceptible to each of these types of corrosion. Grain boundary separation effects due to stress (2,500 to 10,000 psi) were also found. (Author

Crucible Steel Co. of America, Syracuse, N. Y.
DEVELOPMENT OF A DUCTILE, OXIDATION-RESISTANT AND HIGH STRENGTH SINGLE-PHASE (AUSTENITIC) ALLOY BASED ON Fe-Al-Mn-C SYSTEM, by R. C. Gibson. Bimonthly progress rept. no. 2, 15 Dec 59-15 Feb 60, on Contract NOas-60-6025-c. 21 Mar 60, 14p.
Order from LC mi$2.40, ph$3.30 PB 148 003

Work was initiated to develop a ductile, oxidation-resistant and high strength alloy based on the Fe-Al-Mn-C system for use at intermediate temperatures (1100 to 1400 F). Results of heat treating studies performed on an Fe-Al-Mn-C-Mo-W-V base alloy containing additions of copper and nickel have revealed that copper has little or no effect on the hardness of the alloys when aged in the temperature range 1100 to 1400 F. Nickel, however, was observed to significantly increase the hardness of the alloys during aging at these same temperatures (1100 to 1400 F). Based on hardness data, there is no apparent interaction between copper and nickel which affects the aging characteristics of the alloy. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL PROPERTIES OF SOME NICKEL-BASE ALLOYS, by M. E. Langston and C. H. Lund. Rept. on Contract AF 18(600)1375. 20 May 60, 137p. 83 refs. DMIC rept. 129.
Order from OTS $2.75 PB 151 086

The available physical properties of 33 nickel-base alloys are tabulated along with their respective chemical compositions and a brief general description of each alloy, its uses, and available forms. The 33-representative alloys are divided into the following six groups: Group I. Nickel-Copper; Group II. Nickel-Silicon; Group III. Nickel-Chromium; Group IV. Nickel-Chromium-Iron; Group V. Nickel-Chromium-Cobalt; Group VI. Nickel-Molybdenum.

General Electric Co., Cincinnati, Ohio.
DEVELOPMENT OF HIGH STRENGTH MATERIALS FOR SOLID ROCKET MOTORS, by E. N. Bamberger. Annual rept. on Contract NOrd-18119, Tasks I and II. 31 May 59, 136p. R59FPD303.
Order from LC mi$6.90, ph$21.30 PB 148 927

Illinois U., Urbana.
THE EFFECTS OF INELASTIC ACTION ON THE RESISTANCE TO VARIOUS TYPES OF LOADS OF DUCTILE MEMBERS MADE FROM VARIOUS CLASSES OF METALS. PART XII. ECCENTRICALLY-LOADED TENSION MEMBERS AND COLUMNS MADE OF 17-7PH STAINLESS STEEL AND Ti 155A TITANIUM ALLOY AND TESTED AT VARIOUS TEMPERATURES, by Q. M. Sidebottom, S. Dharmarajan and others. Rept. on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5658. Feb 60, 84p. 11 refs. WADC Technical rept. 56-330, Pt. XII.
Order from OTS $2.25 PB 161 836

Experimental data were obtained from eccentrically-loaded columns made of 17-7PH stainless steel and Ti 155A titanium alloy and tested at room temperature, from eccentrically-loaded columns made of 17-7PH stainless steel and tested at 1000°F, and from eccentrically-loaded tension members and columns made of Ti 155A titanium alloy and tested at 800°F. In most cases the creep tests were limited to 30 min. At the elevated temperatures the inelastic deformation was time dependent for the 17-7PH stainless steel and was mostly time independent for the Ti 155A titanium alloy. The theoretical analysis of room temperature tests data obtained from Ti 155A titanium alloy members tested at 800°F was based on the interaction curve-moment-load curve theory. The arc hyperbolic sine theory was used in the analysis of data obtained from 17-7PH stainless steel members tested at 1000°F. In all cases good agreement was found between theory and experiment. (Author) (See also PB 161 303)

Ingersoll Kalamazoo Div., Borg-Warner Corp., Mich.
AN INVESTIGATION OF THE RELATIVE DEFORMATION OF VARIOUS METALS BY CONCUSSION FORMING METHODS, by Don May. Rept. on Contract NOrd-15719. 6 July 59, 94p. 1 ref. Project rept. # SPDIR 20; AD-218 491.
Order from LC mi$5.40, ph$15.30 PB 148 461

The most extensive investigation centered around AISI 4130. Lesser amounts of work were done with AISI 1020, Vascojet 1000, MBMC #1, aluminums 2024-0, 2024-T and 6061-T. Tetryl, the properties of which are included in the main body of the report, was used as the explosive throughout the investigation. The effect of concussion forming on the hardness, thickness and grain structure of typical specimens is reported. The relationship between explosive charge size and the amount of specimen deformation is presented for several materials and conditions. The relationship between material thickness and the amount of specimen deformation is presented for several materials at various conditions. The relationships between the proximity of the explosive charge to the work piece and the amount of deformation are presented for several materials and conditions. The relationship between yield strength and specimen deformation is given for different materials and conditions. A minimum investigation into the feasibility of forming hemispheres at a single detonation was conducted. (Author)

Massachusetts Inst. of Tech., Cambridge.
THE EFFECTS OF STORED ENERGY AND RECRYSTALLIZATION ON THE CREEP RUPTURE PROPERTIES OF INTERNALLY OXIDIZED COPPER-ALUMINA AND COPPER-SILICA ALLOYS, by Masao Adachi and Nicholas J. Grant. Rept. for 1 Sep 58-1 Sep 59 on Solid State Research, Contract AF 33(616)5424. Dec 59, 27p. 9 refs. WADC Technical rept. 59-777.
Order from OTS $0.75 PB 161 846

Copper-silica and copper-alumina alloys of low oxide content were produced by the internal oxidation and extrusion of copper-silicon and copper-aluminum alloy powders. These alloys show normal behavior after recrystallization. With increasing amounts of recrystallization at temperatures up to 1050°C, the creep rupture strength at 450°C decreases and the ductility increases. Cold work of the partially or completely recrystallized alloys results in an increase in creep rupture strength and a decrease in ductility. The strength of dispersed oxide hardened alloys of this kind is due to a combination of micron or sub-micron dispersion of an insoluble oxide and a high value of stored energy through cold work. In the as-extruded condition, both the dispersion and the cold work impede the dislocation movements. After recrystallization the only impediment to dislocation movement is the oxide dispersion. Improved ductility and higher creep rates are a result. (Author)

Massachusetts Inst. of Tech., Cambridge.
STABILIZATION OF THE MARTENSITIC TRANSFORMATION IN IRON-NICKEL ALLOYS, by John Woodilla, P. G. Winchell (Purdue U.) and Morris Cohen. Technical rept. no. 2 on Contract Nonr-1841(35). 15 Sep 59, 8p. 7 refs. AD-226 382.
Order from LC mi$1.80, ph$1.80 PB 148 565

An isothermal mode of the martensitic reaction was employed to derive the activation energy for stabilization. An Fe-Ni alloy with 30.8 wt-% Ni and 0.007 wt-% C, and in the form of rods 0.074 in. in diameter and 2 1/2 in. long were used. The specimens were sealed in evacuated Vycor tubes and austenitized at 1100°C for one-half hour prior to quenching in water. One series of specimens was decarburized (and denitrogenized) prior to the austenitizing treatment by annealing in moist H for 182 hr at 1215°C. All the specimens were transformed to martensite by cooling to -195°C before final austenitizing. Both the 0.007% C and the decarburized series then had an M_s temperature of about -30°C. The isothermal martensitic transformation was conducted at a reference temperature of -88°C, and was traced by means of electrical resistance measurements. The rate of decrease of the resistance ratio ($-dR/_{dt}$) provided a measure of the transformation rate. The stabilization treatment was introduced by up-quenching from the reference temperature to a stabilizing temperature between 0° and 22°C. In the hydrogen-annealed series, the extent of transformation during the stabilizing cycle was usually larger than in the 0.007% C series; some martensite actually formed at the stabilizing temperature as well as during the quench back to the reference temperature. The decarburized specimens displayed no sign of stabilization; this established C and/or N as the controlling agent for the stabilization phenomena.

Materials Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
ELECTRON MICROSCOPY OF ETCH PITS, by Richard E. Pawel. Rept. for Mar 58-Dec 58 on Materials Analysis and Evaluation Techniques. Oct 59, 29p. 9 refs. WADC Technical rept. 59-68; AD-231 280.
Order from OTS $0.75 PB 161 838

An advanced electron microscopic technique has been developed which uses etch pits to delineate the crystalline structure and orientation of single grains of polycrystalline copper, brass and aluminum. In addition this method has been extended to permit the study of the deformation of these materials using the direction and the extent of slippage of the slip lines to indicate the local deformation on a microscale. Suitable chemical etching and replication techniques were developed for these materials in the course of this study. (Author)

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
PRESERVATION OF WATER LUBRICATED PROPULSION SHAFT BEARINGS ON WATERBORNE VESSELS WITH RUBBER BOOT SEALS HAVING BROKEN STAINLESS STEEL CABLES, by W. B. Lew, L. N. Schultz, and L. B. Blakney. Oct 56, 24p. Rept. R-331; AD-125 965.
Order from LC mi$2.70, ph$4.80 PB 146 387

A special case is presented for preserving propulsion shaft, strut and stern tube, water lubricated bearings on waterborne vessels. Divers were required to replace the broken stainless steel cables with Monel cables. All the rubber boot seals were filled with fresh sodium chromate solution. Report covers the installations on the inactivated vessels, USS WRIGHT, USS PITTSBURGH, and USS BALTIMORE.

Minerals Research Lab., U. of California, Berkeley.
STUDIES OF ALLOY THERMODYNAMICS BY LIQUID TIN SOLUTION CALORIMETRY, by Raymond L. Orr and Ralph Hultgren. Final rept. for 1 Nov 53-31 Oct 58 on Study of Atomic Bonding Forces in Alloys, Contract DA 04-200-ORD-171, T. O. 8. 1 Apr 60, 16p. 26 refs. Series no. 76, issue no. 13; OOR rept. 906. 14-Met.
Order from LC mi$2. 40, ph$3. 30 PB 148 433

A liquid tin solution calorimeter capable of accurate measurements of alloy heats of formation as well as other types of thermodynamic measurements has been developed and applied to the thermodynamic study of a number of alloy systems. The accomplishments of this study have been reviewed mainly by reference to previous technical reports and published papers which have been submitted. The technical reports, published papers, and graduate theses resulting from this research are listed, and an evaluation is made of the progress made.

Rock Island Arsenal Lab., Ill.
STORAGE STABILITY OF PETROLATUM TYPE CORROSION PREVENTIVE COMPOUNDS, by Linden H. Wagner. 28 Apr 60, 36p. 10 refs. Rept. no. 60-1366.
Order from LC mi$3. 00, ph$6. 30 PB 148 365

Commercially formulated petrolatum base corrosion preventive compounds consisting of six Class 1A, three Class 2, and five Class 3, qualified under Military Specification MIL-C-11796A, "Corrosion Preventive, Petrolatum, Hot Application", were stored indoors in bulk containers. They were evaluated for storage stability throughout a five year period in accordance with the test requirements of Specification MIL-C-11796A. Infrared absorption spectra were determined simultaneously during the storage period for comparative purposes. Additional coated test panels were exposed in outdoor and shed storage exposure to determine the effect of prolonged weathering after 12, 15, 18, 21 and 24 months. The stability of the compounds varied so that no assurance can be given that products qualified against the specification will continue to be satisfactory beyond approximately three years when placed in storage. (Author)

Watertown Arsenal Labs., Mass.
A MECHANICAL PROPERTY FORECASTER FOR TITANIUM ALLOYS, by C. F. Hickey, Jr. and L. S. Croan. Sept 59, 16p. 2 refs. Technical rept. no. WAL TR-405. 21/2; AD-227 130.
Order from OTS $0. 50 PB 161 018

An investigation was conducted to determine if the mechanical properties of heat-treated titanium alloy forgings in various upset thicknesses can be forecasted by using thin test coupons. All upset discs were the product of the same bar and each was reduced by an equal percentage during upsetting. Ti-6%Al-4%V was selected for test material because of its widespread use as a commercial alloy. Results of the study indicate that mechanical properties of the heavier sections can be forecasted by duplicating their cooling rates in the thin upset test coupon. (Author)

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Ecole Normale Supérieure (France).
THE AXIAL VECTOR CURRENT IN BETA DECAY, by R. P. Feynman (California Inst. of Tech.) M. Gell-Mann, and M. Lévy. Technical note no. 17 on Contract AF 61(052)173. [1960] 30p. 20 refs. AFOSR-TN-60-294; AD-234 428.
Order from LC mi$2.70, ph$4.80 PB 146 551

In order to derive in a convincing manner the formula of Goldberger and Treiman (Phys. Rev. 110:1478, 1958) for the rate of charged pion decay, the possibility is considered that the divergence of the axial vector current in β decay may be proportional to the pion field. Three models of the pion-nucleon interaction (and the weak current) are presented that have the required property. The first, using gradient coupling, has the advantage that it is easily generalized to strange particles, but the disadvantages of being unrenormalizable and of bringing in the vector and axial vector currents in an unsymmetrical way. The second model, using a strong interaction proposed by Schwinger and a weak current proposed by Polkinghorne, is renormalizable and symmetrical between V and A, but it involves postulating a new particle and is hard to extend to strange particles. The third model resembles the second one except that it is not necessary to introduce a new particle. (Renormalizability in the usual sense is then lost, however). (Author)

Institute of Theoretical Physics, Stanford U., Calif.
COUPLED INTEGRAL EQUATIONS FOR THE NUCLEON AND PION ELECTROMAGNETIC FORM FACTORS, by M. Baker and F. Zachariasen. Technical note no. 10 on Contract AF 49(638)388. Feb 60, 47p. 5 refs. AFOSR-TN-60-184; AD-233 730.
Order from LC mi$3.30, ph$7.80 PB 147 334

The dispersion relations for the nucleon isotopic vector form factors and the pion form factor which take into account contributions from both the 2π and NN intermediate states become a set of coupled integral equations for the form factors if the four amplitudes $(\pi\pi|NN)$ $(\pi\pi|\bar{\pi}\bar{\pi})$ $(NN|\pi\pi)$ $(NN|\bar{\pi}\bar{\pi})$ are assumed known. If these 4 amplitudes are replaced by their Born approximation values and spin and certain kinematic factors are neglected, the resulting set of coupled singular integral equations can be solved exactly. Comparison of these exact solutions with the form factors obtained from the usual approximation of retaining only

the lowest mass state (i.e. the 2π state) confirms the hope that high mass states do not contribute much to dispersion integrals. It is also of interest that these solutions are obtained from dispersion relations without subtractions and satisfy the necessary conditions that they vanish at infinite momentum transfer and take on the value at the origin for all values of the coupling parameters appearing in the equations. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
NUCLEON STRUCTURE AND ELECTROMAGNETIC INTERACTION: THEORY, by L. I. Schiff. Technical note no. 3 on Contract AF 49(638)388. July 59, 29p. AFOSR TN-59-900; AD-226 977.
Order from LC mi$2.70, ph$4.80 PB 146 471

Presentation is in four parts. (1) A consideration of corrections to the single-virtual-photon approximation that can arise in electron scattering processes. (2) Information on nucleon form factors obtainable from experiments involving polarized particles, and from pion production. (3) Theory of the nucleon form factors. (4) Possible breakdown of quantum electrodynamics at small distances. (To be published in the Proceedings of the 9th International Conference on High-Energy Physics, Kiev, USSR, July 1959.)

Maryland U., College Park.
DETERMINATION OF K^+-n P-WAVE PHASE SHIFTS FROM K^+-d REACTIONS, by T. B. Day, L. S. Rodberg and others. Rept. on Contracts AF 49(638)24 and AT(40-1)2504. Mar 60, 11p. 6 refs. Physics Dept. technical rept. no 166; AFOSR-TN-60-306; AD-234 300.
Order from LC mi$2. 40, ph$3. 30 PB 146 642

Michigan U. Research Inst., Ann Arbor.
COSMIC RAY INVESTIGATIONS. Annual progress rept. on Contract Nonr-1224(07). 15 June 59, 6p. AD-218 102.
Order from LC mi$1. 80, ph$1. 80 PB 147 261

Naval Radiological Defense Lab., San Francisco, Calif.
OXIDATION STATES OF U^{237} AND Np^{239} IN UNDERWATER BURST DEBRIS, by S. C. Foti and E. C. Freiling. 24 Sep 59, 16p. 13 refs. Research and development technical rept. USNRDL-TR-370; AD-231 331.
Order from LC mi$2. 40, ph$3. 30 PB 147 940

A procedure is described which separates the U and Np present in seawater into their various oxidation states. Application of the procedure to ultrafiltrates of surface water samples from an underwater burst and a lagoon bottom burst is described. Results are presented as a function of time and correlated with physical state distributions made on the same samples. (Author)

Elementary Particles

California U., Berkeley.
X-RAY YIELDS FROM u-MESONIC ATOMS, by M. A. Ruderman. Rept. on Contract AF 49(638)327. Dec 59, 38p. 23 refs. AFOSR-TN-60-118; AD-233 715.
Order from LC mi$3. 00, ph$6. 30 PB 146 745

The interesting suggestion was made that the rapid drop in the yield of K X-rays in the light elements may be associated with the capture of μ-mesons into the metastable 2s-state. The mechanisms for making transitions from the 2s to the 1s state and from various ρ-states into the 2s state were investigated in detail for Li, Be and B. It is found that the paradoxical reduction of K X-rays remains unexplained.

Cambridge U. (Gt. Brit.)
LOW ENERGY PION PHENOMENA, by J. Hamilton and W. S. Woolcock. Scientific note no. 2 on Contract AF 61(052)233. Oct 59, 33p. 43 refs. AFOSR-TN-59-1314. AD-234 215.
Order from LC mi$3.00, ph$6.30 PB 146 739

The relation between low energy pion-nucleon scattering and pion photo-production is examined. Correct extrapolation to threshold of both the π^+ and π^- photoproduction data gives agreement with theory. A recent new method for analysing the scattering data is applied, giving $a_1 = 0.178$, $a_3 = -0.87$, and reasonable agreement with the Panofsky ratio $P = 1.5$ is obtained. An inner Coulomb correction to the scattering data helps to improve this agreement. The possibility of detecting a π-π interaction by low energy pion scattering is examined. A new dispersion relation connects the s- and p-wave phase shifts at low energies; this relation excludes some well known sets of phase shift curves. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
UPPER BOUNDS ON SCATTERING LENGTHS FOR STATIC POTENTIALS, by Larry Spruch and Leonard Rosenberg. Rept. on Contract AF 19(604)4555. Oct 59, 34p. 25 refs. Research rept. no. CX-43, AFCRC-TN-59-669; AD-233 305.
Order from LC mi$3.00, ph$6.30 PB 146 566

It is shown that in the zero energy scattering of a particle by a center of force, where no bound state exists, the Kohn variational principle provides an upper bound on the scattering length. A bound may also be obtained from Hulthén's method, although with the same form of trial function the Kohn result will be lower (and therefore better) than the one obtained from the Hulthén principle. The Rubinow formulation need not provide a bound; for those calculations which have been performed in this form, the results may be converted without any further calculations so that they correspond to the Kohn form, and therefore, under the circumstances considered, do give a bound. Analogous results hold for states of non-zero orbital angular momentum. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
HIGH ENERGY ELECTRON-ELECTRON SCATTERING, by Yung-Su Tsai. Technical note no. 16 on Contract AF 49(638)388. May 60, 69p. 26 refs. AFOSR-TN-60-546.
Order from LC mi$3.90, ph$10.80 PB 148 163

The radiative corrections to the electron-electron scattering to order α^3 are calculated for (1) the colliding beam experiment and (2) the experiment in which the target electron is at rest initially. The contributions from high energy real photons are included. The two photon exchange diagrams are found to give only negligible contributions to the cross sections after infrared cancellation. The effect due to the possible breakdown of quantum electrodynamics is discussed. A preliminary study on the electron-positron colliding beam experiment involving various interactions is made. The vacuum polarizations involving heavier particles than an electron pair in the closed loop are investigated. (Author)

Maryland U., College Park.
ON THE DECAY INTERACTION OF STRANGE PARTICLES, by B. Sakita (U. of Wisconsin) and S. Oneda. Rept. on Contract AF 49(638)24. Feb 60, 16p. 20 refs. Physics Dept. Technical rept. no. 165; AFOSR-TN-60-304; AD-234 727.
Order from LC mi$2.40, ph$3.30 PB 147 443

It is proposed that the strength of the coupling constants is different for the strangeness non-conserving and strangeness conserving currents in the scheme of Fermi interactions of an ordinary charged current-current type. First, the consistency with experimental results is analyzed by introducing phenomenologically the direct Λn interaction which satisfies the $|\Delta I| = 1/2$ rule in addition to the usually assumed primary Fermi interaction. Then, the possibility of the derivation of this interaction as the effective interaction of the primary Fermi interactions is discussed. (Author)

New York U. Coll. of Engineering, N. Y.
A THOMAS-FERMI TECHNIQUE FOR DETERMINING CHARACTERISTICS OF ALKALI ATOMS WITH EXCITED VALENCE ELECTRONS, by Harvey J. Brudner. Technical rept. no. 4 on Contract Nonr-285(15). 1 July 59, 147p. 78 refs. AD-228 163.
Order from LC mi$7.20, ph$22.80 PB 146 968

A technique is developed for the calculation of excited state, one-electron wave functions which is based on the Thomas-Fermi statistical theory of the atom. The case most immediately applicable to calculation via a Thomas-Fermi technique is that of an alkali atom with an excited valence electron since the remaining electrons form a full, symmetric core, all of whose electrons are in the ground state. The technique developed allows for correction for the penetration of the excited electron's wave function, and for semi-empirical correction of polarization and exchange effects. A special, very accurate, numerical technique for solving the Thomas-Fermi differential system for an arbitrary positive ion is described. The Thomas-Fermi potential is then used as a central field in the Schrödinger equation together with the Heisenberg type of polarization energy correction. Angular dependence is assumed to be capable of separation (an approximation also made in Hartree theory), and 2 basic techniques for solving the radial Schrödinger equation are discussed. (Author)

Nuclear Development Corp. of America, White Plains, N. Y.
CONTINUUM THEORY OF GAMMA RAY SPECTRA FOLLOWING INELASTIC SCATTERING, by E. S. Troubetzkoy. Final rept. for 17 Dec 58-30 Sep 59 on Contract DA 18-108-405-cml-295. 1 Nov 59, 12p. NDA 2111-3, Vol. B; AD-233 928.
Order from LC mi$2.40, ph$3.30 PB 146 778

A theory predicting gamma-ray spectra following inelastic scattering of fast neutrons is derived on the basis of the continuum model. The problem is reduced to integrals over the solution of a fourth order differential equation. (Author)

Weizmann Inst., of Science (Israel).
RESEARCH ON THE INTERACTION OF VERY HIGH ENERGY COSMIC RAY PARTICLES. Technical final rept. for 1 Apr 58-30 Sep 59 on Contract AF 61(052)58. [1959] 40p. 32 refs. AFCRC-TR-60-211
Order from LC mi$3.00, ph$6.30 PB 146 706

The work performed under this contract is reported in three sections: The Excited Nucleons' Model of Meson Production. On the Radiation of Mesons with a Constant Transverse Momentum P_T in Cosmic Ray Jets. Nuclear Interaction of Heavy Cosmic Ray Particles in Photographic Emulsion.

Instruments and Installations

Armour Research Foundation, Chicago, Ill.
RESEARCH ON SCINTILLATION CRYSTALS AND THEIR ACTIVATORS. I. ZONE MELTING AND ZONE LEVELING OF LiI(Tl). II. COMPACTION AND ACTIVATION OF SCINTILLATORS. III. EFFECT OF COLOR CENTERS ON THE SCINTILLATION OF KI(Tl), by Harold V. Watts, Robert H. Bragg and others. Rept. for 1 June 56-14 May 58 on Contract AF 33(616)3748. July 58, 67p. 17 refs. WADC Technical rept. 58-380; AD-155 861.
Order from OTS $1.75 PB 161 870

In the preparation and growth of impurity activated inorganic scintillators one faces the problems of undesirable impurities in the starting material and of difficulties in many host-activator systems in maintaining uniform activator concentration over reasonable distances. The techniques of zone melting and zone leveling were applied to the preparation of thallium activated lithium iodide. Lithium iodide was successfully purified by zone melting; and a thallium doped ingot prepared by zone leveling the pure lithium iodide was found to be a scintillator of optimum pulse height with a uniform thallium concentration, maintained for about half of the total ingot length of eight inches. Many of the problems of production of scintillators by crystal growth methods may be by-passed by the successful application of the high pressure compaction technique to the production of scintillators. The compaction technique allows the usage of diverse activation methods in the preparation of scintillators. Some of these methods have been investigated. Since the creation and ionization of color centers are processes which compete with scintillation for the energy absorbed from the impinging nuclear radiation, a correlation of luminescence characteristics versus color center concentrations was studied to gain insight into the details of the influence of defects in scintillators.

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PORTABLE LOW-LEVEL ALPHA COUNTER FOR FIELD USE, by Arthur Lind and John C. Goshorn, Jr. Mar 60, 13p. CWLR-2378.
Order from LC mi$2.40, ph$3.30 PB 148 228

A proportional-probe alpha-survey meter (Nuclear Chicago model 2111) has been modified into an enclosed-chamber-type alpha counter, using a multiplier-phototube, alpha scintillator, and a housing designed to accept swipes. The modified instrument is both reliable and sensitive enough to detect very low levels of alpha contamination. The major improvement in reliability is the elimination of the air probe which was subject to high-voltage leakage and microphonics. (Author)

Materials Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
ATTEMPT TO EVALUATE CHLORINATED HYDROCARBON DOSIMETERS BY CROSS CALIBRATING ELEVEN GAMMA RAY SOURCES, by Robert L. Hickmott, Maurice J. Cote, and Philip B. Hemmig. Rept. for Mar 58-Nov 59 on Materials Analysis and Evaluation Techniques. Nov 59, 18p. WADC Technical note 59-401.
Order from OTS $0.50 PB 161 875

An evaluation of the chlorinated hydrocarbon dosimetry system of Convair, Fort Worth was attempted. The evaluation consisted of two phases. The first phase tested the precision of the dosimetry system. It involved the irradiation of thiry five single dosimeters at WADC. The second phase was intended to field test the dosimetry system. It was also hoped that data from this phase would permit the cross calibration of the participating facilities. Data obtained in this program is presented with an analysis of the results. (Author)

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
OPTICALLY ACTIVE ORGANIC COMPOUNDS AS HIGH LEVEL GAMMA DOSIMETERS, by Stanley M. Dec. Rept. for Aug 58-June 59 on Materials Analysis and Evaluation Techniques. Feb 60, 39p. 9 refs. WADC Technical rept. 59-711.
Order from OTS $1.00 PB 161 881

This project was initiated in order to develop a dosimeter system which could extend the range of current dosimeter methods. A new technique was used, wherein the effects on the rotation of optically active organic compounds were determined with gamma radiation. Data was presented for fourteen optically active compounds. Several potential dosimeter systems were uncovered indicating linear, or near linear response in the degradation of optical activity as a function of total gamma dose up to 4×10^{10} ergs $gram^{-1}$ carbon. Further investigation is recommended to develop the systems. Calibration, reproducibility, sensitivity to impurities, dose rate dependence, and irradiation to higher dose levels are factors which should be considered. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
RECYCLING DOSERATE METER RGI-20, by E. J. Wesley and T. L. Sheridan. 18 May 59, 29p. 2 refs. Research and development technical rept. USNRDL-TR-323; AD-220 474.
Order from LC mi$2.70, ph$4.80 PB 148 372

A hybrid tube plus transistor blocking oscillator system was adapted to a high range gamma doserate meter for disaster survey applications. The instrument features single battery operation, a hermetically sealed input consisting of the ion chamber detector and electrometer tube, and low impedance range switching at the meter. Included is a summary of the design criteria and formulas for both the ion chamber detector and the recycling circuit, with particular reference to the mechanism of compensation for battery voltage and ambient temperature changes. The calibration setting for the instrument is maintained within 5% for battery voltage drift from 1.5 to 1.1 v and temperature changes from 55°C to -40°C. (Author)

Nuclear Science and Engineering Corp., Pittsburgh, Pa.
OPERATION AND MAINTENANCE MANUAL. 8-COUNTER LOW BACKGROUND NUCLEAR RADIATION MEASUREMENT SYSTEM. Final rept. on Contract AF 19(604)3874. 18 Jan 60, 54p. AFCRC TR-60-112; AD-233 727.
Order from LC mi$3.60, ph$9.30 PB 146 382

The 8-counter low-background nuclear radiation measurement system is a device designed to measure minute quantities of radioactivity. Each counter is independent of the other counters, both electronically and mechanically, so that the individual sample changes may be made in any counter without disturbing operation of the other counters. Thus, in addition to providing a means of measuring levels of radioactivity that are not easily measured by conventional detection devices, the system provides for efficient use of the equipment by allowing eight samples to be counted at one time for the relatively long counting periods required to obtain a statistically sufficient number of counts. (Author)

Nuclear Engineering and Power

Combustion Engineering, Inc., Windsor, Conn.
OXYGEN REMOVAL FROM REACTOR WATER BY A COPPER AMMINE COMPLEX EXCHANGE RESIN, by A. S. Powell and E. V. Falcone. Rept. on Contract DA 44-192-eng-11.18 Dec 59, 13p. 5 refs. CEND/2407/RS/68.
Order from LC mi$2.40, ph$3.30 PB 147 042

Tests of a copper ammine complex exchange resin were made by flowing either air or oxygen-saturated water through a 30 in. long glass column containing 0.00018 ft.^{3} (50 ml) of the resin at the start of each test. Water flows of 6, 8 and 12 gpm/ft.^{3} (41.6, 55.5 and 83.3 ml/min) at 120, 150, 175 and 200°F and pH's 6, 7 and 8 were used. Oxygen in inflowing water was determined by the Winkler method; that in water leaving the bed by the Indigo-Carmine method. Flow was continued until effluent reached 0.1 ppm oxygen. The amount of oxygen removed did not vary with change in flow rate, pH or temperature. Some resin broke down during runs, particularly at the highest temperature, causing high pressure drops and low oxygen removals. Total solids in effluents ranged from 8 ppm at the start of a run to 111 ppm at the end. Analyses of effluent water showed a maximum of 1.2 ppm copper content. Regeneration of the resin columns was complex and caused leaching of copper oxides. Successive regenerations caused the resin to break down into fines which blocked flow through the column.

Institute of Engineering Research, U. of California, Berkeley.
THE ELASTIC-PLASTIC CYLINDER SUBJECTED TO RADIALLY DISTRIBUTED HEAT SOURCE, LATERAL PRESSURE AND AXIAL FORCE WITH APPLICATION TO NUCLEAR REACTOR FUEL ELEMENTS, by T. B. Kammash, S. A. Murch, and P. M. Naghdi. Technical rept. no. 1 on Contract DA 04-200-ORD-171, continuation of U. of Michigan Contract DA 20-018-ORD-14447. July 59, 40p. 14 refs. Series 130, issue 1; OOR rept. 2275.1-E; AD-226 197.
Order from LC mi$3.00, ph$6.30 PB 148 437

The elastic-plastic deformation of a solid cylinder in the presence of a distributed heat source and subjected to a lateral pressure p and an axial force F is considered in detail using Tresca's yield function, its associated flow law, and a linear work-hardening law Particular attention is given to the class of problems in which the radial stress, and not the axial stress, is the intermediate principal stress. The general results are applied to the cylindrical nuclear reactor fuel element in the state of plane strain with a radially distributed Gaussian heat source, acting in its fissionable interior. The solution is expressed in closed form in terms of the exponential integral and the incomplete gamma function and is found to exhibit 3 stages of plastic deformation. In stage I the plastic domain consists of 2 concentric and adjacent zones with different stress fields and different rates of propagation which expand outward from the center of the cylinder; in stage II the elastic domain vanishes, while the inner plastic zone continues to propagate; and in stage III a third plastic zone is formed at the outer radius which propagates inward. Throughout the deformation the states of stress are found to exhibit regular progression. A numerical example is included. (Author)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
THE NEPA CRITICAL EXPERIMENT FACILITY: MATERIALS FOR ANP ZERO POWER REACTOR EXPERIMENTS, by F. T. Bly. 16 Apr 51, declassified 31 Aug 57, 47p. NEPA 1829, Appendix C of NEPA 1769.
Order from LC mi$3.30, ep$9.30 PB 149 472

Contents:
Geometry of zero power reactor blocks
Quantity of materials
Purity of materials
Density of materials
Cost of materials

Nuclear Reactions

Avco Research Lab., Everett, Mass.
LOW ENERGY ELASTIC SCATTERING ON ELECTRONS BY OXYGEN AND NITROGEN, by P. Hammerlind, W. W. Shine, and B. Kivel. Rept. on Contract AF 04(645)18. Mar 57, 19p. 9 refs. Research rept. 6 (formerly Research note 31) AD-150 621.
Order from LC mi$2.40, ph$3.30 PB 147 395

The elastic scattering of slow electrons by O and N is calculated by the method of phase shifts. The Hartree potential gives a cross section (2×10^{-15} cm^2) for O on the order of magnitude needed to agree with the experiments of Lamb and Lin in air. Since the Hartree potential is known to be too weak as it neglects exchange and polarization, this agreement is considered fortuitous. Exchange forces are introduced by a new approximation based on a suggestion of Slater for bound atomic states. The exchange approximation is adjusted to fit the more elaborate calculation of Bates and Massey for zero energy and zero polarization. The addition of a reasonable polarization force results in an acceptable potential and closer agreement with experiment. A similar calculation is made for nitrogen. In this case the Hartree potential alone gives a cross section which is too large. The inclusion of exchange and polarization leads to better agreement with the measurements in air. (Author)

Nuclear Development Corp. of America, White Plains, N. Y.
FAST NEUTRON CROSS SECTIONS OF IRON, SILICON, ALUMINUM AND OXYGEN, by E. S. Troubetzkoy. Final rept. for 17 Dec 58-30 Sep 59 on Contract DA 18-108-405-cml-295. 1 Nov 59, 58p. 54 refs. NDA 2111-3, Vol. C; AD-233 939.
Order from LC mi$3.60, ph$9.30 PB 146 779

A set of neutron cross sections for iron, silicon, aluminum, and oxygen has been prepared for energies up to 18 Mev. The cross sections tabulated include

σ_T, σ_{nn}, σ_{nn}, σ_{nx}, $\sigma_{n\gamma}$, $\sigma_n(\theta)$, $\sigma_{nn'}(E, E')$, $\sigma_{nn'\gamma}(E, E_\gamma)$, σ_{n2n}, and cross sections for charged particle emission. (Author)

Pennsylvania U., Philadelphia.
TOTAL GAMMA ABSORPTION IN C^{12}, N^{14}, O^{16}, AND Al^{27} AT 20 MEV, by Edward E. Carroll, Jr. Technical rept. no. 5 [6] on Contract Nonr-551(17). Sep 59, 130p. 107 refs. AD-235 189.
Order from LC mi$6.30, ph$19.80 PB 148 591

Total gamma absorption cross-sections of C^{12} from 20.0 to 21.15 Mev, and of N^{14}, O^{16}, and Al^{27} from 20.0 to 20.5 Mev, were measured using monochromatic gamma rays. A direct absorption technique was used in which samples were placed between the target of an electrostatic generator, and large sodium-iodide scintillation detectors. Monochromatic photons from the $T^3(p,\gamma)He^4$ reaction were varied in energy by changing the energy of the incident protons. The C^{12} cross-section showed pronounced structure with resonances resolved at 20.15 Mev, 20.46 Mev, and 20.92 Mev, with integrated cross-sections of 1.1, 1.0, and 6.6 Mev-millibarns respectively. Oxygen showed a sharply rising cross-section suggesting a strong resonance peaked above about 20.5 Mev. The cross-sections of N^{14} and Al^{27} were smooth over the energy interval investigated. (Author)

Vienna U. (Austria).
ON THE RENORMALIZATION OF BETA COUPLING, by K. Baumann and A. Hõld. Scientific note no. 1 on Contract AF 61(052)265. 17 Nov 59, 5p. 5 refs. AFOSR-TN-60-26; AD-232 391.
Order from LC mi$1.80, ph$1.80 PB 146 712

The renormalization of the vector and axial vector current is calculated for a single Dirac field which is coupled to itself. A nonlocal Fermi-type interaction is introduced which has been treated by Abrikosov et al (Phys. Rev. 111:321, 1958). In the limit of small nonlocality the renormalization can be performed nonperturbationally. The vector nonrenormalization and an axial vector renormalization factor are found to be greater than one. (Author)

Radioactivity

Cuyo U., Mendoza (Argentina).
THE OSCILLOSCOPE METHOD OF MEASURING NUCLEAR HALF-LIVES, by I. Bergström, E. Bonacalza and others. Technical note no. 2 on Contract AF 61(052)118. 1 Feb 60, 39p. 23 refs. AFOSR-TN-60-295; AD-234 429.
Order from LC mi$3.00, ph$6.30 PB 146 643

It is shown that the modern fast oscilloscopes now available commercially are very simple and powerful tools for measuring nuclear half-lives. The advantages and the limitations of the method are discussed. In order to illustrate the problems which are associated with measurements in different half-life regions, seven half-lives associated with metastable states in nuclei were measured. The oscilloscope method can be used in the whole region where conventional delayed coincidence technique is applicable. A very great advantage of the oscilloscope method is that above about 1 μs, it can be very easily used as a multi-channel time analyzer, by continuously photographing the events on the oscilloscope screen.

Naval Radiological Defense Lab., San Francisco, Calif.
ACTIVITY-SIZE RELATIONSHIP OF FALLOUT PARTICLES FROM TWO SHOTS, OPERATION REDWING, by H. K. Chan. 19 Feb 59, 71p. 10 refs. Research and Development Technical rept. USNRDL-TR-314; AD-233 607.
Order from LC mi$4.50, ph$12.30 PB 146 474

The activity of coral fallout particles was studied as a function of individual size. Single particles from 2 shots at Operation Redwing were sized and identified as being of a spheroidal, irregular or dendrite-like type and then measured for gamma activity. Two particle size parameters were employed, equivalent projected area diameter (D_a) and maximum diameter (D_m). The study shows that an extensive range of activities is associated with each size and size-type group. Field data taken at one station indicate that the activities of a size-type group follow a normal distribution. According to the same data the activity varies as $D_a^{2.2}$ and $D_m^{1.7}$ for irregular particles, $D_a^{3.7}$ for spheriodal particles, and $D_m^{2.1}$ for dendrite-like particles. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Arctic Aeromedical Lab., Ladd AFB, Alaska.
AN EVALUATION OF SOME SURVIVAL GILL NETS, by T. Saunders English. Mar 57, 14p. 3 refs. Technical note AAL-TN-57-3.
Order from LC mi$2.40, ph$3.30 PB 146 621

This study was to examine the survival gill nets supplied to compare the types of nets available and to find a quantitative expression of the amount of food to be expected from fishing with a survival net in at least a few situations. The desirable knowledge seems to include information on whether to use the net and, successively, where, how, and for what duration. The appendix is offered in an attempt to supply such in information.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EXCHANGE OF RADIANT ENERGY BETWEEN CLOTHED MEN AND A DESERT ENVIRONMENT, by A. A. Woodward, W. V. Blevins, and C. M. Greenland. Feb 60, 47p. 22 refs. CWLR-2354.
Order from LC mi$3.30, ph$7.80 PB 148 029

Direct measurements were made of the intensity of direct solar radiation and of sources of diffuse radiation in a desert environment. These showed complex diurnal variation, but followed a regular pattern from day to day. The contributions of each source

to the thermal load on clothed men was also measured. Despite large differences in intensity between solar radiation and diffuse radiation, the actual amount of heat absorbed by clothed men from each of these sources is about the same. (Author)

Material Lab., New York Naval Shipyard, Brooklyn
INVESTIGATION OF CURRENT COMMERCIAL DEVELOPMENTS IN SUNGLASSES WITH POSSIBLE APPLICATIONS FOR MILITARY USE, by L. Banet. Final rept. 30 Dec 58, 31p. 6 refs. Lab. Project 5898-2; AD-225 236L.
Order from LC mi$3.00, ph$6.30 PB 147 241

Data on lens and frame materials were received from twelve manufacturers, including visible light transmission characteristics, optical tolerances, and current prices. The only improvement noted in the survey was the improved abrasion resistance of polarized lenses, which was corroborated by laboratory experiments; no significant improvement in plastic frame materials was observed. In the absence of a satisfactory substitute for the military sunglass specified in Jan-G-475, criteria were developed for desired improvements in design and materials of military sunglasses.

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
A LENS SYSTEM FOR THE MILITARY GENERAL PURPOSE GOGGLES, by L. Banet and M. Kleinman. Final rept. 24 Sep 59, 30p. 11 refs. Lab. Proj. 6159; AD-235 272.
Order from LC mi$2.70, ph$4.80 PB 147 251

The development of a double lens system was initiated to meet the objections which arise from fogging. The literature was reviewed for the purpose of eliciting useful methods for reducing fogging; anti-fog coatings, anti-dim discs, double-layer lenses, various types of air circulators and electrically heated coatings were employed with varying degrees of success. As a satisfactory solution to the fogging problem, a rubber gasket adapter was designed which fits over the standard frame and which secures a second, spare lens of the kit above the standard lens. Two additional modifications of the double-lens are suggested to improve the effectiveness of the system: The first is a thermo-double lens utilizing metallic coatings, and the second involves use of anti-dim inserts of an Ansco material. Prototypes of coated lenses and anti-dim inserts were fabricated. (Author)

PHYSICS

Texas U., Austin.
EFFECTS OF PRESSURE ON PROTON SPIN-LATTICE RELAXATION IN SEVERAL ORGANIC LIQUIDS, by A. W. Nolle and P. P. Mahendroo. Technical rept. no. 10 on Contract Nonr-375(05). 6 Aug 59, 16p. 13 refs. AD-225 928.
Order from LC mi$2.40, ph$3.30 PB 148 142

The proton longitudinal nuclear magnetic resonance relaxation time (T_1) is measured at 29 mc for pressures up to 1400 kg/cm^2 in degassed samples of toluene, benzene, cyclohexane, methyl iodide, 1, 1, 1-trichloroethane, n-heptane, and chloroform. The results are compared with data of Benedek and Purcell [J. Chem. Phys. 22:2003, 1954], who found for several liquids that T_1 decreases with pressure much less rapidly than the reciprocal of the viscosity. For globular and linear molecules (e.g., methyl iodide, n-heptane), the earlier conclusions are not affected by use of degassed samples. For the aromatic molecules, however, T_1 in degassed samples varies roughly with the reciprocal viscosity or the self-diffusion coefficient, contrary to the result obtained without degassing. This is taken to mean that rotational and translational jump rates are reduced by comparable amounts upon application of pressure to these liquids. (Author)

Acoustics

Armed Forces-NRC Committee on Hearing and Bio-Acoustics, St. Louis, Mo.
CHABA ANNUAL REPORT NO. 6, by Hallowell Davis, Donald H. Eldredge, and Shirley K. Hirsh. Technical rept. no. 16, 1 June 58-31 May 59, on Contract Nonr-1151(01). June 59, 46p. 24 refs. AD-219 759.
Order from LC mi$3.30, ph$7.80 PB 146 692

See also PB 142 548

David Taylor Model Basin, Washington, D. C.
THE NEAR-SOUND FIELD OF TURBULENCE, by G. J. Franz. Oct 59, 38p. 24 refs. Rept. 982.
Order from LC mi$3.00, ph$6.30 PB 148 855

General expressions for the velocity potential, particle velocity, instantaneous sound pressure, mean-square sound pressure, and sound intensity for the sound generated by turbulence are derived, starting from Lighthill's fundamental relations for the density fluctuations in the medium outside a turbulent region. The dipole radiation from the turbulent boundary layer of a rigid boundary, the quadrupole radiation from isotropic turbulence, and the lateral quadrupole radiation from turbulence in the presence of a large mean shear are discussed. The frequency spectra and directional patterns of the sound observed at points in the sound field that are much less than a wavelength from multipole sound sources are shown to differ significantly from the frequency spectra and directional patterns of the sound observed at points in the sound field that are many wavelengths from the multipole sound sources. (Author)

General Applied Science Labs., Inc., Westbury, N. Y.
THE OSCILLATION AND NOISE OF AN OVER-PRESSURE SONIC JET, by Andrew G. Hammitt. Rept. on Contract AF 49(638)194. Nov 59, 40p. 4 refs. GASL Technical rept. no. 137; AFOSR-TN-59-1307; AD-233 878.
Order from LC mi$3.00, ph$6.30 PB 146 364

A series of experiments on plane 2-dimensional and axially symmetric over pressure sonic jets was performed to study the oscillating behavior of the jet and accompanying sound field. Shadowgraphs were obtained which show the oscillations and generation of the sound waves for the plane 2-dimensional jet in some detail; but similar results could not be obtained for the axially symmetric jet. Measurements from these pictures show that the oscillating jet and sound fields can be described in terms of the length of the shock wave cells. The importance of the sound waves acting upon the base of the jet is demonstrated, and it is found that the jet can be stabilized by shielding its base from these sound waves. (Author)

Michigan U. Research Inst., Ann Arbor.
APPLICATIONS OF SIGNAL DETECTABILITY THEORY TO PSYCHOPHYSICAL RESEARCH: A BIBLIOGRAPHY, by C. D. Creelman. Technical memo. no. 79 on Contract AF 19(604)2277. June 60, 15p. 149 refs. 2659-10-T; AFCCDD-TN-60-14.
Order from LC mi$2.40, ph$3.30 PB 148 802

Michigan U. Research Inst., Ann Arbor.
DETECTION OF SIGNALS OF UNCERTAIN FREQUENCY, by C. D. Creelman. Technical memo. no. 71 on Contract AF 19(604)2277. Sep 59, 25p. 10 refs. 2659-5-T; AFCRC-TN-59-60.
Order from LC mi$2.70, ph$4.80 PB 148 800

Alternative models for extension of frequency sensitivity in human observers are discussed. One decision procedure for a multiple filter model is considered in some detail as a general model for decision situations in which each available response specifies a subset of the signal alternatives. Two experiments were conducted in an attempt to choose between a sweeping-filter model and a multiple-filter model. Detection in a two-alternative forced-choice experiment in which the signal could be one of two possible signals was measured as a test of the two models. The data, in connection with other available studies, are taken to show the need for a more complex model for auditory discrimination. (Author)

Michigan U. Research Inst., Ann Arbor.
THE THEORY OF SIGNAL DETECTABILITY AS IN INTERPRETIVE TOOL FOR PSYCHOPHYSICAL DATA, by W. P. Tanner, Jr. Technical memo. no. 78 on Contract AF 19(604)2277. May 60, 33p. 12 refs. 2659-9-T; AFCCDD-TN-60-13.
Order from LC mi$3.00, ph$6.30 PB 148 801

The theory of signal detectability is examined from the standpoint of determining a set of satisfactory assumptions for the purpose of developing an interpretive tool for use in psychophysical experiments. It is concluded that the assumption that the observer attempts to maximize the expected value of the outcome of the experiment is satisfactory for this purpose, and that a set of physical conditions can be established which justify a computation of the detectability of a signal in noise based on a finite sampling plan involving 2WT amplitude values over the open interval, O to T. (Author)

Middle Tennessee State Coll., Murfreesboro.
SOUND ABSORPTION IN THE HALOGEN GASES, by F. D. Shields. Final rept. on Relaxation Process in Gases, Contract Nonr-2347(00). [1959] 20p. 16 refs. AD-225 391.
Order from LC mi$2.40, ph$3.30 PB 148 576

Apparatus has been constructed for measuring sound absorption by the tube method in corrosive gases at high temperatures. This apparatus has been used to measure sound absorption in chlorine, bromine and iodine vapors at temperatures between 25 and 256°C. The measurements revealed vibrational relaxation absorption peaks in all the gases. In Cl_2 the relaxation times varied from 4.90 μsec at 25°C to 1.55 μsec at 255°C. In Br_2 the variation was from 0.854 μsec at 28°C to 0.460 μsec 256°C. In I_2 the relaxation time was almost independent of temperature, changing only from 0.106 to 1.102 μsec when the temperature changed from 112 to 253°C. The heights of the absorption peaks were adequately predicted by assuming the relaxing vibrational specific heat to be C_p - 7/2 R. Neither the Schwartz-Herzfeld nor Cottrell-Ream theoretical equations for the relaxation time accurately predict the measured variation with temperature, molecular mass and vibrational frequency. (Author)

Naval Ordnance Test Station, China Lake, Calif.
BIOLOGICAL ENVIRONMENT AS RELATED TO THE TRANSMISSION OF SOUND IN THE SEA. THE DEEP SCATTERING LAYER, by Giorgio Soli. 28 July 59, 18p. 37 refs. NOTS TP 2309; NAVORD rept. 6581; AD-226 614.
Order from LC mi$2.40, ph$3.30 PB 148 447

The deep scattering layer is formed by a concentration of marine animals living at a depth of 300-800 meters. It can be found in every part of the world and has the characteristic of performing a diurnal vertical migration of several hundred meters. Only planktonic animals and certain fishes may show a vertical migration of the type pecular to the deep scattering layer. The organisms that constitute the layer have not been clearly identified.

Psycho-Acoustic Lab., Harvard U., Cambridge, Mass.
PERIODIC STATUS REPORT XXXIII. Rept. for 16 Nov 58-15 May 59 on Contract Nonr-1866(15). 15 May 59, 21p. 77 refs. PNM-82.
Order from LC mi$2.70, ph$4.80 PB 146 685

The list of reports published here starts with PNR-151 (Psycho-Acoustic Navy Report) and contains references to all research published since mid-1954. Copies of the full list (PNR-1 to the present) are available on request. The designation "PAL" in this list indicates that the report was reproduced and distributed directly by the Psycho-Acoustic Laboratory. When no date of publication is given, it indicates that the article has not yet appeared in print. (See also PB 144 685)

Electricity and Magnetism

Army Signal Research and Development Lab., Fort Monmouth, N. J.
ANTENNA PROBLEMS OF MEASUREMENT OF THE AIR-EARTH CURRENT, by Heinz W. Kasemir and Lothar H. Ruhnke. 15 Apr 59, 16p. 3 refs. USASRDL Technical rept. 2022; AD-228 435.
Order from LC mi$2.40, ph$3.30 PB 146 342

The antenna used to collect the air-earth current often distorts the lines of current flow in the air. It also introduces other voltage sources such as the volta potential from the wire or metal plate or piezoelectric charges from cables and insulators. These voltage sources may make the measurement of the air-earth current faulty. This report shows under what conditions a true current measurement is achieved and how the influence of the volta potential and piezoelectric effect can be avoided. A method is described whereby the model factor of even complicated antenna forms can be determined by a simple capacity measurement. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DEVELOPMENT OF MAGNETOSTRICTIVE AND RELATED MATERIALS, Final progress rept., Part 2, 10 Apr 52-9 Apr 54, on Contract AF 18(600)302. [1954] 60p. 25 refs. Rept. no. F-2306, Part 2; AFOSR-TR-54-24.
Order from LC mi$ .60, ph$9.30 PB 146 528

A study of the effects of the order-disorder transformation was made on alloys with compositions near Ni_3Mn, Fe_3Pt, and $FePd_3$. In the Fe-Pd alloys, the work was extended to include measurement of saturation moment at low temperatures and of the long-range order parameter. The kinetics of the ordering process in Fe_3Pt alloys were studied at temperatures from 450 to 750°C. Resistivity measurements on polycrystalline wires were used to follow the ordering process.

Geophysical Inst., U. of Alaska, College.
THE EFFECT OF TOPOGRAPHY AND GEOLOGY ON TELLURIC CURRENTS, by E. M. Westcott and V. P. Hessler. Scientific rept. no. 3 on Contract AF 19(604)3075. Apr 60, 64p. 25 refs. AFCRC-TN-60-431.
Order from LC mi$3.90, ph$10.80 PB 148 017

The electric field vectors E, associated with telluric currents are known to vary in comparative magnitude and principal direction at different locations. Large differences in the vectors from several Alaskan stations prompted a study to determine what effect topography and geology have on the telluric field. The results of this study show that the comparative magnitude may change by a factor of five and the principal direction may range over 33 degrees, and in one extreme case 70 degrees in the area. Model studies using a resistor network were made to determine the effects of some simple topographic and conductivity configurations upon the telluric field. Some of the interesting field results are explained on the basis of the model studies and the resistivity measurements.

Institute of Research, Lehigh U., Bethlehem, Pa.
IMPROVED MAGNETIC MATERIALS, by Ernest Costello, Arnold Holtzman, and Harry Suprinick. Quarterly progress rept. no. 2, 16 Oct 56-15 Jan 57, on Contract DA 36-039-sc-70120. [1957] 27p. 12 refs. AD-138 072.
Order from LC mi$2.70, ph$4.80 PB 149 365

A resume of the theoretical bases for the work on manganese alloys is presented. Additional alloys for the Mn_4C phase of the work have been prepared and are now being homogenized. Further alloy preparation in the Mn_3AlC phase of the work has included a nominal Mn_3CoC alloy which displayed weak ferromagnetism and a nominal Mn_3AlC alloy showing strong ferromagnetism. The X-ray analysis of the magnetic particles extracted from the Mn_3NiC alloy reported on the last report has not been completed. Specimens of a nominal 8% Si-Fe-Si alloy have been prepared for determination of the ordering temperature. Progress has also been made in spark machining rings of the same alloy for magnetic analysis and satisfactory metallographic techniques appear to have been arrived at for the microscopic study of these alloys. Further work on slag melting of alloys is underway. Following reconstruction of the magnetostriction equipment under the supplement to the preceding contract work has been progressing on adaptation of this equipment to high temperature magnetostriction measurements. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INFLUENCE OF LIGHT ON FERROMAGNETISM, by Julian L. Thompson. 6 Jan 58, 26p. 7 refs. NOTS 1935; NAVORD rept. 5840; AD-162 984.
Order from LC mi$2.70, ph$4.80 PB 148 370

Nearly unmagnetized samples of certain iron-nickel alloys are rendered slightly more or less magnetic by the action of light falling on the surface, depending upon the magnetic history of the sample. The effect disappears as soon as the light is removed, the changes taking place in a few milliseconds. Under the same conditions, a certain iron-silicon alloy shows an effect which remains after the illumination is removed. Mechanical shock will produce the same effect as light. The response to light is roughly proportional to intensity and seems to be largely due to the red and near infrared portions of the spectrum. (Author)

Western Ontario U. (Canada).
FINAL REPT. FOR 1 SEPTEMBER 1958-30 AUGUST 1959, ON CONTRACT NONR-2665(00), by R. Stevenson. 30 Aug 59, 35p. 28 refs. AD-226 027.
Order from LC mi$3.00, ph$6.30 PB 148 191

Magneto-optical rotation by transmission through or reflection from solids is examined by the classical free electron theory, with the view of taking such a measurement using fields in the megagauss range. In general the rotation is a markedly non-linear function of the magnetic field, and in some cases can change in sign as the field increases. For very low fields the rotation varies directly with B, but in the high field limit the rotation varies inversely with the field. For substances in which the intercollision time of the electron is small, measurments of the Kerr rotation (i.e., by reflection) will give the electron mobility as a function of the magnetic field, and thus will give important data which can be used in conjunction with high-field magneto-resistance experiments. (Author)

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
ELECTRONIC MATERIAL SCIENCES LABORATORY, by E. W. Sampson and O. N. L. Denniston. Status rept. 1 Dec 59, 203p. 43 refs. AFCRC-TR-59-360; AD-233 841.
Order from LC mi$9.30, ph$31.80 PB 146 349

Airborne Instruments Lab., Inc., Mineola, N. Y.
INTERFERENCE BLANKER MX-2024(XW-1)/UPA, by Harold Kurland. Final engineering rept. on Contract AF 30(602)1454. Feb 58, 16p. 4 refs. Rept. no. 3581-1; RADC TR-58-56; AD-148 688.
Order from LC mi$2.40, ph$3.30 PB 146 373

A pulse-interference separator and blanker for the reduction of random pulse interference in Normal and MTI video has been investigated, developed, and constructed. A means of reducing the loss of information that normally results when operating with MTI video is incorporated in this equipment. (Author)

Airborne Instruments Lab., Mineola, N. Y.
NONLINEAR ANTENNA STUDY, by C. O. Ball. Technical note on Contract AF 30(602)1873. Dec 58, 28p. Rept. no. 5341-TN-1; RADC-TN-58-305; AD-148 975.
Order from LC mi$2.70, ph$4.80 PB 146 594

This technical note presents the results of the first stage of investigation pursuant to a study concerned with nonlinear antenna systems. The purpose of this first stage was to evaluate the A-J characteristics of self-adjusting antennas. A self-adjusting antenna is a system of antennas with a combining method that involves automatically rephasing the inputs so that the jammer components are canceled upon additive combination. Effectively, this is a system for automatically placing a null of a linear array on a jammer location. A short evaluation was also made of a related antenna utilizing an analytic solution of an equation involving the jammer-plus-signal phasor.

David Sarnoff Research Center, Princeton, N. J.
THERMIONIC EMISSION STUDIES, by G. A. Morton, A. H. Sommer and others. Quarterly rept. no. 3, 1 Apr-30 June 59, on Contract DA 36-039-sc-78155. [1959] 49p. 17 refs.
Order from LC mi$3.30, ph$7.80 PB 147 272

Thermionic Emission: Work on the tungsten bronzes has been discontinued as showing insufficient promise. The reasons for this decision are discussed. Hot Electron Emission (HEE) from Silicon: The study of Cs-treated silicon junctions was continued, in particular the effect of the Cs on the rectification properties of the junction and the change of HEE with time. The relationship of HEE threshold voltage to breakdown voltage was investigated, leading to a preliminary interpretation deviating from earlier assumptions. Measurements were also made to distinguish the resistance of the junction from the resistance of the silicon in series with it. (Author) (See also PB 145 236)

Electronics Research Lab., U. of California, Berkeley.
RECIPROCITY THEOREMS FOR ELECTROMAGNETIC FIELDS WHOSE TIME DEPENDENCE IS ARBITRARY, by W. J. Welch. Rept. on Contract N7onr-295(29). 11 June 59, 15p. 4 refs. Rept. no. 88; Series no. 60, issue no. 237; AD-227 407.
Order from LC mi$2.40, ph$3.30 PB 146 583

Two reciprocity theorems are derived which are valid for fields whose sources may have arbitrary time dependence. The first theorem involves the electromagnetic potentials, and the second is in terms of the electric and magnetic fields directly. In both cases it is necessary to make use of the advanced as well as the retarded solutions to Maxwell's equations. Some properties of the theorems are discussed, and as an application, the second is used to derive a variational expression for scattering of electromagnetic waves from a perfect conductor. (Author)

Michigan U. [Research Inst.] Ann Arbor.
SOME GENERAL PROPERTIES OF THE HEARING MECHANISM, by W. P. Tanner, Jr., J. A. Swets and others. Technical rept. no. 30 on Contract DA 36-039-sc-63203. Mar 56, 100p. 41 refs. 2262-108-T.
Order from LC mi$5.40, ph$15.30 PB 149 363

This report deals with the auditory processes of detection and frequency analysis. It presents a decision-making theory of detection and some data supporting the theory. Other data included are consistent with a theory of frequency analysis that characterizes the human observer as instantaneously sensitive to a limited range of frequencies, with a shifting of the frequency range of sensitivity requiring a measurable amount of time. Finally, the problem of speech perception is considered in terms of the mechanism inferred from these studies. The results of this investigation are regarded as contributing to the methodology of psychophysical testing, to auditory theory, and to general behavior theory. The data indicate directly a need for certain innovations in conventional testing procedures by virtue of exhibiting some properties of the auditory mechanism not previously considered. The nature of both the detection and frequency-analysis properties discussed calls for a recognition of the influence of central processes on sensory processes, and demonstrates the feasibility of studying central processes by sensory experiments. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ON THE THEORY OF M-TYPE TUBES WITH THICK BEAMS, by Georges Mourier. Rept. on Contract AF 49(638)340. 22 Aug 58, 20p. 12 refs. Research rept. R-680-58; PIB-608; AFOSR-TN-58-926. AD-204 738.
Order from LC mi$2.40, ph$3.30 PB 147 446

The effects of space charge in crossed field, M-type tubes is considered qualitatively. The consideration of 2 surface waves associated respectively with the upper and low boundaries of the beam make possible a broad understanding of the behavior of M-type tubes with thick, heavy-current beams. No systematic comparison of theory with experiments is made. However, the gain calculation seems to be in general agreement with experiment, as is the prediction of a minimum efficiency for intermediate values of beam current. The most serious restriction on this analysis is probably the assumption of laminar flow. (Author)

Naval Research Lab., Washington, D. C.
SOURCE AND DETECTOR CORRECTIONS FOR ANGULAR CORRELATION MEASUREMENTS, by F. C. Young. Interim rept. 20 June 60, 9p. 4 refs. NRL rept. 5475.
Order from LC mi$1.80, ph$1.80 PB 145 718

The geometrical corrections to the angular correlation function for circular detectors with spherical and cylindrical sources have been calculated. The calculations were made to second order in terms of the various geometrical parameters, and curves were plotted showing the dependence of the corrections on these parameters, as well as on the correlation angle. The parameters were: the angle between the two gamma rays; the angle between the symmetry axes of the two detectors of solid angle $d\Omega_1$, and $d\Omega_2$; the radius of the detectors; the radius of the source; and the distance from the source to the center face of each detector. An extension of these corrections to include cylindrical detectors was investigated and the results were of the same mathematical form as for circular detectors. (Author)

Navy Electronics Lab., San Diego, Calif.
SEQUENTIAL SIGNAL DETECTOR, RAYLEIGH CASE, by J. W. Caspers. 7 Nov 56, 33p. 5 refs. Research rept. 730.
Order from LC mi$3.00, ph$6.30 PB 149 187

A detector based on the sequential probability ratio test has been examined theoretically. It is shown that it will respond to signals more rapidly, on the average, than the best non-sequential detector. Equations and curves are given which predict the performance of the sequential detector and compare it with that of the Neyman-Pearson detector. Further analyses and experimentation are outlined which are directed toward a more comprehensive understanding of the sequential detector, toward its simplification, and toward an estimation of its value as a signal-to-noise ratio estimator. (Author)

Washington U. [Seattle]. Coll. of Engineering.
ANTENNA PATTERNS FOR MAXIMUM INFORMATION RATE, by Paul A. Lux, H. Myron Swarm, and David D. McNelis. Technical rept. no. 41 on Contract AF 19(604)4098. Apr 60, 33p. 6 refs. AFCRC-TN-60-175.
Order from LC mi$3.00, ph$6.30 PB 148 236

This paper is concerned with finding the optimum directivity pattern of an antenna. Because of irregularities in the atmosphere, ionosphere, or meteor bursts a signal does not arrive at the receiver from a single direction. Therefore maximum directivity with its attendant narrow beam width may not be the best criterion of antenna performance. Nor is the performance of an omnidirectional antenna apt to be optimum regardless of how optimum is defined. However, a directivity pattern between these two extremes results in optimum performance when a logical definition of optimum is applied. The optimum directivity pattern is determined by the type of signal to be received and the type of receiver being used. In this paper, an optimum pattern is defined and determined as a function of the distribution of the incoming signal power in azimuthal angle. Systems similar to meteor-burst channels are considered, i.e., the signals are assumed to arrive in discrete, non-overlapping bursts. (Author)

Molecular Physics and Spectroscopy

Carnegie Inst. of Tech., Pittsburgh, Pa.
AUTOMATIC COMPUTATION OF ELECTRONIC ENERGIES OF DIATOMIC MOLECULES, by Tadashi Arai. Technical rept. on Contract DA 36-061-ORD-466. [1960] 69p. 10 refs. OOR rept-1350.16-C; AD-233 992.
Order from LC mi$3.90, ph$10.80 PB 148 533

A general method for computing electronic energies and wave functions of diatomic molecules is described and arranged in such a way that the processes of the computation are carried through systematically and fully automatically by an electronic computer. In principle, therefore, we are able to compute the energy values and the wave functions by inserting the number of electrons in the molecule concerned, the spin multiplicity S, the angular momentum (its component L along the nuclear axis) and other symmetry requirements, if we decide what kind of basic functions we wish to use as orbitals. At the first step, an orthonormal set of orbitals is built up from the orbitals assumed as bases. By taking every possible combination of the orthonormal orbitals, candidate basic functions are generated. Each of them is tested to see if it satisfies the symmetry requirements of the molecule. Thus all the basic functions which should be obtained from the orbitals assumed are systematically generated. The energy matrix involving them is calculated by the use of the representation matrices of the permutation group. Every necessary permutation for computing the energy matrix is considered automatically by the computer. The only data required to be stored in the machine are spin functions and the representation matrices of the permutation group for a small number of electrons (say 6 electrons). Those are universal quantities for any kind of Fermi particles and are easily obtainable. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
SENSITIVITY OF MICROWAVE SPECTROMETERS AND HYPERFINE SPECTRA OF $CFCl_3$, by Maurice W. Long. Doctoral thesis. Technical rept. no. 1 on Contract Nonr-991(07). 15 June 59, 110p. 41 refs.
Order from LC mi$5.70, ph$16.80 PB 147 451

Comparisons based on theoretical and experimental investigations are made on the following detection system for use with Stark spectrographs: crystal diodes and tuned amplifiers, bolometers and tuned amplifiers, and superheterodynes in conjunction with a microwave bridge. Equipment modifications are described which provide improved sensitivity for detecting small decrements in a relatively large amount of power; the modified equipment is sensitive to signal changes of one part in 10^{10}. Absorption lines at X-band having a calculated absorption coefficient at room temperature of 4×10^{-11} cm^{-1} were measured. It is believed that these are the weakest lines ever reported. A theoretical calculation is made for the hyperfine structure of the $J = 1 \rightarrow 2$ rotational transition for symmetric top molecules having three identical nuclei of spin 3/2. This calculation is used to analyze the $CFCl_3^{35}$ transition at 9.86 kmc, and provides the quadrupole coupling constant with respect to the molecular symmetry axis.

Hebrew U. (Israel).
ELECTRON PARAMAGNETIC RESONANCE IN $BaTiO_3$, by W. Low and D. Shaltiel (Israel Inst. of Tech.) Rept. on Contract AF 61(052)59. [1959] 3p. 3 refs. AFOSR-TN-58-919; AD-234 036.
Order from LC mi$1.80, ph$1.80 PB 149 290

Institute of Mathematical Sciences, New York U., N. Y.
THE APPLICATION OF WAVE FUNCTIONS CONTAINING INTERELECTRON COORDINATES II. THE GROUND STATE ENERGY OF ATOMS, by Peter Walsh and Sidney Borowitz. Rept. on Contracts AF 19(604)4555 and DA 30-069-ORD-2581. Dec 59, 42p. 23 refs. Research rept. no. CX-45; AFCRC-TN-59-657; AD-233 304.
Order from LC mi$3.30, ph$7.80 PB 146 568

An attempt was made to explore further the use of interelectron coordinates in constructing atomic wave functions. A simple method is developed for constructing wave functions of this type which yields surprisingly good values for the energy of a variety of atomic systems in zero order. (See also PB 142 836)

Little, Arthur D., Inc., Cambridge, Mass.
INFRARED SPECTRA OF GASEOUS GROUP IV HALIDES: ZIRCONIUM FLUORIDE, ZIRCONIUM CHLORIDE AND HAFNIUM CHLORIDE, by Alfred Büchler. Interim technical rept. no. 1 on Study of High-Temperature Thermodynamics of Light-Metal Compounds, Contract DA 19-020-ORD-4829. 20 Apr 60, 10p. 10 refs. OOR rept. 006.1-C.
Order from LC mi$1.80, ph$1.80 PB 148 429

The infrared spectra of gaseous ZrF_4, $ZrCl_4$, and $HfCl_4$ have been observed between 3000 and 200 cm^{-1}. The observed frequencies are

	ν_3 cm^{-1}	ν_4 cm^{-1}
ZrF_4	668	200
$ZrCl_4$	423	---
$HfCl_4$	393	---

Lyman Lab. [of Physics] Harvard U., Cambridge, Mass.
N^{14} - N^{15} HYPERFINE ANOMALY, by L. Wilmer Anderson and Francis M. Pipkin. (Mallinckrodt [Chemical] Lab.). Rept. on Contract Nonr-1866, T.O. 14. [1959] 52p. 33 refs. AD-220 657.
Order from LC mi$3.60, ph$9.30 PB 148 151

The optical transmission of an optically oriented sodium vapor in spin exchange equilibrium with atomic nitrogen was used to measure the zero field hyperfine splitting of N^{14} and N^{15}. The nuclear moments of N^{14} and N^{15} were remeasured by observing the effects of saturating the nitrogen resonance on the proton resonance in NH_4^+. The N^{14} - N^{15} hyperfine anomaly obtained by combining measurements is

$$\Delta = \frac{A(15)/A(14)}{g(15)/g(14)} - 1 = 0.000981 \pm 0.000017.$$ A short discussion of the mechanism of spin exchange collisions is given.

Malinckrodt Chemical Lab., Harvard U., Cambridge Mass.
MICROWAVE SPECTRUM, STRUCTURE, DIPOLE MOMENT AND NUCLEAR QUADRUPOLE EFFECTS IN VINYL CHLORIDE, by Daniel Kivelson, E. Bright Wilson, Jr., and David R. Lide, Jr. (National Bureau of Standards). Rept. on Contract Nonr-1866, T.O. 14. [1959] 19p. 16 refs. AD-220 658.
Order from LC mi$2.40, ph$3.30 PB 148 152

The microwave spectra of nine isotopic species of vinyl chloride have been measured and analysed, yielding moments of inertia from which a molecular structure was calculated. The bond lengths found are (in A) C=C 1.33_2, C-Cl 1.72_6, average C-H 1.08. The bond angles are C_2C_1Cl 122°, $C_2C_1H_1$ 124°, $C_1C_2H_3$ (cis to Cl) 121°, $C_1C_2H_2$ (trans to Cl) 120°. Planarity was assumed. The chlorine nuclear quadrupole hyperfine lines were re-examined. From the data for several isotopic species it was shown that the C-Cl bond direction is within five degrees of a principal axis of the field gradient tensor. The lack of cylindrical symmetry of the field gradient about the C-Cl bond was confirmed. This is evidence that the observed shortening of the C-Cl bond is at least in part due to conjugation with the C=C double bond and not solely to hybridization effects. The component of dipole moment along the a inertial axis was found to be 1.42 ± 0.02 D. (Author)

National Bureau of Standards, Washington, D C.
STANDARDIZATION OF THERMAL EMITTANCE MEASUREMENTS, by William N. Harrison, Joseph C. Richmond and others. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)58-20. Mar 60, 37p. 3 refs. WADC Technical rept. 59-510.
Order from OTS $1.00 PB 161 879

The principles governing emission, transmission, reflection and absorption of radiant energy are briefly reviewed; definitions of pertinent terms as used in the text are given; and mathematical relationships between properties and quantities that are involved in the project are presented. A double-beam ratio-recording

spectrometer was modified so that it would compare radiant energy beams emitted by a blackbody furnace and a specimen at the same temperature, and record automatically a curve of normal spectral emittance of the specimen as a function of wavelength. Preliminary designs of equipment were formulated for the automati recording of spectral emittance data in a form suitable for direct entry into a computer, and for the on-line, automatic processing of data to obtain a single value for total emittance or for absorptance for radiant energy of any known spectral distribution. (Author)

Noyes Chemical Lab., U. of Illinois, Urbana.
THE INTENSITY OF THE INFRARED C≡N BAND OF p-ALKYLBENZONITRILES IN VARIOUS SOLVENTS, by Theordore L. Brown. Technical rept. no. 2 on Contract Nonr-2533(00). 10 Aug 59, 9p. 7 refs. AD-225 134.
Order from LC mi$1.80, ph$1.80 PB 148 127

The integrated intensities of the C≡N absorption in p-methyl, p-ethyl, p-isopropyl, and p-tert-butyl compounds were measured in CCl_4, $CHCl_3$, and CCl_4-pyridine solvents. In $CHCl_3$ and CCl_4 solutions the alkyl groups caused an increase in the C≡N intensity in the inductive order. This order was essentially absent in the mixed solvent containing 16% pyridine. The inverse order of intensities was found in CCl_4 and $CHCl_3$ rather than that which was expected from the correlation of the electrophilic substituent constants (σ^+) for the p-alkyl groups to the square root of the intensity. In the more basic mixed solvent, the changes in relative values were in the direction of the Baker-Nathan order. An attempt was made to estimate the quantities involved in the expression derived for the intensities from the observed dipole moment of the molecule. Essentially all of the intensity variation in the alkylbenzonitriles were reasonably accounted for by considering the polarizabilities of the alkyl groups. The conclusion is drawn that the intensity variations in CCl_4 can be explained without recourse to a hyperconjugation mechanism.

Noyes Chemical Lab., U. of Illinois, Urbana.
SOME PROPERTIES OF p-ALKYLBENZONITRILES AND ACETOPHENONES, by Theodore L. Brown. Final rept. on Contract Nonr-2533(00). 10 Aug 59, 4p. 3 refs.
Order from LC mi$1.80, ph$1.80 PB 148 128

The purpose of this study was to gain additional information which might be helpful in assessing the importance of C-H hyperconjugative electron release in determining the electronic properties of alkyl groups.

Ohio State U. Research Foundation, Columbus.
FUNDAMENTAL RESEARCHES IN THE LONG WAVELENGTH X-RAY REGION, by C. H. Shaw. T Technical rept. no. 8 on Contract N6onr-225(21). June 58, 13p. 25 refs. AD-161 665.
Order from LC mi$2.40, ph$3.30 PB 146 600

A brief summary of work concerned with x-ray investi gations of the structure and other fundamental physical properties of matter. It has long been recognized that an understanding of these properties ultimately rests upon a knowledge of atomic and electronic structure. Included in the report are:
Geometry of the two-crystal x-ray spectrometer, by J. A. Soules, pub. in the Ohio Jnl. of Science 54:304, Sep 54
Design of differential x-ray filters for low-intensity scattering experiments, by Jack A. Soules, William L. Gordon, and C. H. Shaw, pub. in the Review of Scientific Instruments 27:12-14, Jan 56.

Ohio State U. Research Foundation, Columbus.
INFRARED EMISSION SPECTRA OF GASEOUS B_2O_3 AND B_2O_2. FREQUENCY ASSIGNMENT AND THERMAL FUNCTIONS, by D. White, D. E. Mann and others. Technical rept. no. 2 on Contract Nonr-495(12) June 59, 30p. 20 refs. AD-219 358.
Order from LC mi$2.70, ph$4.80 PB 149 258

The infrared emission spectra of gaseous B_2O_3 and B_2O_2 in the temperature range 1400-1800°K was studied in the region 700-4000 cm^{-1}. Three distinct bands were found for gaseous natural B_2O_3 at 2040, 1302 and 742 cm^{-1} and the B^{10}-B^{11} isotope shifts measured. From the isotope shift data and other considerations the B_2O_3 molecule was assigned a V structure in the C_{2v} symmetry class. A force constant analysis was made and a frequency assignment from which thermal functions were computed is given. The observed frequencies lead to force constants which are consistent with the high stability of the molecule. Only one emission band of gaseous B_2O_2, at 1890 cm^{-1}, was observed. Assuming a linear structure, $D_{\infty h}$, for this molecule, a frequency assignment and thermal functions were estimated. (Author)

Oregon State Coll., Corvallis.
THE RATE OF VIBRATIONAL DEACTIVATION BY THE SPECTROPHONE METHOD. I. CARBON MONOXIDE, by G. C. Turrell, W. D. Jones, and J. C. Decius. Technical rept. no. 3 on Contract Nonr-1286(03). 1 Aug 59, 31p. 21 refs. AD-225 317.
Order from LC mi$3.00, ph$6.30 PB 148 189

An apparatus for observing the pressure signal generated by an infrared beam traversing a gas sample has been constructed. This spectrophone uses a modulation frequency of 600 cps. and is capable of measuring changes in the time lag between the incident infrared energy and the pressure with an accuracy of about 5 μsec. It has been applied to the study of vibrational relaxation times for pure carbon monoxide, as well as mixtures with the infrared inert gases H_2, He, Ne, A, N_2. At one atmosphere and at room temperature, the relaxation time for pure CO is 190 μsec.; other values range from 1.5 μsec. for CO-H_2 collisions up to 370 μsec. for CO-A. These results are compared with relaxation times for CO at elevated temperatures found by other methods. A discussion of the validity of spectrophone results and some of the complications are included. (Author)

Stanford U., Calif.
ANALYSIS OF A MAGNETIC RESONANCE SPECTROMETER, by J. P. Goldsborough and M. Mandel. Rept. on Paramagnetic Resonance, Contract AF 18(603)131. June 60, 15p. 5 refs. Technical note no. 131-5; AFOSR-TN-60-533; AD-238 355.
Order from LC mi$2.40, ph$3.30 PB 148 412

This paper analyzes an electron paramagnetic resonance microwave bridge spectrometer and expressions are given for the relation between the signal and the imaginary part of the magnetic susceptibility. From these the conditions for maximum signal are obtained. The analysis is also applicable to many other types of magnetic resonance spectrometers. (Author)

University of Southern California, Los Angeles.
INFRARED REFLECTION SPECTRA: A CATALOGUE, by David A. Dows and J. L. Hollenberg. Technical rept. no. 3 on Vibrational Spectra of Crystals at Low Temperatures, Contract DA 04-495-ORD-900. 25 Mar 60, 15p. 1 ref. OOR rept. 1815.11-C.
Order from LC mi$2.40, ph$3.30 PB 148 432

A catalogue of reflection band shapes is presented which should be useful in (a) deciding whether reflection will be measureable in a given case, (b) semiquantitative estimation of maximum reflection intensities and widths, and (c) estimation of absolute intensities from observed reflection spectra.

University of Southern California. Engineering Center, Los Angeles.
TRANSPORT PHENOMENA OF A RAREFIED AND FULLY IONIZED GAS IN THE PRESENCE OF A STRONG MAGNETIC FIELD. PART II, by Toyoki Koga. Technical note on Contract AF 18(603)95. 12 Feb 60, 19p. 3 refs. USCEC rept. 56-210; AFOSR-TN-60-103; AD-233 080.
Order from LC mi$2.40, ph$3.30 PB 146 719

Washington U., Seattle.
s-TETRAZINE I. ELECTRONIC ADSORPTION SPECTRA AND, IN PARTICULAR, THE VISIBLE $n\rightarrow\pi^*$ VIBRONIC BAND SYSTEMS UNDER HIGH RESOLUTION, by Glenn H. Spencer, Jr. (Doctoral thesis), Paul C. Cross, and Kenneth B. Wiberg. Technical note 3 on Contract AF 18(600)1522. Jan 60, 38p. 38 refs. AFOSR-TN-60-69; AD-233 496.
Order from LC mi$3.00, ph$6.30 PB 146 746

The low resolution electronic spectrum of s-tetrazine vapor was measured down to about 190 mμ, and the complex systems of vibronic bands that comprise the $n\rightarrow\pi^*$ visible absorption spectrum were studied under higher resolution. These latter spectra were photoelectrically recorded in the third order of a 21 ft grating spectrograph, using path lengths from 0.05 to 48 m and temperatures from -70 to 70°C. In the absorption regions 4500 to 6100 Å, the spectrum consists of over 500 sharp, vibronic band peaks. Their collected Q-branch maxima were measured to the nearest cm^{-1}, but no discrete rovibronic structure was resolved. (Author)

Washington U., Seattle.
s-TETRAZINE II. INFRARED SPECTRA, by Glenn H. Spencer, Jr. (Doctoral thesis), Paul C. Cross, and Kenneth B. Wiberg. Technical note 4 on Contract AF 18(600)1522. Jan 60, 21p. 22 refs. AFOSR-TN-60-68; AD-233 513.
Order from LC mi$2.70, ph$4.80 PB 146 747

To aid in the vibronic analysis of the $n\rightarrow\pi^*$ visible absorption band systems of s-tetrazine vapor, infrared spectra of vapor, solution, and cold, solid film phases of natural and of deuterated mixtures of s-tetrazine have been obtained. By use of the product rule and by correlation of the fundamental modes of s-tetrazine with those of benzene and the other azines, it is possible to make tentative vibrational assignments for all seven of the fundamental bands that would be expected to be infrared active in the wavelength region from 2 to 15. However, the low frequency modes 16a and 16b, A_{μ} and $B_{1\mu}$, respectively, have not yet been observed, and the lack of knowledge of the frequencies of eight of the nine gerade modes (Raman active only) has prevented any definite assignment of combination bands. The interesting, peculiar observation of what is believed to be the totally symmetrical mode 6a near 730 $cm.^{-1}$ in the solid film spectra of the various deuterated mixtures is also reported. (Author) (See also PB 146 746)

Optics

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE FABRICATION OF INFRARED FILTER WHEELS USING SPRAY TECHNIQUES, by Hugh R. Carlon. 31 Dec 58, 11p. 1 ref. CWL Technical memo. 32-39; AD-208 394.
Order from LC mi$2.40, ph$3.30 PB 148 445

The present model E33R2 LOPAIR instrument employs a monochromator for wavelength selection, but an instrument has been successfully demonstrated which utilizes a rotating wheel, consisting of two semicircles of selected filter materials, which alternately transmit and block radiation at the reference and analytical wavelengths, thus producing an AC signal when an absorption occurs. These filter wheels have previously been manufactured by the process of vacuum evaporation, which is tedious and time-consuming. The spray techniques described here yield filter surfaces of equal quality to those obtained by vacuum evaporation, yet require only a fraction of the time. In addition, the spray process has certain advantages which make it a very flexibie method of fabrication. (Author)

Cornell U., Ithaca, N. Y.
A PHOTON-COUNTING SPECTROMETER FOR ATTENUATION MEASUREMENTS IN THE SOFT X-RAY REGION, by D. H. Tomboulian. Technical rept. on Contract Nonr-401(37). Sep 59, 21p. 6 refs. AD-226 163.
Order from LC mi$2.70, ph$4.80 PB 148 872

Diamond Ordnance Fuze Labs., Washington, D. C.
THE QUASI-PARALLEL LIGHT PRINCIPLE: FORMATION OF HOLLOW-CONICAL, FLAT, OR TUBULAR OPTICAL PATTERNS, by Harald W. Straub, Josef M. Arthaber, and Ward J. Moore. 13 Jan 60, 15p. TR-745; AD-232 434.
Order from LC mi$2.40, ph$3.30 PB 146 301

A light beam whose boundary rays are truly parallel for a limited, but relatively large distance, is discussed. Parallel boundary rays were obtained when the parameters of the optical system were chosen so that a real image of an extended source is formed not at infinity but at a finite distance, and this image is equal in size to the lens or mirror that projects the image. This beam can be converted to the pattern of a well defined hollow cone, a tube or an equally well defined thin, flat sheet without using nonconventional optical means. The reversal of the principle, that is, replacement of the source by a photodetector, leads to detection patterns which may be relatively narrow for a given distance, or thin-walled hollow cones, or tabular, or thin flat sheets. This method for forming quasi-parallel, flat; and tabular patterns not only avoids the necessity of nonconventional optical parts but also affords good definition of the pattern as well as optical gain especially in the near field.

Naval Research Lab., Washington, D. C.
INFRARED TRANSMISSION OF THE ATMOSPHERE, by H. W. Yates and J. H. Taylor. Final rept. 8 June 60, 43p. 22 refs. NRL rept. 5453.
Order from LC mi$3.30, ph$7.80 PB 144 636

The transmission of the atmosphere in the spectral range from 0.5 to 15 μ has been studied over three sea-level paths 0.3, 5.5, and 16.25 km in length, with an average spectral resolution, $\lambda/\Delta\lambda$, of 300. The conditions encountered covered a wide range, from 0.11 cm precipitable water in the 0.3-km path to a maximum of 38 cm precipitable water in the 16.25-km path, and values of the visual scattering coefficient were measured from 0.048 km^{-1} to 0.24 km^{-1}. Data have been evaluated on selective transmission vs water-vapor concentration for the infrared "window" regions, and the behavior of the scattering coefficient with wavelength has been plotted for representative atmospheres. Similar data were plotted for several measurements made over a range of 27.7 km at an altitude of 10,000 ft. (Author)

Ohio State U. Research Foundation, Columbus.
ECHELETTE GRATINGS AS FILTERS, by Ely E. Bell and Robert A. Oetjen. Scientific rept. no. 1 on Contract AF 19(604)4119. July 59, 19p. 7 refs. AFCRC-TN-59-668; AD-231 891.
Order from LC mi$2.40, ph$3.30 PB 149 257

In the existing far infrared spectrograph at Ohio State University, echelette gratings were used for filtering when investigating radiation of wavelength greater than about 70μ. However, little detailed information about the reflection characteristics of these gratings was available. Therefore, with an eye to improving the filtering in this instrument at these longer wavelengths, the following were undertaken: (1) A calculation of the reflection characteristics, hence the filtering properties, of an ideal echelette grating; (2) A measurement of the reflection characteristics of some actual gratings and comparison with the ideal; and (3) An investigation of the possibility of finding a combination of gratings that would provide filtering more efficient than that now used. (Author)

Scripps Institution of Oceanography, U. of California La Jolla.
CORRELATION BETWEEN MEASURED PATH FUNCTION AND RELATIVE HUMIDITY, by Almerian R. Boileau. Rept. on Contract NObs-79092. 1 Feb 59, 34p. 16 refs. SIO Reference 59-5; AD-212 741.
Order from LC mi$3.00, ph$6.30 PB 148 853

This report describes the results of data gathered from a second formation flight of two airplanes, the instrumented B-29 and a microwave refractometer-equipped C-131 from Patrick Air Force Base squadron

Wayne State U., Detroit, Mich.
THEORETICAL INVESTIGATIONS ON THE LIGHT SCATTERING OF COLLOIDAL SPHERES. VIII. THE ANGULAR LOCATION OF INTENSITY MAXIMA AND MINIMA IN THE RADIATION DIAGRAM OF COLLOIDAL SPHERES, by Masayuki Nakagaki and Wilfried Heller. Technical rept. no. 33 on Contract Nonr-736(00). 20 June 59, 31p. 17 refs. AD-219 587.
Order from LC mi$3.00, ph$6.30 PB 146 351

The angular position of scattering maxima and minima in the radiation diagram of nonabsorbing colloidal spheres is calculated for $(m-1)\rightarrow 0$ and for $m \geq 1.20$, using in the former case the Rayleigh-Gans approximation and in the latter the exact Mie scattering functions. By means of empirical equations based upon the discrepancies between the Rayleigh-Gans data and the Mie data, the approximate location of scattering maxima and minima is calculated also for the m-values 1.05, 1.10, 1.15, 1.25, and 1.30. The expected precision and accuracy of particle size determinations from the angular location of scattering maxima and minima is discussed and the minimum angular ranges to be covered in a given instance are defined. A few pertinent features of the related La Mer method (HOTS) are briefly discussed. (Author)

Solid State Physics

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
AN INVESTIGATION OF THE QUESTION OF FIBER ORIENTATION IN THIN IRON FILMS, by Roger W. Clapp, Jr. 28 Sep 59, 18p. ARGMA TR-1C33R; AD-227 426.
Order from LC mi$2.40, ph$3.30 PB 148 356

Iron films, in the thickness range 20 to 250Å, were condensed from the vapor phase onto Formvar or baked-out silica substrates at temperatures less than 50°C. The films were sufficiently thin to permit study of the film-substrate combination by means of transmission electron diffraction. No fiber orientation was observed for films deposited in vacuum (10^{-5}mm) or in helium at pressures of 10^{-2} mm or 10^{-1} mm. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
GENERAL FORMULAE FOR THE TRANSFORMATION OF THE ELASTIC, PIEZOELECTRIC AND DIELECTRIC CONSTANTS, by R. Bechmann. 15 May 59, 92p. 6 refs. USASRDL technical rept. 2051; AD-220 104.
Order from LC mi$5.40, ph$15.30 PB 148 113

The well-known elastic, piezoelectric and dielectric constants of anisotropic media are tabulated. A new form for the transformations of elastic and piezoelectric constants was derived. These transformations are presented in the form of tables. (Author)

Brown U., Providence, R. I.
RESEARCH DIRECTED TOWARD THE INVESTIGATION OF SILICON AND SILICON-CARBIDE SURFACES, by J. A. Dillon, Jr. and R. M. Oman. Final scientific rept. for 1 Oct 58-30 Sep 59 on Contract AF 19(604)4568. [1959] 37p. 38 refs. AFCRC-TR-59-199; AD-228 984.
Order from LC mi$3.00, ph$6.30 PB 146 388

Contents:
Ion-bombardment etching of silicon and germanium
  Low pressure experiments
  High pressure experiments
Thermal etching of silicon crystals
  Experimental arrangement
  Results of heating at intermediate pressure
The interaction oxygen with silicon-carbide crystals
  High vacuum experiments
  High pressure experiments
  Intermediate pressure experiments
Silicon-carbide surfaces

  Gross surface properties of natural crystals
  Asymmetry in atomic species
  Chemical etching
  Point-contact rectification measurements
Correlation of etching behavior with adsorption rate
(See also AD-225 651)

Cambridge U. (Gt. Brit.)
EFFECT OF STRAIN-RATE ON THE FLOW-STRESS OF f.c.c. METALS, by P. B. Hirsch, T. E. Mitchell, and P. R. Thornton. Annual summary rept. no. 1 on Contract AF 61(052)98. Oct 59, 43p. 18 refs. AFOSR-TN-60-152; AD-234 224.
Order from LC mi$3.30, ph$7.80 PB 147 335

The initial results of an experimental study of the reversible flow-stress change which occurs when the strain-rate is increased by a factor of ten during a tensile test of a f.c.c. metal are presented. Polycrystalline α-brasses and polycrystalline neutron irradiated Cu were studied as a function of deformation from 4.2°k to 300°k. Single crystals of pure Cu and of 70/30 α-brass were also studied in the same manner.

Illinois Inst. of Tech., Chicago.
AN X-RAY DIFFRACTION STUDY OF CRYSTAL PERFECTION IN SILICON, by Robert H. Bragg and Leonid V. Azaroff. Rept. on Contract AF 49(638)425. 24 June 60, 8p. 6 refs. AFOSR-TN-60-632.
Order from LC mi$1.80, ph$1.80 PB 148 778

The results of a preliminary study of the perfection of single crystals of Si is described. A modified Laue focussing arrangement was used to examine neighboring regions of a relatively perfect slice taken out of a Si ingot. Small variations in the line-width and the total diffracted intensity were observed for regions separated by about two millimeters. It also turned out that only short-wavelength x-radiation could show up small differences in crystal perfection. Some of the implications of this study and comparison to etch-pit determinations are also described. (Author)

Illinois U., Urbana.
PHOTOREPRODUCTION OF H CENTERS AT 15°K, by Jack Kingsley. Technical note no. 1 on Contract AF 49(638)529. May 60, 6p. 4 refs. AFOSR-TN-60-634.
Order from LC mi$1.80, ph$1.80 PB 148 772

Madrid U. (Spain).
STUDIES ON POLYMORPHISM IN SINGLE CRYSTALS, by J. L. Amoros. Final technical rept. for 1 Mar 59-29 Feb 60 on Contract DA 91-591-EUC-1084. [1960] 87p. 87 refs. AD-235 150.
Order from LC mi$4.80, ph$13.80 PB 147 253

The study of certain crystal transformations was carried out and certain techniques were accommodated to the required conditions of the research. One completed piece of work is presented: the work on the mechanism of the transition IV - II in NH_4NO_3. A second one is presented in preliminary form: the work on the study of diffuse scattering during the paraferroelectric transition of $NaNO_2$ and that of $NaNO_3$. With these 2 research pieces it was intended to get a direct knowledge of crystal transitions of two very different types: a first and second order transitions.

Manufacturing Labs., Inc., Cambridge, Mass.
THE LATTICE STABILITY OF METALS. I. TITANIUM AND ZIRCONIUM, by Larry Kaufman. Technical rept. no. 1 on [Contract Nonr-2600(00)]. 1 Oct 58, 40p. 36 refs.
Order from LC mi$3.00, ph$6.30 PB 148 794

The difference in free energy between the b. c. c. and h. c. p. modifications of titanium and zirconium have been calculated between 0°K and 2000°K by using existing thermodynamic data. These results have been employed to investigate the energetics of the b. c. c. $\rightleftharpoons$ h. c. p. reactions in the Ti-Zr system and in a series of titanium-base alloy systems. It is found that the chemical driving force for martensitic b. c. c. $\rightarrow$ h. c. p. reactions in these systems is about 50 cal/mol. This value, compared to 300 cal/mol for iron-base alloys, can be explained by the difference in physical characteristics of martensitic transformations in iron-base and in titanium-base alloys. A method is suggested for estimating M_S vs. composition curves

for titanium and zirconium-base systems where such data are presently unavailable. (Author)

Maryland U., College Park.
THE ROTATION OF DIATOMIC MOLECULES IN MOLECULAR CRYSTALS, by Barbara Castle Kohin. Doctoral thesis. Rept. on Contract AF 49(638)399. Jan 60, 81p. 37 refs. Physics Dept. Technical rept. no. 164; AFOSR TN-60-58; AD-233 579.
Order from LC mi$4.80, ph$13.80 PB 146 677

Molecular rotation in crystals of N_2 and CO is investigated. The following contributions to the crystal field hindering free rotation are taken into account: (1) the interaction of the molecular quadrupoles, (2) the effect of the anisotropic molecular polarizabilities, and (3) the asymmetry in the short-range repulsive forces.

Massachusetts Inst. of Tech., Cambridge.
THE EFFECT OF PLASTIC STRAIN RATE ON DIFFUSION IN ALUMINUM-ZINC ALLOYS, by G. A. Bruggeman, M. Cohen, and B. L. Averbach. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)3264. Apr 60, 51p. 21 refs. WADD Technical rept. 60-218.
Order from OTS $1.50 PB 161 884

The effect of compressive strain-rate on interdiffusion and zinc self-diffusion in aluminum-zinc alloys has been investigated. At a strain rate of $2 \times 10^{-4} sec^{-1}$, the interdiffusion coefficient is increased by factors of 20, 13, and 8 at 375, 415, and 450°C respectively. At comparable strain rates, little enhancement of self-diffusion is detected. Quasi-hydrostatic pressure causes the interdiffusion coefficient to decrease much more than predicted theoretically. Factors are suggested which could account for the results, but existing uncertainties preclude a precise interpretation. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
THE EFFECT OF CRYSTALLINE FIELDS ON CHARGE DENSITIES AND MAGNETIC FORM FACTORS, by A. J. Freeman and R. E. Watson. Jan 60, 17p. 14 refs. MRL rept. no. 70; AD-235 053.
Order from LC mi$2.40, ph$3.30 PB 146 967

The effects of crystalline fields on 3d charge densities and magnetic form factors for transition metal ions are discussed. It is shown that the crystalline field has two effects on the free ion 3d wave functions; (1) a differentiation or "splitting" of the two types of cubic 3d functions by an expansion of the t_{2g} (e_g) orbitals and a contraction of the e_g (t_{2g}) orbitals resulting in two different radial charge densities and (2) a net expansion of the charge distribution from the free ion value. The magnetic form factors due to this "splitting" effect when calculated according to the methods of Weiss and Freeman show measurable deviations from the free atom results. A form factor for Mn^{+2} based on optical absorption data shows a large expansion of the 3d charge density, in agreement with experiment. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
RADIATION-ENHANCED HELIUM PRECIPITATION IN COPPER, by A. N. Goland. Feb 60, 7p. 3 refs. Rept. no. 73; AD-237 988.
Order from LC mi$1.80, ph$1.80 PB 148 201

Visual observation of radiation-enhanced diffusion has been accomplished by metallographic examination of the precipitation of helium in neutron-irradiated copper. Helium was injected into copper specimens by alpha-particle bombardment and vacancies were then introduced into some of the specimens by fast neutron irradiation. With both types of specimens held at temperatures high enough for diffusion to occur (425°C), considerably more precipitation was visible in the neutron-irradiated specimens than those not irradiated. Thus illustrating the enhancement of diffusion by radiation-induced excess vacancies. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
THEORY OF D FOR SELF-DIFFUSION IN SOLID METALS, by G. M. Pound, W. R. Bitler, and H. W. Paxton. Rept. on Contract Nonr-760(08). [1959] 17p. 30 refs.
Order from LC mi$2.40, ph$3.30 PB 148 570

The kinetics of diffusion in solids is treated in terms of statistical mechanics from the point of view of absolute rate theory. An approximate description of the activated state leads to the conclusion that in the two degrees of freedom orthogonal to the jump direction only the lower vibrational energy levels are occupied. This circumstance gives rise to a negative contribution to the experimental entropy of activation for diffusion in solids which is negligible for the vacancy mechanism but very appreciable for the ring mechanism. It is suggested that a low D_o, perhaps of the order of 10^{-3} cm^2/sec, is an experimental criterion tor 4-atom ring diffusion and that the self-diffusion in pure chromium and uranium (b.c.c.) occurs by this mechanism. Further, a low Arrhenius frequency factor is predicted for all processes in solids which require simultaneous jump of n atoms, e.g. in the thermally activated movement of dislocation loops. (Author)

Minerals Research Lab., U. of California, Berkeley
A STUDY OF LOW TEMPERATURE CREEP MECHANISMS IN ALUMINUM SINGLE CRYSTALS, by L. A Shepherd and J. E. Dorn. Technical rept. no. 8 on Contract Nonr-222(49). 18 Sep 59, 54p. 27 refs. Series no. 103; issue no. 8.
Order from LC mi$3.60, ph$9.30 PB 148 896

A study was made of the effects of small abrupt changes in stress and temperature upon the creep rate of aluminum single crystals at low temperatures. With an important exception, the results were found to be in agreement with the predictions of the dislocation intersection mechanisms. Whereas intersection theory predicts that the change in the logarithm of the strain rate with stress,

$$\beta = \frac{\partial \ln \dot{\gamma}}{\partial \tau} = \frac{const}{kt},$$

β was found experimentally to increase by a factor of 5 between 78° and 160°K. A qualitative model is offered to explain this behavior in terms of pile-ups of dislocations aiding intersection at the higher temperature. (Author)

Naval Ordnance Lab., White Oak, Md.
MAGNETIC MATERIALS, by Louis R. Maxwell. 12 Jan 59, 34p. NAVORD rept. 6263; AD-225 661.
Order from LC mi$3.00, ph$6.30 PB 148 453

The free atom of the transition metals which possesses uncompensated electron spins is the elementary magnet with which ferromagnetism and ferrimagnetism is developed. The various types of magnetic materials and their important properties can be interpreted in terms of the free atom and its local atomic environment. High permeability, square loop materials, and special functional materials existing as alloys are discussed. Interesting examples of domain wall motion in iron whiskers are included. When the magnetic ions find themselves in a spinel environment the properties change to that described as ferrimagnetism. Various basic properties of ferrimagnetism are given including an example of the development of permanent magnetic materials having low symmetry as in the case of ferrooxdure. The garnets are described where the magnetic ions find themselves in three different sites. Recent work on the transparent properties of garnets and certain ferrites are presented showing unusual photographs of domain walls. Further basic developments and applications of magnetic materials are included which cover effects due to neutron irradiation. (Author)

New York U., N. Y.
STOICHIOMETRY AND ELECTRONIC PROPERTIES OF PbTe, by Edward Miller, Kurt K. Komarek, and Irving B. Cadoff. Rept. for 1 Dec 56-30 Sep 59 on Solid State Research and Properties of Matter, Contract AF 33(616)3883. Dec 59, 39p. 35 refs. WADC Technical rept. 59-570.
Order from OTS $1.00 PB 161 842

Off-stoichiometric single crystals of PbTe were grown by the Bridgman technique at a solidification rate of 0.35 cm/hr. At this low solidification rate the crystals were longitudinally segregated, the composition at any point corresponding to that dictated by the solidus curve of the phase diagram. The phase diagram shows that PbTe has an off-stoichiometric melting point; the difference in concentration between the maximum melting point and the stoichiometric point being 0.002 atomic percent, with the congruent melting point on the tellurium rich side of the stoichiometric point. Stoichiometric PbTe is in equilibrium with liquid 0.41 weight percent rich in lead, the equilibrium temperature being 923.2°C. The solubility of both lead and tellurium in PbTe is restricted, the maximum lead and tellurium excess being 5×10^{19} atoms/cm^3. The crystals were cut into thin sections perpendicular to the growth direction and the slices homogenized to yield samples of different impurity concentrations of lead or tellurium. Resistivity, Hall coefficient, and thermoelectric power measurements were made as a function of temperature on three slices corresponding to stoichiometric, excess lead, and excess tellurium. (Author)

Purdue Research Foundation, Lafayette, Ind.
SEMICONDUCTOR RESEARCH. Quarterly rept. no. 12, 1 May-31 July 59, on Contract DA 36-039-sc-71131. [1959] 36p. 14 refs. PRF 1258; AD-230 803.
Order from LC mi$3.00, ph$6.30 PB 146 998

Contents:
Defect crystals, by H. M. James and B. V. Paranjape
Choice of gauge in perturbation theory, by H. M. James and K. S. Mendelson
Transport properties in extrinsic tellurium, by V. A. Johnson and P. Skadron
Preparation and analyses of semiconductors, by L. Roth
Heat capacity of n-type germanium below 1 deg K, by P. H. Keesom and C. A. Bryant
The transport properties of semiconductors at low temperatures, by J. F. Goff and N. Pearlman
Magnetic susceptibility, by D. H. Damon and A. N. Gerritsen
Infrared absorption in irradiated silicon, by A. K. Ramdas and H. Y. Fan
1 cm electron spin resonance spectrometer, by M. Nisenoff, and W. Jung, H. Y. Fan
Paramagnetic resonance in neutron-irradiated silicon, by M. Nisenoff and H. Y. Fan
Impurity conduction in silicon, by R. K. Ray and H. Y. Fan
Dependence of mobility of hot carriers on carrier concentration, by D. Brown and R. Bray.
(See also PB 145 883)

Raytheon Co., Waltham, Mass.
BETA SILICON CARBIDE, by D. M. Warschauer. Scientific rept. no. 1 on Contract AF 19(604)6133. 25 Apr 60, 35p. 6 refs. AFCRC-TN-60-555.
Order from LC mi$3.00, ph$6.30 PB 148 354

The results of tests for the optimum composition of gas for the vapor-decomposition method of growth indicate that best results are achieved when hydrogen and silicon tetrachloride are used alone, rather than with addition of a carbon-bearing compound. The best crystals have been grown at 1950°C; these crystals are stoichiometric to within 0.3 percent, and the impurity content does not exceed 0.003 percent of the impurity most abundant. It has been demonstrated that formation of methane and of high-molecular weight complexes of silicon dichloride are important factors in the growth process. Somewhat smaller crystals of a different shape are being grown by deposition from solution; advances have been in improving the purity of this material, and preliminary measurements of electrical properties are under way. (Author)

Sheffield U. (Gt. Brit.)
ELECTRONIC WAVE FUNCTIONS IN PERTURBED METAL LATTICES, by N. H. March and A. M. Murray. Final technical rept. no. 2, 1 May 59-30 Apr 60, on Contract DA 91-591-EUC-1090. [1960] 41p. 13 refs.
Order from LC mi$3.30, ph$7.80 PB 148 520

The calculation of electronic wave functions round a vacancy in a finite metal has been completed, and the final results are reported here. Calculations are described for particle numbers of approximately

2×10^2, 2×10^3 and 10^0. A self-consistent von Weizsäcker calculation is also reported, and comparison made between this, the finite metal results, and existing Thomas-Fermi calculations. Calculations also reveal long-range oscillations in the total perturbed electron density for finite metals. Reference is made to a number of applications of the present results. Results obtained by a density matrix approach to the imperfections problem are discussed. (See also PB 143 112)

Stanford Electronics Labs., Stanford U., Calif.
SPECTRAL RESPONSE OF SOLAR CELL STRUCTURES, by L. M. Terman. Rept. on Contract Nonr-225(31). 21 Sep 59, 25p. 3 refs. Technical rept. no. 1605-1; AD-226 436.
Order from LC mi$2.70, ph$4.80 PB 148 597

The purpose of this study was to measure the spectral response of silicon solar cell structures, and to observe how the response varied with the depth of the p-n junction. Spectral response was defined as the relative short-circuit current as a function of the wavelength of incident light for equal energy incident upon the cell at all wavelengths. Cells were made with the junction depths varying from 0.6 to 5.0μ, and having smooth (etched) surfaces and rough (lapped) surfaces. Response curves from these cells are presented. These curves indicate that in order to increase the relative short-wavelength response ($\lambda < 0.75\mu$) the junction should be made closer to the surface, while in order to increase the relative long-wavelength response ($\lambda > 0.75\mu$) the junction must be made comparatively far below the surface. The effect of having a lapped surface on the cell is to reduce the lifetime near the surface, thus reducing the response to short wavelengths of incident light. A simple theoretical model is then presented which appears to adequately describe the mechanism involved in determining the shape of the response curves. (Author)

Sylvania Electronic Systems, Waltham, Mass.
INVESTIGATION OF SOME SEMICONDUCTOR SWITCHING ELEMENTS AND THEIR APPLICATION TO A SINGLE-POLE, EIGHT-THROW SWITCH, by Stephen N. Miller. Rept. on Contract AF 19(604)5474 1 Apr 60, 70p. 20 refs. Scientific rept. SR424-2; AFCRC-TN-60-399.
Order from LC mi$3.90, ph$10.80 PB 148 562

A four-terminal, T-network, equivalent circuit impedance representation is presented which satisfactorily predicts the microwave switching properties of three germanium diodes in single-pole, single-throw switches at 2.0, 3.0, and 4.0 kmc. Typical characteristics of these switches are average insertion loss $\leq$ 1.9 decibels, average switching ratio $>$ 15 decibels, and 10-percent to 90-percent power level changes of $T_{on} \leq 40$ nanoseconds, and $T_{off} = 20$ nanoseconds, all over a 5:1 frequency band to 4.0 kmc. General design formulas for a multithrow switch at three frequencies with satisfactory results. Performance data is presented for the eight-throw switch over a 5:1 band to 4.0 kmc. Compared to the SPST switch, some improvement in switching ratio and degradation in insertion loss are noted.

Wayne State U., Detroit, Mich.
THE ARC IMAGE FURNACE FOR GROWING SEMICONDUCTOR CRYSTALS, by R. P. Poplawsky and J. E. Thomas, Jr. Technical note no. 3 on Contract AF 49(638)158. 1 Mar 60, 116p. 36 refs. AFOSR-TN-60-312.
Order from OTS $2.50 PB 161 868

The optical, mechanical, and electrical details of an arc image furnace are given. This furnace uses two 60" paraboloidal reflectors in vertical arrangement with a high intensity carbon arc as the source. It was designed to study "arc image" crystal growing techniques. Two crucible-free techniques, "pushing" and "pulling", which resulted in the growth of several arc image silicon crystals are discussed. Pushing a silicon crystal consists of melting the top surface of a single crystal seed disk, which is positioned at the image point of the furnace, and then feeding a long, small diameter, polycrystalline rod into this melt. Pulling a silicon crystal is accomplished by first dipping a small rectangular seed crystal into a melt produced on the top surface of a relatively large, polycrystalline, silicon cylinder. The seed is then slowly withdrawn and liquid material solidifies onto it. The results of measurements made on pushed and pulled silicon crystals show that they are essentially free of oxygen, have high resistivities when a good grade of bulk material is used, and have a dislocation density of the order of 10^4 cm.$^{-2}$. The factors which influence the growth and quality of arc image crystals are discussed. These include: maximum useful furnace power, shapes of floating zones, and radiant flux considerations.

Wayne State U., Detroit, Mich.
OBSERVATIONS OF SURFACE TRANSVERSE MAGNETORESISTANCE EFFECTS ON N-TYPE GERMANIUM, by Walter A. Albers, Jr. and J. E. Thomas, Jr. Technical note no. 2 on Contract AF 49(638)158. 1 Mar 60, 94p. 35 refs. AFOSR-TN-60-313.
Order from LC mi$5.40, ph$15.30 PB 148 762

Two techniques were developed for preparing large surface-to-volume ratio single crystal samples for surface studies. In both cases the methods depend on having, initially, thick slices of semiconductor single crystal material. This material is then either (1) made the anode of an electrolytic cell and illuminated with near-infrared so that the sample etches thin in the illuminated region or (2) is exposed to a flowing stream of an acid mixture and is subsequently etched thin by the resulting chemical reactions. Several thin samples of n-type germanium were prepared. The electrical conductivity and the magnetoresistance of these samples were simultaneously measured as a function of the surface conditions of the sample.

Wayne State U., Detroit, Mich.
SURFACE PHENOMENA IN SEMICONDUCTORS AND GROWTH OF SEMICONDUCTOR CRYSTALS, by W. A. Albers, V. E. Noble and others. Technical rept. on Contract AF 49(638)158. 1 Mar 60, 41p. 14 refs. AFOSR-TR-60-41.
Order from OTS $1.25 PB 161 867

A photo-electric etching technique has been developed for the preparation of thin filaments of single crystal germanium. Magneto-resistance measurements made on these thin samples have yielded one of the first direct observations of the mobility of electrical carriers near the surface of a semiconductor. 1/f noise measurements have been made upon the thin filaments in order to relate the semiconductor surface properties to the process of carrier trapping by surface energy states. The problem of preparing hyper-pure crystals of semiconducting materials was attacked by employing a high intensity carbon arc. An interpretation of the results of vertical liquid zone and irradiance profile calculations, has indicated the feasibility of growing large, good quality crystals of the medium high melting point semiconductors using arc image techniques.

X-Ray and Crystal Analysis Lab., Pennsylvania State U., University Park.
CRYSTAL STRUCTURE RESEARCH BY X-RAY AND NEUTRON DIFFRACTION, by Ray Pepinsky. Final rept. for 1 June 57-14 Sep 58 on Contract DA 36-039-sc-72385. [1958] 88p. 18 refs. AD-208 071.
Order from LC mi$4.80, ph$13.80 PB 146 579

Many new ferroelectrics have been discovered, and the importance of the glycine molecule and of the tetrahedral ions such as NH_4^+ and SO_4^{--} in the ferroelectric transitions have been emphasized. An extensive study has been carried out on the various physical properties of ferroelectric sulfates as well as fluoberyllates. X-ray structure analysis of triglycine sulfate has shown the mechanism of ferroelectricity in this crystal.

Rutgers State U. Coll. of Engineering, New Brunswick, N. J.
ON THE MECHANICAL AND THERMAL STABILITY OF LOW-ANGLE BOUNDARIES IN ZINC SINGLE CRYSTALS, by Sigmund Weissmann, Makato Hirabayashi, and Hiroshi Fujita. Final rept. on Contract DA 30-069-ORD-1777. 1 May 60, 51p. 18 refs. OOR rept. 1665.3-Met.
Order from LC mi$3.60, ph$9.30 PB 148 442

The mechanical and thermal stability of low-angle boundaries in zinc single crystals was studied by methods combining metallographic techniques with x-ray reflection microscopy and diffraction analysis. It was found that low-angle boundaries perpendicular to the basal plane do not offer any appreciable resistance to a shearing force parallel to the basel plane if they are pure tilt boundaries, but are substantial barriers if they are asymmetrical. If the external force exceeds a critical value these asymmetrical low-angle boundaries become sites where fracture may occur. The strengthening effect of the asymmetrical low-angle boundaries is attributed to the effective stress field of the screw dislocations, which are mechanically stabilized by the edge dislocations. The stress field of the screw dislocations is also responsible for the thermal instability of the asymmetrical low-angle boundaries, which on annealing are gradually converted into pure tilt boundaries. A coarse substructure established after annealing and consisting of pure tilt boundaries is thermally very stable. On solidification after partial melting of the crystal the coarse substructure is re-established, whereas the fine substructure is entirely modified. (Author)

Theoretical Physics

Avco-[Everett] Research Lab., Mass.
MAGNETOHYDRODYNAMIC DISTORTION OF A MAGNETIC FIELD DUE TO UNIFORM FLOW, by David S. Falk. Rept. on Contract AF 04(645)18. 30 Apr 58, 8p. Research rept. 29; AD-201 913.
Order from LC mi$1.80, ph$1.80 PB 147 195

An exact solution has been obtained for the distortion of the magnetic field of a straight wire of vanishing diameter, due to the uniform flow of a fluid with constant scalar conductivity, in the limit where the effect of the field on the flow is neglected.

Brandeis U., Waltham, Mass.
QUANTUM CORRECTED STATISTICAL METHOD, by L. C. R. Alfred. Technical rept. no. 7 on Contract Nonr-1677(01). Sep 59, 22p. 9 refs. AD-228 394.
Order from LC mi$2.70, ph$4.80 PB 148 595

Quantum corrections are applied to the single particle density matrix in a semiclassical ensemble where the distribution is unrestricted. A form for the density matrix containing implicitly a function of the wave mechanical Hamiltonian operator is devised. A formalism is then developed to decompose this operator function into effectively classical and non-classical parts. The classical part corresponds to the semiclassical density matrix, and the quantum corrections are obtained from the nonclassical terms The quantum corrected density matrix for a spherically symmetrical and a 1 dimensional system were evaluated. The densities for a linear harmonic oscillator and a Coulomb potential for a Fermi-Dirac distribution were also examined. (Author)

California U., Berkeley.
ON FINITE RENORMALIZATION CONSTANTS AND THE MULTIPLICATION OF CAUSAL FUNCTIONS IN PERTURBATION THEORY, by H. J. Bremermann. Technical rept. no. 8 on Contract Nonr-222(62). Sep 59, 32p. 11 refs. AD-227 963.
Order from LC mi$3.00, ph$6.30 PB 148 583

Chicago U., Ill.
QUANTIZATION OF NON-LINEAR SYSTEMS, by I. E. Segal. Technical note no. 2 on Contract AF 49(638)666. May 60, 71p. 23 refs. AFOSR-TN-60-575.
Order from LC mi$4.50, ph$12.30 PB 148 416

A direct method of quantization, applicable to a given non-linear hyperbolic partial differential equation, is indicated. From such classical equations alone, without a given Lagrangian or Hamiltonian, or a priori linear reference system such as a bare or incoming field, a quantized field is constructed, satisfying the conventional commutation relations. While mathematically quite heuristic in part, local products of quantized fields do not intervene, and there are grounds for the belief that the formulation is free from non-trivial divergences. (Author)

Hebrew U. (Israel).
TABLES OF EIGENVALUES AND MATRIXELEMENTS OF TRANSITION PROBABILITIES FOR AN AXIAL SPIN HAMILTONIAN WITH S = 3/2, by R. Stahl-Brada and W. Low. Technical note no. 9 on Contract AF 61(052)59. July 59, 58p. 1 ref. AFOSR-TN-59-1125; AD-232 062.
Order from LC mi$3.60, ph$9.30 PB 146 717

Numerically computed eigenvalues of the matrix corresponding to the axial spin Hamiltonian $\mathcal{H}_S = g\beta H.S + D(S_z - \frac{1}{3} S(S+1))$ with the spin number S =3/2 are tabulated.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE WAVE MOTIONS OF SMALL AMPLITUDE IN A FULLY IONIZED PLASMA. PART II. WITH LONGITUDINAL APPLIED MAGNETIC FIELD, by S. I. Pai. Rept. on Contract AF 49(638)401. Apr 60, 30p. Technical note BN-207; AFOSR-TN-60-576.
Order from LC mi$2.70, ph$4.80 PB 148 211

Wave motions of infinitesimal amplitude in a fully ionized plasma, consisting of single charged ions and electrons, have been investigated by a two fluid theory under uniform external magnetic field. The interaction of the basic modes of wave due to external magnetic field has been discussed. The case where the external uniform magnetic field is in the direction of propagation of the waves has been analysed in detail. The effect of finite electrical conductivity on these transverse waves has been briefly discussed.

Institute of Mathematical Sciences, New York U., N. Y.
STATISTICAL MECHANICS AND THE BOLTZMANN EQUATION, by Robert M. Lewis. Rept. on Contract AF 49(638)341. Jan 60, 10p. 5 refs. Research rept. no. HT-4; AFOSR-TN-60-10; AD-233 307.
Order from LC mi$1.80, ph$1.80 PB 146 720

A very simple derivation of the Boltzmann equation is given. The derivation is based on the solution of the initial value problem for the hierarchy equations of statistical mechanics. (Author)

Institute of Optics, U. of Rochester, N. Y.
CORRELATION THEORY OF STATIONARY ELECTROMAGNETIC FIELDS. PART I: THE BASIC FIELD EQUATIONS, by E. Wolf and P. Roman (U. of Manchester). Technical note no. 1 on Contract AF 49(638)602. Oct 59, 22p. 8 refs. AFOSR TN-59-1188; AD-232 919.
Order from LC mi$2.70, ph$4.80 PB 146 336

In recent papers a class of second order correlation tensors was introduced and certain differential equations which govern their propagation were postulated. These correlation tensors, which may be regarded as natural generalizations of functions used in the analysis of partially coherent optical wavefields, characterize the correlations which exist between the electromagnetic field vectors at any 2 points in the field, at any 2 instants of time. A derivation of the basic differential equations is presented; and it is shown that the 2 sets into which equation naturally split are not independent, but follows from each other as a consequence of certain symmetry properties which the correlation tensors exhibit. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
HIGH ENERGY LIMIT OF FORM FACTORS, by S. D. Drell and F. Zachariasen. Technical note no. no. 13 on Contract AF 49(638)388. Feb 60, 20p. 8 refs. AFOSR TN-60-183; AD-233 743.
Order from LC mi$2.40, ph$3.30 PB 146 420

The following theorem is proved: for finite charge renormalization constant Z_3^{-1}, the form factors describing any vertex with 2 particles on the mass shell must vanish at infinite momentum transfer. The relation of this result to the work of Lehmann, Symanzik, and Zimmerman (Nuovo Cimento 2:425, 1955) is discussed. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
A TEST OF APPROXIMATION METHODS IN POTENTIAL SCATTERING, by J. D. Bjorken and A. Goldberg. Technical note. no. 11 on Contract AF 49(638)388. Feb 60, 24p. 11 refs. AFOSR-TN-60-167; AD-233 740.
Order from LC mi$2.70, ph$4.80 PB 146 419

Various approximation procedures fashionable in field theory for computing scattering amplitudes are tested on a soluble problem in potential theory---the s-wave scattering by an exponential potential. The methods include: (1) the Fredholm, or determinantal, expansion; (2) the Chew-Mandelstam procedure of constructing the scattering amplitude T_0 from analyticity properties and unitarity; (3) expansion of T_0 in powers of the potential strength λ (Born approximation); and (4) expansion of tan δ_0 in powers of λ, and (5) expansion of cot δ_0 in powers of λ.

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF MICROWAVE PROPERTIES OF PLASMAS, by M. Chodorow. Scientific rept. no. 7, 1 Nov 59-31 Jan 60, on Contract AF 19(604)5226. Feb 60, 21p. M. L. rept. 697; AFCRC-TN-60-185.
Order from LC mi$2.70, ph$4.80 PB 148 168

Thermal Plasma: The major source of ion loss now appears to be from diffusion as well as from recombination. Noise in Plasmas: An analysis of the correlation measurement has been made, and simpler versions of the original experiment have been examined. Harmonic Generation in Plasmas: Theoretical work has been concerned with predicting the second harmonic output of a generator. Electron Beam Interaction with a Plasma: Numerical solutions Electron Plasma Waves: Propagation measurements on the enlarged plasma guide system. Parametric Effects: A re-examination of the theory of traveling-wave type parametric amplification in a plasma column has given some new insight on the rather marginal performance of the tubes used up to now. Electrostatic Sound Waves: Experiments attempting

to excite low-velocity plasma sound waves are described. Plasma Confinement: A new electrode configuration for imposing the rf field on the plasma confirmed earlier conclusions that the confinement phenomena is not a radiation pressure effect but more likely a sheath effect. Plasma Studies: This new project is presently concerned with two aspects of plasmas: analysis of nonlinear effects by Hamiltonian methods, and the investigation of a possible experiment to verify the concept of Landau damping. (See also PB 144 927)

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF THE MICROWAVE PROPERTIES OF PLASMAS, by M. Chodorow. Scientific rept. no. 5, 1 Aug-31 Oct 59, on Contract AF 19(604)5226. Dec 59, 21p. M. L. rept. no. 669; AFCRC-TN-60-113; AD-233 580.
Order from LC mi$2.70, ph$4.80 PB 146 646

Contents:
Plasma research
  Thermal plasma
  Noise in plasmas
  Harmonic generation in plasmas
  Microwave measurements in plasmas
Other plasma studies
  Electron beam interaction with a plasma
  Electron plasma waves
  Parametric effects
  Electrostatic sound waves
  Plasma confinement

Microwave Lab., Stanford U., Calif.
LANDAU DAMPING OF CIRCUIT AND ION WAVES, by P. A. Sturrock. Technical note on Contract AF 49(638)415. Jan 60, 17p. 8 refs. M.L. rept. no. 665; AFOSR-TN-60-141; AD-233 751.
Order from LC mi$2.40, ph$3.30 PB 146 348

It is shown that the interaction of a slow circuit wave with the thermal electrons of a plasma column should lead to dissipation of the circuit wave by the mechanism of Landau damping. Numerical estimates indicate that this effect should be susceptible to experimental verification. Such an experiment, if successful, would offer a method for determining the electron velocity distribution of a plasma column. A circuit analogue for the ion-acoustic-wave mechanism is derived which facilitates calculation of the Landau damping of ion waves. This effect is found to be small and cannot account for the difficulty experienced in attempting to set up these waves. (Author)

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
RADIATION BY PLASMA OSCILLATIONS IN A BOUNDED PLASMA IN A MAGNETIC FIELD, by H. W. Wyld, Jr. 23 Oct 59, 28p. 3 refs. PRL-9-23.
Order from LC mi$2.70, ph$4.80 PB 147 000

The radiation by a thermal distribution of plasma oscillations in a bounded plasma in a magnetic field is calculated in the limit $(\omega_c/\omega_p)^{1/2} \ll 1$, where ω_c and ω_p are the cyclotron and plasma frequencies. The calculation is performed in two ways leading to the same result: (1) a "Fresnel formula" for the ratio of the intensity of the electromagnetic wave transmitted through the plasma boundary to the intensity of an incident plasma oscillation is derived; (2) the decaying modes, satisfying a radiation condition at infinity, of a bounded plasma in a magnetic field are found.

Purdue U., Lafayette, Ind.
ON THE POSSIBILITY OF THE CHARGE DEPENDENT CORRECTION TO THE GRAVITATIONAL FORCE, by Masaaki Kawaguchi. Rept. on Contract AF 18(600)1579. [1957] 5p. 6 refs. AFOSR-TN-58-189.
Order from LC mi$1.80, ph$1.80 PB 137 679

Sindel S. p. A., Rome (Italy).
MICROWAVE DETERMINATIONS OF AFTERGLOW TEMPERATURES AND ELECTRON COLLISION FREQUENCIES IN NITROGEN, by D. Formato and A. Gilardini. Technical scientific note no. 1 on Contract AF 61(052)39. 7 Aug 59, 15p. 9 refs. AFCRC-TN-60-149; AD-233 986.
Order from LC mi$2.40, ph$3.30 PB 146 644

A new method for measuring afterglow electron temperatures from microwave noise measurements is described. By using this method it was shown that the electron temperatures in the afterglow of a dc pulsed discharge in a long glass tube are much larger than thermal over the measured decay time. This may explain the different electron collision frequency values measured in nitrogen by different authors with microwave techniques. (Author)

Sperry Gyroscope Co., Great Neck, N. Y.
A BEAM-GENERATED BEAM-PLASMA SYSTEM, by C. C. Wang, J. E. Hopson, and L. P. Levine. Scientific rept. no. 1 on Contract AF 19(604)5555. Mar 60, 60p. 23 refs. Sperry rept. no. NA-8210-8191-1; AFCRC-TN-60-374.
Order from LC mi$3.60, ph$9.30 PB 148 316

The minimum pressure condition for plasma generation, the result of directing an electron beam through a residual gas (hydrogen in this study) along magnetic field lines, has been theoretically predicted and experimentally verified. For pressures greater than the minimum pressure, the equilibrium plasma density has been analyzed. Plasma growth greater than that expected from collisions of primary electrons with residual gas atoms was found; diffusion-controlled breakdown caused by a microwave generation process of the system explains this growth. Microwave interaction of the beam-generated plasma circuit with the primary beam is exhibited as a velocity modulation of the beam.

Experiments show a discrete bandwidth noise spectrum theoretically, discrete frequency oscillations over a prescribed bandwidth should be produced. Plasma circuit characteristics are not independent of microwave power level as assumed in the theory; the microwave power generated is apparently absorbed by the plasma. The plasma, then, is unstable. (Author)

Stevens Inst. of Tech., Hoboken, N. J.
INVESTIGATION OF PLASMA ACCELERATIONS, by K. C. Rogers, D. Finkelstein and others. Quarterly progress rept. no. 6, 1 Oct-31 Dec 59, on Megatron Accelerator, Contract DA 36-039-sc-78097. [1959] 23p. 16 refs. AD-233 991.
Order from LC mi$2.70, ph$4.80 PB 147 979

Some results of further theoretical work on the megatron beam are summarized. Possible instabilities are listed and stability criteria are given. The instabilities considered are single-particle magnetic guide field resonances, kink hydrodynamic instability, negative mass instability, and two stream instability. (Author)

Technische Hochschule, Munich (West Germany).
WAVE PROPAGATION IN A PLASMA-CABLE, by G. Biener. Technical final rept. for 1 Oct 57-30 Sep 59 on Contract AF 61(052)11. [1959] 43p. 9 refs. AFCRC-TR-60-110; AD-233 778.
Order from LC mi$3.30, ph$7.80 PB 146 637

In the case of a time-varying plasma when the gaseous discharge increases or decreases within a short time, probe measurements cannot always be carried out. For studying time-varying gaseous discharges the classic probe method was discarded in favor of electromagnetic waves whose propagation characteristics will be influenced by the condition of the plasma. A phase measuring method was worked out, by which the phase difference between 2 different points of a progressing wave could be determined and which allows to observe time-varying processes in the gaseous discharge. By these 2 measuring methods (the wave and the probe method) the plasma parameters at stationary conditions were determined and wave propagation in the plasma cable was further investigated. By employing the phase difference method for these measurements it was possible to distinguish between a slow forward wave with a phase and group velocity of equal direction, and a backward wave with a phase and group velocity of opposite directions. Furthermore, the influence of the electronic drift velocity on the propagation was identified by experiments and quantitatively determined. (Author)

Watertown Arsenal Labs., Mass.
THE INTERACTION OF ELECTRONS WITH ELASTIC WAVES IN SOLIDS WITH RESPECT TO ULTRASONIC ATTENUATION, by E. P. Papadakis. May 60, 30p. 18 refs. WAL TR-143/32.
Order from LC mi$2.70, ph$4.80 PB 148 122

Theoretical and experimental work by many researchers show that the attenuation of ultrasonic elastic waves in metals at liquid helium temperatures is dependent upon the momentum transfer between the electrons and the lattice, the population of electrons in the normal- and superconducting states, and the orientation of the elastic displacement with respect to an applied magnetic field. The work is summarized and the results presented in equations and graphs. (Author)

Avco[Everett] Research Lab., Mass.
ELECTRICAL CONDUCTIVITY OF THERMALLY IONIZED AIR PRODUCED IN A SHOCK TUBE, by S. C. Lin. Rept. on Contract AF 04(645)18. Feb 57, 24p. 16 refs. Research rept. 5 (formerly Research note 26).
Order from LC mi$2.70, ph$4.80 PB 146 657

The electrical conductivity of shock-heated air at equilibrium temperature from 3500°K to 6200°K, and at densities of the order of 0.01 N. T. P., has been measured, using the shock wave-magnetic field interaction technique reported by Lin, Resler, and Kantrowitz.

Avco-Everett Research Lab., Mass.
GENERALIZED HEAT TRANSFER FORMULAE AND GRAPHS, by R. W. Detra and H. Hidalgo. Rept. on Contract AF 04(645)18. Mar 60, 19p. 8 refs. Research rept. 72; AD-233 702.
Order from LC mi$2.40, ph$3.30 PB 147 211

Utilizing the research results of previously reported investigations of the laminar, turbulent and radiative heat transfer in dissociated air, some generalized formulae for calculating heat transfer are given. Graphs for determining the laminar heat transfer, momentum thickness Reynolds number, and turbulent heat transfer distributions around an axisymmetric body are also given. These heat transfer correlations are valid for velocities between 6000 fps and 26,000 fps and for altitudes up to 250,000 ft. This range of velocities and altitudes covers the important re-entry regime of practical re-entry trajectories having interest today. These generalized results are specjalized for ICBM nose cone re-entry applications. These formulae and graphs may be found useful for making rapid engineering estimates and preliminary design evaluations of the heating problems associated with re-entry into the Earth's atmosphere. (Author)

Avco-[Everett] Research Lab., Mass.
A SHOCK TUBE INVESTIGATION OF HEAT TRANSFER IN THE WAKE OF A HEMISPHERE-CYLINDER, WITH APPLICATION TO HYPERSONIC FLIGHT, by William E. Powers, Kenneth F. Stetson, and Mac C. Adams. Rept. for Oct 56-June 57, on Contract AF 04(645)18. Aug 58, 41p. 9 refs. Research rept. 30; AD-205 513.
Order from LC mi$3.30, ph$7.80 PB 147 196

Wake heat transfer experiments, under conditions which simulate hypersonic velocities, were conducted in a constant area shock tube. The preliminary objective of establishing the utility of the shock tube for wake investigations was verified as steady state wake heat transfer rates and stable wake geometries were obtained in less than 100 μsec. The heat transfer coefficients for the wake of a sting supported hemisphere-cylinder configuration were obtained for laminar and turbulent flow on the body. Laminar heat transfer rates for the wake averaged about two-thirds

of the theoretical laminar heat transfer rate to a solid surface replacing the wake mixing line. The magnitude of the turbulent heat transfer rates was about one-third of the turbulent prediction for a solid surface replacing the wake boundary. No distinguishable variations of heat transfer rates to the sting or rear face of the model were observed for sting-to-body diameter ratios of 0.3 and 0.6, and observed variations within the wake were less than the experimental scatter of about ± 20%. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOME ASPECTS OF NON-EQUILIBRIUM FLOWS, by Raymond Sedney. Mar 60, 35p. 13 refs. Rept. no 1099.
Order from LC mi$3.00, ph$6.30 PB 148 238

Some of the general features of non-equilibrium flow are discussed and vibrational relaxation is discussed in detail. This case is somewhat simpler than dissociation and ionization but it illustrates some of the main new features of non-equilibrium flow. Those aspects of two-dimensional and axisymmetric flow behind shock waves are examined analytically which yield significant information without requiring numerical solution of the governing equations. The thermodynamics of a vibrational relaxing gas is discussed. The conditions for simulating flows are noted. Crocco's theorem and the characteristic equations are derived. Then a simple method of obtaining the initial gradients of the flow variables behind a shock is shown. These gradients are used in discussing two particular flows. An exact solution for flow over a cusped body is obtained. Flow over a wedge near the tip and far from the tip is considered. It is found that far from the tip a boundary layer type phenomenon occurs. (Author)

Brown U. Div. of Engineering, Providence, R. I.
STEADY-STATE HEAT CONDUCTION IN A CIRCULAR CONE, by Rokuro Muki and Eli Sternberg. Technical rept. no. 13 on Contract Nonr-562(20). Sep 59, 17p. 11 refs. Nonr 562(20)/13; AD-226 342.
Order from LC mi$2.40, ph$3.30 PB 148 584

A determination is made of the steady-state temperature distribution generated in a circular cone of infinite extent by a discontinuous distribution of the prescribed surface temperature. Specifically, the surface of the cone is exposed to a constant temperature up to a given distance from the vertex, the remainder of the boundary being maintained at a distinct uniform temperature. With the aid of the Mellin transform a solution to the foregoing problem (exact within the classical theory of heat-conduction) is deduced both in the form of an infinite residue expansion and in real integral form. The convergence of these 2 alternative representations is established and numerical results are obtained for the variation of the temperature along the axis of the cone if the opening angle is $\pi/3$. (Author)

California U., Berkeley.
DEVELOPMENT AND STRUCTURE OF PLANE DETONATION WAVES, by A. K. Oppenheim and R. A. Stern. Technical note DR 7 on Contract AF 49(638)166. Feb 60, 137p. 207 refs. AFOSR-TN-60-124; AD-233 940.
Order from LC mi$6.90, ph$21.30 PB 146 360

The current status of knowledge on the development and structure of plane detonation waves is critically reviewed. A comprehensive historical survey is reported of the problem including contemporary studies, and the exposition of: (1) current theories concerning the mechanism of the development of the process, and (2) the analysis of the structure of the steady, plane detonation wave. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
REFERENCES TO RESEARCH ON HIGH-EMISSIVITY SURFACES, by J. W. Holladay. 27 June 60, 11p. 20 refs. DMIC memo. 57.
Order from OTS $0.50 PB 161 207

In any space-vehicle heat balance solar absorptivity and emissivity are the principal factors which determine the vehicle temperature. Until recently, little work had been done on the determination of the emissivities of structural materials over a range of temperatures. In view of the new importance of emissivity information, a number of projects have been established to develop improved methods of measuring emissivity and to determine the emissivity of various materials at both high and low temperatures.

Massachusetts Inst. of Tech., Cambridge.
A FUNDAMENTAL EQUATION FOR STEAM IN TERMS OF TCHEBICHEF POLYNOMIALS, by Frank D. Skinner. Doctoral thesis. Technical rept. no. 1 on Contract Nonr-1841(60). Sep 59, 192p. 34 refs.
Order from LC mi$8.70, ph$30.00 PB 148 607

Since the appearance of the perfect-gas law over a century ago, an almost overwhelming number of equations of state have been suggested. A review of some of the more significant equations is presented with particular emphasis on Dr. F. G. Keyes' Equation VII for steam which appeared in 1949. Of the equations presented, most are simple enough to be manipulated into a fundamental form, but their accuracy is limited to fairly low pressures. Dr. Keyes' Equation VII which is accurate to very high pressures is too complex to allow a fundamental equation to be determined. Data obtained from the Keyes equation is used to determine a Tchebichef polynomial equation of a form recently suggested by C. J. Pings, Jr. and B. H. Sage of the California Institute of Technology. This equation which is accurate to very high pressures, can also be easily manipulated to form a fundamental equation for steam.

Materials Research Lab., U. of California, Berkeley
SPECIFIC HEAT OF METALS AND ALLOYS, by Ralph Hultgren. Technical note no. 4 on Contract AF 49(638)83. 1 June 60, 29p. Series no. 137, issue no. 4; AFOSR-TN-60-527.
Order from LC mi$2.70, ph$4.80 PB 148 515

Lecture given at Third Annual Conference for Sponsors, March 29, 1960; Thermophysical Properties Research Center, School of Mechanical Engineering, Purdue University, Lafayette, Indiana.

Minnesotoa U., Minneapolis.
SURVEY OF BOUNDARY LAYER HEAT TRANSFER AT HIGH VELOCITIES AND HIGH TEMPERATURES, by Ernst R. G. Eckert. Rept. on Contract AF 33(616)5676. Apr 60, 115p. 415 refs. WADC Technical rept. 59-624.
Order from OTS $2.50 PB 161 843

Heat transfer in boundary layer flow at high velocities and high temperatures is discussed, and engineering relations for its calculation are presented. Aeronautical and space flight applications have pushed the conditions under which heat transfer knowledge is important to much higher velocities and temperatures. The influence of very large temperature differences, of dissociation and ionization, of low densities, and of chemical reactions on heat transfer has been well established in its general features. In addition, new cooling methods, like transpiration, ablation, or film cooling have been studied. The reference enthalpy method is extended and generalized in this report to include the additional effects mentioned above. This leads to simple relations by which heat transfer can be calculated with an accuracy which should be sufficient for engineering purposes. These relations additionally have the advantage that most of them are applicable to any gas or gas mixture; therefore, not only to the reentry problem but also to heat transfer problems arising in rockets or other propulsion systems and in other applications. (Author)

Naval Ordnance Lab., White Oak, Md.
EQUATION OF STATE OF WATER, by Andre N. Gleyzal and Hans G. Snay. 9 Dec 59, 28p. 5 refs. NAVORD rept. 6749.
Order from LC mi$2.70, ph$4.80 PB 148 220

Thermodynamic quantities such as γ, S, and p as functions of temperature are calculated for temperatures sufficiently high to cause dissociation of the molecule. Thermochemical equilibrium is assumed and the Wilson-Kistiakowsky equation of state is employed. Two types of corrections for the electrostatic force, an "Ulfsold correction" and a "Debye-Hückel correction" are discussed but not used in the numerical calculations reported here. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INVESTIGATION OF THERMAL INSULATION MATERIALS, by J. L. Abbott. 23 July 59, 50p. NOTS TP-2243; NAVORD rept. 6545; AD-225 996.
Order from LC mi$3.30, ph$7.80 PB 148 371

This investigation determined the relative heat transfer characteristics of a number of commercially available thermal insulation materials. Laboratory test methods were developed which closely simulated the results of full-scale aviation-fuel fire tests. The results from laboratory and field tests indicate that a 0.5-in. layer of commercial glass cloth can provide practicable protection of weapons and missiles against fuel fires for sufficient time to insure application of effective fire fighting techniques. The application of reflective metal foil, such as stainless steel, interlayered with the glass cloth further increases the insulation efficiency. Tests on new asbestos fiber insulation materials have shown results which indicate possible superiority to glass cloth, particularly, if they can be fabricated for interlayering with reflective foil. These materials also have the additional advantage of lower density than glass cloth. (Author)

Naval Research Lab., Washington, D. C.
TABLES OF THE EINSTEIN ENERGY, SPECIFIC HEAT AND DERIVATIVE SPECIFIC HEAT FUNCTIONS, by W. C. Overton, Jr. and J. H. Hancock. Final rept. 6 July 60, 21p. 14 refs. NRL rept. 5502.
Order from LC mi$2.70, ph$4.80 PB 146 403

The purpose of the tables given in this report is to provide numerical values of the functions $F_1(x)$, $F_2(x)$, and $F_3(x)$ in order to facilitate the calculation of thermodynamic properties of solids such as the internal energy and specific heat. The function F_1 is the Einstein quantum-theory expression for the average energy of a harmonic oscillator mode. The specific heat of a mode, F_2, is obtained from the derivative of F_1 with respect to temperature, which is proportional to $1/x$, while F_3 is the derivative of F_2 with respect to x. Using NRL's Narec electronic digital computer we have computed tables of these useful functions, F_1, F_2, and F_3, for the range $0.01 \leq x \leq 24.00$, with the interval 0.01. The values in these tables are accurate to ± 1 in the eighth significant digit and provide accuracy to ± 2 in the sixth significant digit with only linear interpolation.

New York U., N. Y.
REACTION KINETICS, THERMODYNAMICS, AND TRANSPORT PROPERTIES IN THE OZONE-OXYGEN SYSTEM, by Edwin S. Campbell and Carole Nudelman. Rept. on A Survey of Properties for Flame Studies, Contract AF 49(638)169. [1959] 122p. 69 refs. AFOSR-TN-60-502.
Order from LC mi$6.30, ph$19.80 PB 147 913

This review was undertaken to collect and evaluate the information required for a detailed theoretical analysis of the ozone flame. Although this is one of the simplest possible chemical systems, much data had to be taken from conflicting information and untested extra-polations. The thermodynamic properties are the most satisfactory of the available data. There is information on the three species of interest in this system and meaningful estimates for the accuracy of the data can be given. These data include energy, enthalpy, free energies, and heat capacities. The most important assets of this system from the standpoint of flame studies are its chemical simplicity and the possibility of varying the relative importance of the reactions by varying the concentration of ozone in the fuel gas and, therefore, the maximum flame temperature. The important transport properties for flame studies are the thermal conductivity and the diffusion coefficients. The only direct experimental information is on the thermal conductivity of oxygen at temperatures from about 80° to about 350°K.

Pennsylvania U., Philadelphia.
THE IRREVERSIBLE THERMODYNAMICS OF NONLINEAR PROCESSES AND NOISE IN DRIVEN SYSTEMS, by William Bernard and Herbert B. Callen Technical rept. no. 13 on Contract Nonr-698(00). June 59, 140p. 15 refs. AD-217 512.
Order from LC mi$6.90, ph$21.30 PB 147 449

The theory of irreversible thermodynamics is reviewed and extended. The irreversible behavior of a system driven by externally applied forces was studied extensively, but attention was focussed primarily on the first order term in the driven response. Also considered are the higher order terms in the driven response and the random fluctuations, or noise, occurring during an irreversible process. In addition to the well known relations between the linear response and the equilibrium fluctuations, several new relations involving the non-linear response, the driven noise, and the equilibrium fluctuations are proved. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
NON-EQUILIBRIUM CENTERED RAREFACTION FOR A REACTING MIXTURE, by Luigi G. Napolitano. Rept. on Contract AF 40(600)732. June 60, 66p 5 refs. AEDC-TN-60-129.
Order from LC mi$3.90, ph$10.80 PB 148 581

General equations are derived which describe the dynamics and thermodynamics of an ideal dissociating gas when only one relaxation time, the chemical one, is different from zero. The equations are applied to the study of an expansion around a two-dimensional corner by the methods of the characteristics. The initial value problem is posed, the equations suitably transformed, and the numerical procedure, based on the usual finite difference approximation to the characteristics and regularity conditions, outlined. The expansion wave around the corner is investigated from a different viewpoint. Two series solutions are given in terms of the parameter $r = R/L$ where R is the distance from the corner and L a characteristic length which essentially depends upon both the energy involved in the reaction process and the rapidity of the reaction itself as compared to the macroscopic convective motion. (Author)

Stanford U., Calif.
HEAT CONDUCTION AND THERMAL STRESSES IN A SOLID HAVING UNEQUAL SPECIFIC HEATS, by E. W. Parkes. Rept. on Contract AF 49(638)223. Feb 60, 24p. 9 refs. SUDAER no. 90; AFOSR-TN-60-320.
Order from LC mi$2.70, ph$4.80 PB 148 506

It is usual in thermoelastic analyses to separate the heat conduction and stressing problems. This division can only be justified if the specific heat at zero stress for the material is closely equal to that at zero strain. For some materials at present under consideration for missile construction, the ratio of specific heats may depart from unity by 25%. The paper investigates the transient temperature distribution and thermal stresses in a solid subjected to one-dimensional heat flow and various kinds of stress-inducing restraints, when the specific heats are unequal. Allowance is made for the stress terms in the heat conduction equation (which are ignored when the analysis is divided) and for the variation of specific heat with temperature. It is concluded that the errors introduced by the conventional approach, although not entirely negligible, are not such as to justify the labor involved in the more correct analysis. (Author)

Stanford U., Calif.
THERMODYNAMIC FOUNDATIONS OF THE THEORY OF DEFORMATION, by J. F. Besseling. Rept. on Contract AF 49(638)223. Aug 59, 31p. 9 refs. SUDAER no. 86; AFOSR-TN-59-871.
Order from LC mi$3.00, ph$6.30 PB 148 503

It is shown that the theory of deformation can be founded on thermodynamic principles, the Galilean principle of relativity, and the concept of a natural reference state which at any instant is locally reproducible by a reversible process. The theory is a priori restricted to small inelastic strains. Explicit relations in terms of material properties are presented for small deviations from the natural reference state. Attention is drawn to the inherent nonlinearity of the thermoelastic equations in dynamic problems. (Author)

Stanford U., Calif.
THERMOELASTICITY, by E. W. Parkes. Rept. on Contract AF 49(638)223. Feb 60, 92p. SUDAER no. 91; AFOSR-TN-60-380.
Order from LC mi$5.40, ph$15.30 PB 148 507

Course of lectures on thermal and elastic constants; Maxwell's equations and the relations between the thermoelastic constants; the thermoelastic equations; boundary conditions; the heat conduction equation; elastic thermal stresses and their effects on stiffness; inelastic thermal stresses and a design philosophy for repeated thermal loading.

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
THE AVAILABLE CHEMICAL ENERGY IN THE UPPER ATMOSPHERE, by Curtis A. Wagner. Rept. on Contract DA 11-022-ORD-2526. 2 May 60, 92p. 31 refs. WIS-OOR-28, Series 5; OOR rept. 1898. 10-C.
Order from LC mi$5.40, ph$15.30 PB 148 435

The total amount of available chemical energy in the atmosphere is determined for various altitudes. This is compared with approximations to the energy required to orbit a fuelless recombination ramjet missile at these same selected altitudes. Since thermodynamic, temperature, pressure, and especially composition data are extremely critical to these calculations, a discussion of sources is included. Details of the thermodynamic calculations and the computational techniques employed in conjunction with the Bendix G-15 high speed computer are also discussed. Tables of important data and results are presented

for future reference and checking; new temperature, pressure, and composition data will undoubtedly be available soon for more accurate calculations. These calculations, using presently available data, indicate that operation of such a vehicle would be marginal around 120 kilometers and impractical elsewhere. (Author)

Wave Propagation

Center for Radiophysics and Space Research, Cornell U., Ithaca, N. Y.
SCATTERING OF RADIO WAVES BY ELECTRONS ABOVE THE IONOSPHERE, by E. E. Salpeter. Arecibo Radio Observatory scientific rept. no. 3 on Contract AF 19(604)6158. 18 Apr 60, 6p. 4 refs. Research rept. RS-8; AFCRC-TN-60-397.
Order from LC mi$1.80, ph$1.80 PB 148 523

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
TROPOSPHERIC SCATTER PROPAGATION INVESTIGATION, by Wilfred K. Klemperer. Final rept. on Contract AF 19(604)1835. 19 Feb 60, 74p. 29 refs. Rept. no. C-1074-P-1; AFCRC-TR-60-132.
Order from LC mi$4.50, ph$12.30 PB 147 909

A receiving station of a 395 mile scatter link operating at 915 mc was established and operated for three years. Probability amplitude distribution and power spectra were obtained for the received signal and analyzed to determine the degree to which the data verified existing theories on tropospheric scatter propagation. Some evidence exists which indicates that amplitude distribution of the received signal is distributed in accordance with Rayleigh statistics for periods up to about 100 seconds. Investigation of the relationship of characteristics of the received signal with meteorological phenomena shows that a correlation exists between the fading range and wind shear in the scatter volume. No correlation was observed between the signal characteristics and the height of the tropopause. Peaks in the received signal due to forward scattering by lightning discharges were identified.

Electrical Engineering Research Lab., U. of Texas, Austin.
A CRITICAL ANALYSIS OF FIELD STRENGTH MEASUREMENTS AT FREQUENCIES ABOVE 30 MCPS, by A. H. LaGrone and Tadao Inami (Doctoral thesis). Rept. on Contract AF 19(604)5504. 3 June 60, 213p. 193 refs. Rept. no. 6-35; AFCRC-TN-60-557
Order from LC mi$9.60, ph$33.30 PB 148 209

Although the study of propagation of radio waves with frequencies above 30 mcps began in relatively recent years, numerous field-strength measurement data are now available. In this paper, the authors have analyzed, compared, and criticized these data. Problems concerning the propagation of radio waves at frequencies above 30 mcps are considered for the optical and diffraction regions, and for scattering in both the troposphere and ionosphere. Original and comprehensive mass plots of signal strength are made to more effectively present the information. Absorption due to oxygen and water vapor molecules in the atmosphere and attenuation caused by scattering due to water drops are also treated. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
RAINFALL ATTENUATION OF 2.15 mm RADIO WAVELENGTHS, by C. W. Tolbert, J. R. Gerhardt, and W. W. Bahn. Rept. on Contract Nonr-375(01). 14 June 59, 20p. 4 refs. Rept. no. 109.
Order from LC mi$2.40, ph$3.30 PB 147 394

The attenuation of 2.15 millimeter radio frequency energy by rainfall has been measured and found to be in fair agreement with the attenuation calculated from the precipitation rates. Some discrepancy between the measured and calculated attenuations is due to the inhomogeneity of the rainfall along the propagation path and to the spectra of drop sizes associated with the various precipitation rates. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
WAVE PROPAGATION THROUGH A TURBULENT TROPOSPHERIC LAYER, by H. D. Wade and B. M. Fannin. Rept. on Contract AF 19(604)5504. 30 May 60, 66p. 27 refs. Rept. no. 6-34; AFCRC-TN-60-556.
Order from LC mi$3.90, ph$10.80 PB 148 208

The analysis of wave propagation phenomena induced by homogeneous tropospheric layers is adequately accomplished through the use of conventional wave theory (microwave optics). Propagation through homogeneous tropospheric turbulence can be handled theoretically by the use of a first Born approximation (single scattering) approach in many cases. The choice of the proper theory to apply to the case of propagation through a tropospheric layer of anisotropic turbulence is not clearly established. This report presents a preliminary analysis of wave propagation through such a layer. A comparison is made of single scattering and wave theory analyses of wave propagation through a homogeneous non-turbulent tropospheric layer in order to gain insight into the validity of single scatter theory for a limiting case. The single scattering approach is then applied to an assumed mathematical model of an anisotropically turbulent tropospheric layer, and integral expressions are derived for the cross-correlation functions of the amplitude and phase, respectively, of a wave which has passed through the layer.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
BIBLIOGRAPHY ON ELECTROMAGNETIC WAVE PROPAGATION, by Arnold Matschke. Rept. on Contract DA 36-039-sc-78281. 1 Apr 59, 79p. 870 refs. EDL-M186; AD-216 404.
Order from LC mi$4.50, ph$12.30 PB 148 046

The purpose of this bibliography is to provide an up-to-date (1947-1958) reference to publications from laboratories foremost in their respective fields of upper atmospheric research, wave propagation, and wave scattering phenomena. The laboratories whose work in these fields has comprised the basis for this report are: Cavendish Laboratory, University of Cambridge; Electrical Engineering Department, Cornell University; Ionospheric Research Laboratory, the Pennsylvania State University; Radio Propagation Laboratory, Stanford University; Stanford Research Institute. (Author)

Electronics Research Lab., U. of California, Berkeley.
ANALYSIS OF THE IMAGE PLANE METHOD FOR MEASURING RADAR CROSS-SECTIONS, by Andrejs Olte. Rept. on Contract N7onr-29529. 2 Sep 59, 54p. 11 refs. Rept. no. 92; Series no. 60, issue no. 249; AD-230 400.
Order from LC mi$3.60, ph$9.30 PB 148 619

Investigation concerns the development of a technique to measure scattered field patterns and scattering cross sections with a high degree of precision and accuracy. Emphasis is on extension of the image plane technique previously developed. The discussion covers a description of the measuring system in use and some order of magnitude calculations, an analysis of the system, and the range and accuracy of the CW image plane technique. The following equivalent techniques are compared and discussed: the Doppler technique, the pulse technique, the continuous wave full space technique, and the continuous wave image plane technique.

Electronics Research Lab., U. of California, Berkeley.
BACK-SCATTERING FROM CONES, by G. August and D. J. Angelakos. Rept. on Contract N7onr-29529. 22 Sep 59, 25p. 8 refs. Rept. no. 95; Series no. 60; issue no. 252; AD-230 508.
Order from LC mi$2.70, ph$4.80 PB 148 621

The purpose of this experimental investigation was to determine the back-scatter cross sections of a family of right-circular metallic cones with a greater accuracy than measured in a previous investigation. Three cones in the resonance region were examined, using the image plane method of measurement. Back-scatter was measured at about 9328 mc. as a function of the aspect angle between the incident radiation propagation direction and the cone axis. The cones and a comparison sphere were halves of volumes of revolution, thus allowing use of the image technique. A 4.5" diameter metallic sphere was used as a reference target. The theory of scattering from a metallic sphere is well-known, and its absolute back-scatter cross section may be calculated. Consequently, the absolute back-scatter cross sections of the cones may be computed by comparison of the data of this report with the absolute cross-section of the reference sphere. By use of a suitable measurement procedure, it was possible to largely eliminate a characteristic error of the image plane technique. The accuracy of the measurements was improved by an averaging process, and the measurements themselves gave an estimate of the error in the data. (Author)

Electronics Research Lab., U. of California, Berkeley.
SOME NEW FORMS OF HUYGENS' PRINCIPLE, by V. H. Rumsey. Rept. on Contract N7onr-29529. 18 Sep 59, 43p. 19 refs. Rept. no. 93; Series no. 60, issue no. 250; AD-230 483.
Order from LC mi$3.30, ph$7.80 PB 148 620

Several theorems are derived by using the reaction concept. They apply to single frequency sources of finite extent, and to fields which are finite and continuous on a hypothetical closed surface S whose inside or outside is source free. The field on the source-free side of S is uniquely determined by the normal components E_n and H_n on S. For measurements on the source-free side of S, the primary source can be replaced by any of the following secondary sources on S: (a) normal electric and magnetic dipoles in free space; (b) normal electric and magnetic quadrupoles backed by a medium which makes $E_n = 0$ and $H_n = 0$; and (c) a certain combination of electric and magnetic normal dipoles and quadrupoles, which gives zero field on the source side of S. The prescription for (a) requires the solution for the field of the primary source when it is inside a cavity on whose walls $E_n = 0$ and $H_n = 0$. The surface densities of the various components of secondary sources (b) and (c) are given in terms of the free space primary field. The formulas are comparatively simple when S is plane. Many applications are cited including a combination of multipoles, consisting of vertical electric and magnetic dipoles, which is equivalent to a horizontal electric dipole. (Author)

Florida U., Engineering and Industrial Experiment Station, Gainesville.
UHF PROPAGATION STUDY, VOL. I, by M. H. Latour. Final rept. on Contract Nonr-580(04). Sep 59, 75p. 10 refs. AD-228 623.
Order from LC mi$4.50, ph$12.30 PB 148 589

Results of a UHF experimental trans-horizon propagation study are presented. The propagation path of 300 miles was entirely over sea. Received pulse signals at 1260 mc were sorted into 30 levels approximately one db apart and amplitude distribution recorded in real time. Summer time signals were found to be generally higher than those received during the Winter. Any diurnal variations were masked by other factors which produced greater signal variations. The signal level appeared to be related to the absolute value of the surface refractive index of the atmosphere. Refractometer data indicated greater fluctuations of atmospheric refractivity with height during the summer months. The short term variation of the signal appeared to be Rayleigh distributed except during periods of super-refraction. The fluctuation rate varies inversely with signal amplitude, with higher rates associated with low signal periods. Evidence of multipath propagation was observed frequently. Many cases of extreme delays were obviously caused by the ionized paths of lightning discharges. Other cases are suspected of being caused by foreward scatter from rain. (Author)

Göttingen U. (West Germany).
ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES. PHASE G: EFFECTIVENESS OF ABSORBERS FOR ELECTROMAGNETIC CM-WAVES UNDER OBLIQUE ANGLES OF INCIDENCE, by G. Kurtze. Technical final rept. on Contract AF 61(514)1041. 31 July 58, 28p. 5 refs. RADC-TR-59-26C; AD-210 939.
Order from LC mi$2.70, ph$4.80 PB 146 709

In the development of absorbers for electromagnetic cm-waves main emphasis has mostly been laid on getting minimum reflection for normally incident waves. For laboratory use and also for RADAR camouflage under certain conditions, however, also the specular reflection of absorbers under oblique angles of incidence should be small. For absorbers with layer thicknesses of about one wavelength or larger this demand will mostly be fulfilled. The present study has been started in order to find out how resonance type absorbers with layer thicknesses small in comparison with the wavelength behave in this respect, and how the angular response of their reflection factor can be improved. It is the first step towards the development of wide angle resonance absorbers.

Institute of Mathematical Sciences, New York U., N. Y.
MULTIPLE DIFFRACTION BY AN APERTURE IN A HARD SCREEN, by Samuel N, Karp and Joseph B. Keller. Rept. on Contract AF 19(604)5238. Nov 59, 22p. 8 refs. Research rept. EM-143; AFCRC-TN-59-995; AD-233 253.
Order from LC mi$2.70, ph$4.80 PB 147 344

Two methods previously applied to diffraction by an aperture in a soft screen (one on which the field vanishes) are adapted to the case of a hard screen (one on which the normal derivative of the field vanishes). These methods are the geometrical theory of diffraction and the self consistent field method. They are both applied to diffraction by an infinite slit and both yield the same result at distances greater than several wave lengths from the edges of the screen. The former is also applied to diffraction by a circular aperture. Expressions for the diffracted fields, the diffraction patterns and the transmission cross sections are obtained for the problems of the slit and the circular aperture. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
RADIO PROPAGATION AND IONIZED GASES. A SURVEY, by H. D. Rix. Scientific rept. no. 123, part A on Ionospheric Research, Contract DA 36-061-ORD-577. 1 Sep 59, 53p. 49 refs. AD-233 394.
Order from LC mi$3.60, ph$9.30 PB 147 248

This report surveys electromagnetic wave propagation effects relating to the problem of radio interference encountered during powered flight of large missiles. An expression for the absorption of a radio signal traversing a plasma is developed from the approximate theory of plasma conductivity. Properties of several types of plasma - flames, gaseous discharges and shock waves - are described in terms of methods of measuring electron density, mechanisms of ionization and means of controlling free electron concentration. Specific propagation effects treated include high frequency antenna breakdown and ionospheric effects. A guide to the relevant literature of these various subjects is provided. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
DIFFRACTION BY AN ABSORBING HALF-PLANE, by C. J. Marcinkowski. Rept. on Contract AF 19(604)4143. 29 Sep 59, 93p. 36 refs. Research rept. R-750-59; PIB-678; AFCRC-TN-60-153; AD-234 015.
Order from LC mi$5.40, ph$15.30 PB 146 321

The 2-dimensional electromagnetic problem of plane-wave scattering by a half-plane with a constant impedance is solved by the Wiener-Hopf technique. Previous solutions have dealt with small surface impedance and were formulated by the classical Fourier transform procedure. In contrast, results of this study are applied to the (no longer small) surface impedance of a half-plane which absorbs perfectly a plane wave incident at a prescribed angle. Moreover, a transmission line formulation of the problem is employed. A saddle point evaluation of the scattered far-fields shows that the back-scattered fields are appreciably influenced by the surface impedance while the forward-scattered fields are relatively unaffected. A null appears in the back-scattered fields. Another variant of the factorization technique for dielectric surfaces was discovered and illustrated by obtaining the well-known solutions for a perfectly reflecting half-plane. (Author)

Raytheon Co., Waltham, Mass.
IONOSPHERE PROPAGATION STUDIES, by Leonard C. Edwards, and Donald A. Hedlund. Final scientific rept., Pt. 1, 15 June 57-15 Sep 59, on Contract AF 19(604)2246. 15 Oct 59, 38p. 7 refs. AFCRC-TR-60-104(1); AD-233 734.
Order from LC mi$3.00, ph$6.30 PB 146 813

An experimental investigation of some characteristics of ionospheric forward scattering was conducted in the HF band. The nature of the scattering process was investigated, and an indication of the usefulness of this mode of propagation was provided at frequencies ordinarily employed for communication only when normal ionospheric modes prevail. An experimental HF radio link was established between Greencastle, Indiana and South Dartmouth, Massachusetts. Measurements were made over a 3-yr period to describe the diurnal and seasonal variations in the scatter signal level. Special attention was given to describing the variations in signal level which occur when operating very near the classical MUF for the path. Several experiments were also conducted to investigate the area extent and possible movement of ionospheric regions which contribute to the received scatter signal. Experiments of this type emphasized the effectiveness which can be obtained for any given antenna applied to an ionospheric scatter path. A search was made in the data regularly recorded, and in data obtained in several special experiments, to determine if sufficient ionization is associated with earth satellites to be detected using HF techniques. (Author) (See also PB 144 379)

Stanford Electronics Lab., Stanford U., Calif.
A NEW MECHANISM FOR ACCELERATING ELECTRONS IN THE OUTER IONOSPHERE, by R. A. Helliwell and T. F. Bell. Technical rept. no. 4 on Contract AF 18(603)126. 23 Feb 60, 10p. 7 refs. AFOSR-TN-60-151; AD-234 472.
Order from LC mi$1.80, ph$1.80 PB 147 336

The phenomena of high energy trapped particles are studied in the earth's outer ionosphere using a new device for particle acceleration, the geocyclotron. Through this device, trapped electrons in the outer ionosphere can be accelerated to high energy utilizing circularly polarized radiation, traveling in the whistler-mode, and the inherent phase stability of the particle-wave interaction. It is shown that this interaction is roughly analogous to the well-known synchrotron interaction. Implications of the theory are discussed and experiments are suggested which might lead to important new information concerning the behavior of particles trapped in the earth's magnetic field. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A THEORY OF TRAPPING OF WHISTLERS IN FIELD-ALIGNED COLUMNS OF ENHANCED IONIZATION, by R. L. Smith, R. A. Helliwell, and I. W. Yabroff. Technical rept. no. 3 on Contract AF 18(603)126. 31 Dec 59, 22p. 15 refs. AFOSR-TN-60-139; AD-233 813.
Order from LC mi$2.70, ph$4.80 PB 146 359

A ray theory of whistler propagation in ducts is developed for the purpose of explaining discrete whistler components. By use of refractive index surfaces and a Snell's Law construction, it is shown that the only feature of the electron distribution affecting the trapping conditions is the ratio of the electron density in the column to that of the background. In most practical cases the electron density in the column required for trapping must be greater than the background level. However, under certain conditions the density in the column must be less than the background level. Using the theory, it is found that the enhancement required for trapping increases markedly toward the equator, providing a possible explanation for reduced whistler occurrence at the lower latitudes. (Author)

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Avco-[Everett] Research Lab., Mass.
DEVELOPMENT OF THE CALORIMETER HEAT TRANSFER GAGE FOR USE IN SHOCK TUBES, by Peter H. Rose. Rept. on Contract AF 04(645)18. Feb 58, 52p. 13 refs. Research rept. 17; AD-159 547.
Order from LC mi$3.60, ph$9.30 PB 147 396

A heat transfer gage suitable for measuring extremely high heat transfer rates under the quasi-transient conditions occurring in shock tubes has been developed. The instrument is based on a colorimetric principle and is made possible by the short steady state times inherent in shock tubes. The technique developed supplements, verifies and extends the shock tube heat transfer measurements made by thin film resistance thermometers. Much heat transfer data has already been collected by this type of instrument and has been reported. The operating principles and experimental experiments with calorimeter heat transfer gages are reported in some detail. (Author)

California U., Los Angeles.
ON THE THEORY OF ADAPTIVE CONTROL SYSTEMS, THE LEARNING MODEL APPROACH, by M. Margolis and C. T. Leondes. Rept. on Contract AF 49(638)438. Oct 59, 29p. 4 refs. AFOSR-TN-59-1200; AD-233 275.
Order from LC mi$2.70, ph$4.80 PB 146 736

The main objective of feedback control is to maintain satisfactory performance despite adverse environmental effects. A process adaptive system is one which determines the values of the significant parameters in the physical process and used these values to program the controller according to the specified controll laws. The use of a process adaptive system makes it possible to design the complete control system for a specified requirement without compromising the setting of the controller parameters for the range of dynamic characteristic variation. The learning model will determine these variations and present the exact values to the proper computing circuits for adjusting the parameters in the controller. The particular method for determining the dynamic characteristics of the physical process makes use of a model, referred to as the learning model, and a mechanism to adjust the parameters of the model. The model is a computer mechanization of the physical process with undetermined parameters. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS, by C. R. Mason, J. D. Walton and others. Quarterly rept. no. 14, 1 Feb-30 Apr 59, on Contract NOrd-15701. [1959] 30p.
Order from LC mi$2.70, ph$4.80 PB 148 059

Thermal Protection Systems: The thermal diffusivity-temperature relationship was determined by considering K and Cp separately and calculating the diffusivity at specified temperatures. The thermal conductivity of slip-cast fused silica (density 117 lb/cu ft) was found to vary linearly with temperature over a range from 420° to 1350°F with values of 0.36 and 0.42 (Btu)-(ft)/(hr)(sq ft)(°F) respectively. Coatings: A technique for forming thin shapes by flame spraying onto a removable brass pattern was developed. Thermets: Certain physical properties of beryllium-chromic oxide thermets were determined using either beryllia or chromium as the reaction throttler. (See also PB 142 326)

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly rept. for July-Sep 59. Jan 60, 130p. 53 refs. NOLC rept. 473; NAVORD rept. 5970; AD-234 258.
Order from LC mi$6.30, ph$19.80 PB 147 247

Contents:
Automatic programming
Ferroelectric phenomena
Ferromagnetic resonance
High-temperature polymer program
Infrared atomic spectra
Magnetization reversal studies
Radiation analysis
Semiconductor physics
Small antenna study
(See also PB 144 558)

Naval Ordnance Test Station, China Lake, Calif.
SOME GYROSCOPIC OSCILLATIONS. PART 1. GENERAL CONSIDERATIONS, by C. J. Thorne. 25 May 59, 84p. 2 refs. NOTS TP 2240; NAVORD rept. 6542, pt. 1.
Order from LC mi$4.80, ph$13.80 PB 148 101

Consideration is given to nonlinear terms in the differential equations governing the motion of gyroscopes under constant acceleration and a "correcting" torque. Unstable oscillations are noted when a "correcting" torque is present and the nonlinear terms are included. (Author)

Virginia Agricultural Experiment Station, Blacksburg.
SOME FURTHER RESULTS ON THE LIFE DISTRIBUTION AND RELIABILITY OF A SYSTEM WITH SPARE COMPONENTS, by Donald F. Morrison. Technical rept. no. 46 on Research on Order Statistics and the Design of Experiments, Contract DA 36-034-ORD-1527. Apr 60, 64p. 18 refs. OOR rept. 1166. 52-M.
Order from LC mi$3.90, ph$10.80 PB 148 441

Contents:
The distribution of component failures on an interval of time
Cost functions for measuring the efficacy of spare components
Systems with several types of components

Communication Theory

Air Force Cambridge Research Center, Bedford, Mass.
PROCEEDINGS OF SEMINAR ON SPEECH COMPRESSION PROCESSING, 28-30 SEPTEMBER, 1959, VOLUME II. Dec 59, 211p. 62 refs. AFCRC-TR-59-198, vol. 2.
Order from LC mi$9.60, ph$33.30 PB 146 624

Contents:
The speech research program of the Air Force Cambridge Research Center
An approach to speech bandwidth compression
A digital voice data processer
Study of correlation instrumentation for speech analysis and synthesis
The magnetic drum as a component in speech compression and processing equipment
Speech research at the Royal Institute of Technology, Stockholm
The speech program at Wright Air Development Center
The Army and speech processing
Parametric recognition of phonetic sounds
Linguistic concepts in automatic speech recognition procedures
Research on speech recognition at Lincoln Laboratory
Electronic cognition of speech
Some problems in speech recognition
Investigation procedures for speech recognition
Analysis by synthesis
A round table résumé of speech research in Europe
(See also PB 146 623)

Air Force Cambridge Research Center, Bedford, Mass.
PROCEEDINGS OF SEMINAR ON SPEECH COMPRESSION AND PROCESSING, 28-30 SEPTEMBER 1959, VOLUME I. Dec 59, 208p. 55 refs. AFCRC-TR-59-198, vol. 1; AD-233 717.
Order from LC mi$9.30, ph$31.80 PB 146 623

Contents:
Basic factors in speech perception and applications to speech processing
Effects of multiple narrow pass band filtering on the intelligibility of speech
Some aspects of intonation and stress
The effective use of digital simulation for speech processing
Experiments with a dynamic analog of the vocal tract
Automatic resolution of speech spectra into elemental spectra
Some progress with vocoder-type systems
Characteristics of modern vocoders and remaining problems
Vocoders for military use
A twelve-channel transistorized vocoder
Simulation of a vocoder
The SRDE speech bandwidth compression project
The Formoder as a tool for speech studies
A digitalized continuous-analysis speech compression system
A review of Stromberg-Carlson research programs in Formant tracking and word recognition

International Telemeter Corp., Los Angeles, Calif.
FINAL REPORT. Rept. [on Contract AF 30(602)1566] 15 Nov 57, 10p. RADC-TR-58-4; AD-148 548.
Order from LC mi$1.80, ph$1.80 PB 146 724

The ultimate objective of this work is the construction of a billion-bit memory with 10 millisecond access time. The immediate objective, which was accomplished, was the construction of one module - with a single reading head - of a capacity of 30 million bits and random access of 50 milliseconds. In order to obtain results on its performance, it was considered important to build the memory as part of a useful system. A Mechanical Translator was chosen because there is a definite military requirement for MT, a minimum amount of input-output is necessary and the contents of the store are already well organized (in dictionaries). The objective of the Mechanical Translation system is to provide an automatic means of working satisfactory translations of Russian technical material, in large volume without the need of pre-or-post-editing. This report then covers the work done in building a photostore as the heart of a Mechanical Translation system. It also includes the preparation of the contents and loading the memory with the information.

Photographic Equipment

International Telemeter Corp., Los Angeles, Calif.
FILM-TO-DISC TRANSFER UNIT OPERATION MANUAL. Technical rept. no. 16 [on Contract AF 30(602)1566] 20 Oct 57, 12p. RADC-TN-57-387; AD-131 383.
Order from LC mi$2.40, ph$3.30 PB 146 726

International Telemeter Corp., Los Angeles, Calif.
TAPE-TO-FILM TRANSFER UNIT OPERATION MANUAL. Technical rept. no. 14 [on Contract AF 30(602)1566] 20 Oct 57, 27p. RADC-TN-57-385; AD-131 381
Order from LC mi$2.70, ph$4.80 PB 146 725

This manual has been prepared in such a manner as to enable the operator to understand basically, the working of the machine. While this is not entirely essential, it is the best way to avoid unnecessary errors. The making of a film from paper tape is fundamentally a simple process, but as a great many operations are required, and many of them being repetitive, great care is needed if a perfect film is to be the result. In the construction of the machine, every effort has been made to eliminate possible operator errors. This has been accomplished by the use of a complicated system of interlocks. Even the most thoughtful interlock system will be of no avail if the operator is unaware of their presence. It is for this reason that every part of the operation manual must be understood and studied closely before commencing to operate the machine.

SOCIAL SCIENCES

California U., Los Angeles.
AN EMPIRICAL STUDY OF ARRIVAL, SERVICE TIME, AND WAITING TIME DISTRIBUTIONS OF A JOB SHOP PRODUCTION PROCESS, by Ross T. Nelson. Rept. on Management Sciences Research Proj. Contract [Nonr-233(02)]. 19 June 59, 41p. 13 refs. Research rept. no. 60.
Order from LC mi$3.30, ph$7.80 PB 146 682

There were two principle purposes for this empirical study: To collect arrival and service time data in a typical job shop and analyze the data with respect to the basic questions of time stability and distribution forms. To evaluate waiting line theoretical models as potential aids in job shop production control systems on the basis of empirical data. Time stability tests were applied to both the arrival and service time data. The hyper-Erlang model, proposed on the basis of the service time analysis of Section 2, is described more precisely in Section 3 by the equations of detailed balance, the secular equation, and a discussion of the computational requirements. It is concluded that, while this model might provide more accurate results in many cases, numerical computation would probably require a computer program.

Harpur Coll., State U. of New York [Endicott, N. Y.]
OFFSHORE CLAIMS IN NORTHWESTERN EUROPE, by Lewis M. Alexander. Technical rept. no. 1 on Contract Nonr-1349(03). Sep 59, 53p. 58 refs. AD-226 983.
Order from LC mi$3.60, ph$9.30 PB 148 580

The problems of national claims to offshore areas have in recent years become a major topic of international concern. In the conflict between offshore rights and the freedom of the seas the states of Northwestern Europe have stood out as leaders in the formulation of national and international policy. The nature and extent of the offshore claims of these states are summarized. (Author)

Brown U., Providence, R. I.
PRICE EQUILIBRIUM AND THE "GREATEST GOOD FOR THE GREATEST NUMBER", by David Gale. Technical rept. no. 3 on Contract Nonr-562(15). 1959, 20p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 146 411

The present note was prompted by the observation that the idea of equilibrium prices plays a central role in many other economic situations besides that of price formation for an economy as a whole. Our concern here will be with situations in which it makes sense to assume that each individual in the economy places a definite monetary value on the various objects of goods bundles under consideration.

Documentation

Directorate of Engineering Standards, Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
MICROFILM APERTURE CARD SYSTEM, by Thomas H. Korte, Thomas C. Myers, and John W. Berry. [1959] 160p. WADC Technical rept. 59-746; AD-232 960.
Order from OTS $3.00 PB 161 871

The microfilm aperture card system, which is a new concept in the storage, reproduction, and distribution of engineering drawings, and associated data is discussed. The microfilm aperture card is a common, ordinary tabulating punch card. A rectangular hole or aperture is die-cut into this card. The hole is edged with a narrow, transparent adhesive ledge. To this adhesive ledge is affixed a segment, or frame, of microfilm containing a transparency of an engineering drawing. Factual information to the drawing is punched into the card and automatically printed along the top edge. The new system will operate as follows: instead of furnishing full-size vandykes of drawings

by contract, the aircraft and supporting industries of the US will furnish microfilm and punched tabulating cards to the central AF automation control. From these, master microfilm aperture cards will be generated for the AF central drawing repository. The new method combines the advantages of microfilm with the operational precision and speed of automatic tabulating equipment. The system overcomes the problems of excess storage space and shipping-weight as well as the problems of high-cost and low-output-rate formerly associated with comprehensive handling of engineering drawings.

Herner and Co., Washington, D. C.
THE RELATIONSHIP OF INFORMATION-USE STUDIES AND THE DESIGN OF INFORMATION STORAGE AND RETRIEVAL SYSTEMS, by Saul Herner. Technical note no. 1 on Contract AF 30(602)1857. 8 Dec 58. 30p. 20 refs. RADC-TN-59-136; AD-213 781.
Order from LC mi$2.70, ph$4.80 PB 147 028

A review is presented of the results of past studies of the information-gathering methods of workers in various fields, and the general applicability of these results to the design and improvement of information programs and systems is shown. Two cases from the literature are used to illustrate storage and retrieval systems that do and do not meet the requirements of their users, and to show the contrasting need of the pure scientist for mere references to information and of the applied scientist for direct access to actual information. The applied scientist is shown to require the services of large storage and retrieval programs manned by highly trained personnel, while the pure scientist is best served by a conventional library in which the publications are arranged on the basis of a classification scheme reflective of the scientist's customary association of subjects. Low redundancy in manual and machine systems is cited as a means of improving input and output. Differences in the required information coverage of systems serving pure scientists, applied scientists, and social scientists and humanists are indicated, with the pure scientist requiring a narrow collection going back comparatively far in time, the applied scientist requiring a broad but shallow coverage, and the social scientist requiring both depth and breadth. Investigations of the various media used by user groups to communicate and obtain different kinds of information are advanced as a further means of knowing what should and should not be put into a storage and retrieval system. (Author)

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Aug 60.
Order from OTS $1.25, $10.00/year PB 161 284

Contents:
Articles:
A fision-product detector for water-cooled reactors, by C. M. Gordon, J. H. Miller, and R. E. Larson
Basic hydrogen-producing processes in electrolytic cells. III--Influence of the electronic configuration of palladium alloys on their catalytic activity, by S. Schuldiner
Precision frequency standards and millisecond timing, by H. F. Hastings
Scientific program:
Astronomy and Astrophysics: Fission product radioactivity in the air along the 80th meridian (west) during 1959
Chemistry: Properties of paints as affected by ultraviolet radiation in a vacuum. Microbial inhibitors for systems of jet fuel and water. Homogeneous ionic polymerization of alpha-methylstyrene
Mechanics: Dynamic design-analysis method for calculating the shock response of Navy shipboard equipment
Metallurgy and Ceramics: Exploratory titanium alloy research. Crack propagation tests of air-melted and consutrode AMS 6434 steel. Oil-ash corrosion in marine boilers. New technique and apparatus for high-temperature measurements of strain in sheet metal specimens. Preliminary study of the mechanisms of oxidation of iron-chromium binary alloys in water vapor
Nuclear and Atomic Physics: New method for the analysis of lithium hydride uses on-the-shelf equipment, permits careful handling of specimen, and protects against unwanted side reactions
Optics: Typical absolute spectral irradiance curves of upwelling of light over an area of the North Atlantic Ocean
Radio: Impedance-matching network for a two-band, "discage" antenna. Data transmission facility for the NRL space surveillance system. Luminance required of opaque and transparent crt phosphors. Spiral-grating antenna array without doublets eliminates problem of spacing between elements
Solid-State Physics: Modification in growing technique imporves optical quality of single crystals of ZnF_2:Mn. Elevated temperature diffusion of the systems Nb-Pt, Nb-Se, Nb-Zn, Nb-Co, Ni-Ta, and Fe-Mo. Effect of O_2 on the magnetoresistance of Cu
Sound: Mutual mechanical radiation resistance for all values of ka of an unbaffled circular rigid piston with pressure-released back. Use of spheroidal wave functions in the empirical description of scalar wave fields.
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General

Blast and shock measurements. III Transient ground displacement measurement, by W. E. Morris. Naval Ordnance Lab., White Oak, Md. [1952]. Decl. Sep 59. 249p. Order from LC. Mi $11.10, ph $37.80. WT-368

Biology and Medicine

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Chemistry—General

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Progress report on development of radioisotope tracer techniques for studying decomposition of complex organic wastes, by R. E. McKinney. Massachusetts Inst. of Tech., Cambridge. Feb 59 to Jan 60. 8p. Contract AT(30-1) 2329. Order from LC. MI $1.80, ph $1.80. AECU-4712

Progress report No. XXVI, Massachusetts Inst. of Tech., Cambridge Lab. for Insulation Research. Jan 60. 73p. Contract Nonr-1841(10); Nonr-1841(50); AT(30-1)-1937; AF19(604)-5482; and AF32(616)-5920. Order from LC. Mi $4.50, ph $12.30. AECU-4715

Electrochemical studies of hafnium, zirconium and yttrium, Bureau of Mines. Boulder City Metallurgy Research Lab., Nev. and Bureau of Mines. Reno Metallurgical Research Center, Nev. Oct 50 to Dec 59. 6p. Contract AT(11-1)-475. Order from LC. Mi $1.80, ph $1.80. AECU-4726

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Absorption spectra in fused salts, by H. M. Haendler. Brookhaven National Laboratory, Upton, N. Y. Jan 60. 13p. Contract No. AT-30-2-GEN-16, Subcontract No. S-284. Order from OTS. Price 50. BNL 599 (T-172)

Comparison of two colorimetric methods for uranium, by R. L. McCutchen. Oak Ridge National Lab., Tenn. Mar 59. 10p. Order from LC. Mi $1.80, ph $1.80. CF-59-3-108

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Counting techniques in the radio-chemical determination of U-235 fission burn-up, by D. G. Miller. Knolls Atomic Power Lab., Schenectady, N. Y. Mar 60. 29p. Contract W-31-109-eng-52. Mi $3.00, ph $6.30. KAPL-M-DGM-5

Free energy functions for gaseous monoxides, by L. Brewer and others. Lawrence Radiation Lab., Berkeley, Calif. June 60. 17p. Contract No. W-7405-eng-48. Order from OTS. 50 cents. UCRL-8713(Rev.)

An investigation of a "dynamic" theory for mass transfer, by R. B. Schappel. Union carbide nuclear company, Division of union carbide corp., Oak Ridge, Tennessee. May 60. 115p. Contract No. W-7405-eng-26. Order from OTS. $2.75. Y-1298

Geology and Mineralogy

Exploratory diamond drilling in the No Name Canyon area, White Canyon Dristrict, San Juan County, Utah, by E. V. Mace. Grand Junction, Colorado. Jan 58. 17p. Order from OTS. 50 cents. RME-105

Mobile and portable units for geochemical exploration for uranium, by C. T. Illsley, and others. Grand Junction, Colorado. July 59. 27p. Order from OTS. 75 cents. RME-131

Health and Safety

AEC group shelter, by R. L. Corsbie. AEC Facilities Division, Holmes & Narver, Inc., Los Angeles, California. Jan 60. 33p. Order from OTS. 50 cents. CEX-58.7

Fallout program, quarterly summary report, by E. P. Hardy, Jr., and others. United States Atomic Energy Commission, New York Operations Office. July 60. 250p. Order from OTS. $3.50. HASL-88

Estimating safety probabilities from fallout forecasts for Nevada test site, by Jack W. Reed. Sandia Corp., Albuquerque, New Mexico. Feb 57. Reprinted July 60. 26p. Order from OTS. 75 cents. SC-4073(TR)

Instruments

A slide rule type of device to measure logarithmic decay times as presented by oscillograph records, by R. N. Leach. Sandia Corp., Albuquerque, New Mexico. Mar 60. 19p. Order from OTS. 75 cents. SC-4418(RR)

Final report on investigation of dynamic characteristics of relays, Sandia Corp., Albuquerque, New Mexico. June 60. 74p. Order from OTS. $2.00. SC-4423(RR)

Metallurgy and Ceramics

Phase diagram studies, by R. F. Domagala. General Electric, Aircraft Nuclear Propulsion Dept., Cincinnati 15, Ohio. May 60. 7p. U. S. Air Force, Contract No. AF33(600)-38062, and U. S. Atomic Energy Commission, Contract No. AT(11-1)-171. Order from OTS. 50 cents. APEX-554

Characterization of inclusions in dingot uranium, by D. M. Cheney, and others. Battelle Memorial Institute, Columbus 1, Ohio. Jan 57. 22p. Order from OTS. 35 cents. BMI-1158

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Corrosion of the Zircaloy-2-Niobium couple, by R. E. Campagnoni, and others. General Electric Co., Knolls Atomic Power Laboratory, Schenectady, N. Y. Contract No. W-31-109-Eng-52. Mar 60. 15p. Order from OTS. 50 cents. KAPL-2079

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Particle Accelerators and High-Voltage Machines

Longitudinal space charge effects - influence of energy loss, by C. E. Nielsen, and others. Midwestern Universities Research Association, Madison, Wisconsin. Contract No. AT(11-1)-384. Mar 60. 15p. Order from OTS. 50 cents. MURA-488

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Electrical Resistivity of plutonium metal between 1.73°K and 298°K, by T. A. Sandenaw, and others. Los Alamos Scientific Lab., U. of Calif., Los Alamos, New Mexico. Contract W-7405-ENG-36. Feb 60. 15p. Order from OTS. 50 cents. LA-2392

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Plutonium recycle program annual report, fiscal year 1959, by J. M. Atwood. Hanford Atomic Products Operation, Richland, Washington. Contract No. AT(45-1)-1350. Oct 59. 138p. Order from OTS. $2.75. HW-62000

Oak Ridge Gaseous diffusion plant staff publications, by E. L. Hoey. Union Carbide Nuclear Co., Div. of Union Carbide Corp., Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. July 60. 37p. Order from OTS. 75 cents. K-1449

Radiation Effects on Materials

Effect of irradiation of solid catalysts, by H. C. Andersen, and others. Engelhard Industries, Inc., Newark, N. J. Feb 60. 27p. Contract AT(30-1)-2402. Order from LC. Mi $2.70, ph $4.80. AECU-4733

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Decontamination, by P. S. Kingsley, and others. Hanford Atomic Products Operation, Richland, Washington. June 60. 35p. Contract No. AT-(45-1) - 1350. 35p. Order from OTS. $1.00. HW-63110

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Argonne low power reactor health physics manual, by E. D. Graham, and others. Argonne National Laboratory, Argonne, Illinois. Contract W-31-109-eng-38. Aug 59. 125p. Order from OTS. $2.50. ANL-6016

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Hazards summary report for the VMR critical-assembly experiments, by R. A. Egen. Battelle Memorial Institute, Columbus 1, Ohio. June 60. 72p. Order from OTS. $2.00. BMI-1445

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The kinetics of metal-water reactions-feasibility study of some new techniques, by S. C. Furman. Vallecitos Atomic Lab., General Electric, Pleasanton, Calif. Contract No. AT(04-3)-189. Jan 60. 46p. Order from OTS. $1.25. GEAP-3338

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Reactors—Power

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Instrumentation and controls study for SM-1 nuclear power plant, by R. E. May and others. Alco Products, Inc., Ft. Belvoir, Va. Contract No. AT(30-3)-326. Oct 59. 340p. Order from OTS. $6.00. APAE-52(Vol. 1)

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Vol. 34, No. 5 Pages 523 - 671 November 18, 1960

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Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
SPACE TECHNOLOGY: A PARTIAL SEARCH OF THE LITERATURE CONCERNING THE APPLICATION OF ORBITAL SPACE SATELLITES TO ADVANCED WEAPONS SYSTEMS, by Alfred M. Anzalone. Oct 59, 109p. 238 refs. F. R. E. L. Literature Search no. 9 pt. 1; AD-231 822.
Order from LC mi$5.70, ph$16.80 PB 149 150

Part I of this report contains a preface and a Uniterm index in addition to a list of annotated references. The Uniterm index includes subjects, contracts, projects, item designations, and personal authors.

Raytheon Co., Waltham, Mass.
PARTIAL FUEL GAGE BIBLIOGRAPHY. Rept. on Contract AF 33(038)22632. [1952] 99p. 233 refs. ATI-163 321.
Order from LC mi$5.40, ph$15.30 PB 150 301

This report released for sale to the public 19 Sep 60.

Selected patent classes and selected files of journals were searched, with a view to determining the amount of material present, and the resources required to assemble it into a useful critical bibliography. About five percent of the applicable U.S. and foreign patent classes were searched, and perhaps ten percent of the American, English, and German literature was surveyed carefully. The U.S. patents searched covered fuel gages other than float types. The foreign patents included those classes (British Group XIX, German Klasse 42(c), Gruppen 26-30, and French Group XII(3) directly concerned with aircraft fuel quantity gages. The Anglo-American and German literature was skimmed for both fuel gages themselves, and for flowmeter theory and practice.

ASTRONOMY

Astrophysics

Astrophysical Observatory, Smithsonian Institution, Cambridge, Mass.
STUDIES OF RATE OF ACCRETION OF INTERPLANETARY MATTER BY THE EARTH, by Fred L. Whipple and Paul W. Hodge. Final rept. on Contract AF 19(604)1901. 4 Apr 60, 31p. AFCRC-TR-60-253.
Order from LC mi$3.00, ph$6.30 PB 147 552

The problems of how much material the earth accretes and in what precise way the accretion occurs have not yet been solved. To solve them, we must learn as much as possible about both the falls of large meteorites and the accretion of meteoritic particles and dust. Our first investigation involved an exhaustive survey of the soil around the Arizona Meteorite Crater In the soil, we found numerous tiny meteoritic particles (approximately 100 microns in diameter). The total mass of the original meteoritic material which these particles represented was estimated to be 12, 300 short tons. Our second attack on the problem involved the collection of armospheric dust by various types of high-flying vehicles, and the search for the meteoritic component of this material. Preliminary results indicate that the amount of terrestrial dust at heights of 50, 000 feet and more is somewhat greater than many investigators have supposed and that the probable influx of meteoritic particles into the earth's atmosphere is smaller than the values generally quoted.

Kiruna Geophysical Observatory (Sweden).
A SWEPT FREQUENCY INTERFEROMETER FOR 35 - 65 Mc/s, by Bengt Hultqvist. Technical summary rept. Task 4, 15 Oct 57-15 Oct 59, on Contract AF 61(514)1314, 20 Oct 59, 42p. 8 refs. AFCRC-TN-60-146.
Order from LC mi$3.30, ph$7.80 PB 148 808

The swept-frequency interferometer is described and its most important properties are discussed. The records obtained in single frequency and swept frequency operation are analyzed with regard to the influence of the length of the base line and the declination of the radio source. For the swept-frequency record formulas are given for the slope of the interference ridges, the number of interference maxima, frequency difference between consecutive interference maxima, the rate of increase of the number of maxima and the frequency of the first harmonic of the low frequency signal. The development work performed on the interferometer is described. (Author)

Minnesota U. School of Physics, Minneapolis.
GAMMA-RAY BURST FROM A SOLAR FLARE, by L. E. Peterson and J. R. Winckler. Technical rept. no. 2.12 Cosmic Ray Intensity at High Altitude, Contract [Nonr-710(19)]. Dec 58, 27p. 17 refs.
Order from LC mi$2.70, ph$4.80 PB 148 796

An observation was previously reported of a burst of high energy radiation during a cosmic ray balloon flight in time coincidence with a class II solar flare. The burst has been interpreted as Bremsstrahlung γ-rays of about 0.5 Mev, from electrons accelerated to 1.0 Mev during the growth of the flare stopping in the solar photosphere. These same electrons, spiralling in the intense magnetic fields of the flare region, can account for solar radio bursts at 3 cm and 21 cm by betatron radiation. The observations and their consequences are examined in greater detail.

Naval Ordnance Test Station, China Lake, Calif.
INFRARED RADIANT INTENSITIES OF THE SUN AND OF THE MOON IN THE 2- TO 6-MICRON REGION (MEASURED BY AN AIRBORNE RADIOMETER) by Gordon C. Augason. 3 May 60, 17p. 5 refs. NOTS TP-2443; NAVWEPS rept. 7050.
Order from LC mi$2.40, ph$3.30 PB 149 081

In the design and use of infrared-sensing devices, it is often necessary to consider the effects of direct and reflected sunlight on the studies to be made with that equipment. This report presents in graphic form measurements of radiation from the sun and from the moon. The measurements were recorded by an airborne radiometer sensitive in the 2- to 6-micron region of the spectrum. A method is given for using these data to determine the effects of the radiation, and a suggestion is made as to the possible use of such information. (Author)

Naval Ordnance Test Station, China Lake, Calif.
SEMINAR LECTURES ON CELESTIAL MECHANICS. 27 May 58, 201p. 39 refs. NOTS 2040; AD-232 080.
Order from LC mi$9.30, ph$31.80 PB 149 988

This report released for sale to the public 12 Sep 60

Contents:
Fundamental principles, by R. H. Olds
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Perturbations, by R.B. Leipnik
Determination of orbits, by W. C. White

Naval Research Lab., Washington, D. C.
MEASUREMENTS OF THE POSITIONS, FLUXES AND SIZES OF CELESTIAL RADIO SOURCES AT 10.2 CM, by R. M. Sloanaker and J. H. Nichols. Interim rept. 13 July 60, 24p. 29 refs. NRL rept. 5485.
Order from LC mi$2.70, ph$4.80 PB 146 037

The positions of eight bright discrete celestial radio sources at 10.2 cm have been measured with the U. S. Naval Research Laboratory 84-ft antenna to estimated accuracies of ±1 min of arc probable error. For six of the sources, for which accurate optical positions are available, the measured radio positions coincide with the positions of the optical centers of the sources to within the uncertainties in the radio measurements. The equivalent gaussian diameters and flux densities were also determined. (Author)

Oklahoma State U. Research Foundation, Stillwater.
ACOUSTIC DETECTION OF METEORIC PARTICLES, by Richard F. Buck. Final rept. v. 1 on Contract AF 19(604)1908. 14 Apr 60, 162p. AFCRC-TR-60-272.
Order from LC mi$7.80, ph$25.80 PB 149 098

The technique used for detection has been based upon acoustic activation of suitable devices by the impact of such meteoric material upon metallic surfaces carried by high altitude rockets. Related laboratory investigations have been concerned with two general aspects of the basic investigation: the establishment of a working technique and verification of the validity of information obtained through this technique, and in a more indirect approach, a secondary series of investigations performed in order to establish the suitability of the specific electronic devices developed for use in the technique. Specific details regarding rocket experimentation are given for a number of rocket flights and an up-to-date tabulation of the data is included. A discussion of the problems of interpretation of the information acquired from each specific rocket experiment system accompanies the data.

Oklahoma State U. Research Foundation, Stillwater.
AN ANALYSIS OF ROCKET AND EARTH SATELLITE MEASUREMENTS OF MICROMETRIC INFLUX, by Curtis W. McCracken. Master's thesis. Final rept., vol. II, on Acoustic Detection of Meteoric Particles, Contract AF 19(604)1908. 14 Apr 60, 129p. 52 refs. AFCRC-TN-60-272.
Order from LC mi$6.30, ph$19.80 PB 149 099

The primary purpose of this paper is an attempt to attach a meaningful significance to recent measurements of micrometeoric influx, as determined by high-altitude rockets and Earth satellites. Other known data on meteoric influx are introduced to support the micrometeor data and to provide a framework onto which the micrometeor data can be added in the analysis. Some of the data on meteoric influx, as well as the recent data on micrometeoric influx, suggest a major change in the mass distribution function from the function in prevalent use at the present time. (Author) (See also PB 149 098)

BEHAVIORAL SCIENCES

Human Engineering

Hearing and Communication Lab., Indiana U., Bloomington.
OPERATING CHARACTERISTICS, SIGNAL DETECTABILITY AND THE METHOD OF FREE RESPONSE, by James P. Egan, Gordon Z. Greenberg, and Arthur I. Schulman. Technical rept. on Research Concerning the General Problem of Information Reception by Means of Speech Communication, Contract AF 19(604)1962. 15 Dec 59, 87p. 7 refs. AFCRC-TR-59-58.
Order from LC mi$4.80, ph$13.80 PB 148 882

This paper is concerned with an experimental analysis of the following problem in signal detection: a weak signal of brief duration is presented a number of times in a long observational interval. The temporal intervals between the presentations of the tones are randomly selected, and the listener is not given any information as regards the distribution of these random intervals.

Naval Training Device Center, Port Washington, N. Y.
BIBLIOGRAPHY OF UNCLASSIFIED HUMAN ENGINEERING REPORTS. 1 Jan 56, rev. 1 Jan 58, 21p. 457 refs. NAVEXOS P-1491, supersedes same and supplement of 1956.
Order from LC mi$2.70, ph$4.80 PB 150 185

This report released for sale to the public 19 Sep 60.

For each report the following information is given: the author, report title, date of issue, security classification, and report number. The report titles are organized under broad subject matter titles.

Personnel and Training

Adjutant General's Office, Washington, D. C.
APTITUDE DISTRIBUTION IN THE COMBAT ARMS, by Robert F. Boldt and Dennis Seidman. Rept. on Combat Allocation a-31. Apr 60, 23p. 2 refs. Technical Research rept. 1119.
Order from LC mi$2.70, ph$4.80 PB 149 458

As a result of expressed concern that the quality of manpower being supplied to combat divisions was substantially below that being supplied to the rest of the Army, a study was undertaken to find how aptitude levels in combat divisions compared with aptitude levels in the Army as a whole. Data obtained for the combat sample (approximately 10,000 enlisted men from 6 Pentomic divisions) were compared with total Army statistics with respect to (1) aptitude area score distributions and (2) relative frequencies of aptitude area scores officially recorded as unsatisfactory. Study was further made, within combat divisions, of aptitude levels of men in different MOS, using the primary assignment MOS. Combat division personnel were found to average 2 points below total Army in scores on the various aptitude areas, including combat. They had 2 to 6 percent more men with scores below 90 in six of seven aptitude areas, again including the combat area. The combat aptitude of men in combat MOS averaged 6 points below combat aptitude of men in other than combat jobs. It was concluded that substantial benefit would be expected to the Army as a whole--not solely the combat arms--from implementation of an optimal allocation procedure using differential aptitude measures. (Author)

Adjutant General's Office, Washington, D. C.
DIFFERENTIAL VALIDITY OF THE ACB FOR COURSES IN SEVEN JOB AREAS, by William H. Helme. Rept. on New Classification Techniques c-00. Apr 60, 18p. 11 refs. Technical research rept. 1118.
Order from LC mi$2.40, ph$3.30 PB 149 457

Analysis was made of findings from studies in which the Army Classification Battery was validated against performance in 73 courses representing seven job areas. Four tests--Army Clerical Speed, Automotive Information, Electronics Information, and Army Radio Code Aptitude--were highly effective differential selectors for the related job areas. Three tests had high across-the-board validity, but each test has served a particular classification need as well--Verbal Test for Clerical MOS, Arithmetic Reasoning for Infantry MOS, and Pattern Analysis for Precision Maintenance MOS, Validity patterns of tests in the mechanical-electrical domain indicated need for addition of content to develop optimal differential predictors. (Author)

American Inst. for Research [Pittsburgh, Pa.]
ACCURACY OF INFORMATION ON LINE WORK ORDERS FOR ARMAMENT-ELECTRONICS MAINTENANCE, by Richard L. Krumm and Paul H. Newman. Rept. on Contract AF 41(657)119, Phase 2. Dec 58, 40p. WADC TR-58-490; AD-207 335.
Order from OTS $1.00 PB 151 705

Ten weeks were spent at two Armament-Electronics squadrons observing representative troubleshooting tasks. Observations were made of time spent by mechanics in performing 76 typical steps of a troubleshooting job. The observer then obtained from Line Work Orders the mechanics' statements of time required. Comparison of actual time worked with reported time indicated that (a) although the relationship between observed and reported time was curvilinear, there is reason to expect that the relationship would be linear if certain changes are made in squadron procedures; (b) errors in reporting time worked are largest for shorter jobs and for jobs requiring a time greater than four hours per man; (c) depending on the number of men available for assignment, squadrons may differ significantly in the number of man-hours spent on each job even though the jobs are of comparable difficulty; and (d) there is a marked consistency in the amount of time spent in accomplishing subtasks

of a troubleshooting job which are necessary, but which are not "troubleshooting" per se. (Author)

Behavioral Sciences Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
CONFERENCE ON INTEGRATED AIRCREW TRAINING (MARCH 1960), by Paul D. Hood, Richard L. Krumm and others. Rept. on Human Factors in the Design of Devices for Operator Training and Evaluation. July 60, 63p. 8 refs. WADD Technical rept. 60-320.
Order from OTS $1.75 PB 161 923

A conference was held to review information and stimulate discussion on the use of interconnected crew station simulators for aircrew training. The four presentations reveiwed recent research on this topic and specific problems associated with the further research and use of integrated aircrew training. The early history and theory of integrated crew training, as well as recent research into this area were presented. Equipment problems associated with B-52 integrated training were presented from the operational viewpoint; and the role of integrated aircrew training in a flight training program was discussed. (Author)

Bureau of Naval Personnel, Washington, D. C.
ABSTRACTS OF PERSONNEL RESEARCH REPORTS OF THE BUREAU OF NAVAL PERSONNEL.
June 60, Supersedes Mar 58, 109p. 163 refs. BuPers Technical Bulletin 60-6.
Order from LC mi$5.70, ph$16.80 PB 149 350

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TECHNIQUES TO AIR-TO-SURFACE TRAINING, by Edwin K. Smith, Frank J. Anastasio and others. Rept. on Contract Nonr-1628(00). June 59, 62p. 9 refs. Technical rept. NAVTRADEVCEN 1628-7; AD-235 074.
Order from LC mi$3.90, ph$10.80 PB 150 309

This report released for sale to the public 19 Sep 60.

The results are presented of an investigation to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to an air-to-surface attack trainer. It includes an analysis of the training task to determine the skills to be developed and the cues required for its performance. The study has developed point source projection systems which will provide some training in air-to-surface attack. However, before proceeding with design and construction of a training device, certain limitations to the scope of the possible training exercises derived from limitations of the point source system should be reviewed and evaluated by persons fully conversant with the requirements of the training task. In addition, the concepts and configurations involved should be evaluated by the experiments described. (Author)

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TECHNIQUES TO GROUND OPERATION TRAINING, by Edwin K. Smith, Frank J. Anastasio and others. Rept. on Contract Nonr-1628(00). June 59, 35p. 3 refs. Technical rept. NAVTRADEVCEN 1628-10; AD-233 915.
Order from LC mi$3.00, ph$6.30 PB 150 312

This report released for sale to the public 19 Sep 60.

This report describes the results of a study to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to a multi-vehicle ground reconnaissance operational trainer. The scope and important elements of the problem were determined from analysis of the training task as called out in the contract specification. The investigation revealed that a point light source projection system cannot be devised to meet the requirements of this task as specified. However, during the investigation it developed that the point source system might well be applicable to ground-level training tasks where the trainee follows predetermined general routes, such as roads and where terrain contour is not essential. In view of this development, it is recommended that point source visual displays be investigated further for application to training tasks with these characteristics; e. g., driver training devices. (Author) (See also PB 150 311)

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TECHNIQUES TO SURFACE VESSEL OPERATION TRAINING, by Edwin K. Smith, Frank J. Anastasio and others. Rept. on Contract Nonr-1628(00). June 59, 54p. 4 refs. Technical rept. NAVTRADEVCEN 1628-9; AD-233 914.
Order from LC mi$3.60, ph$9.30 PB 150 311

This report released for sale to the public 19 Sep 60.

An investigation was undertaken to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to a destroyer docking trainer. It includes an analysis of the training task to determine the skills to be developed and the cues required for its performance. The study has developed point source projection systems which will provide valuable training in shiphandling and destroyer docking. However, the scope of training will be limited to some extent by limitations inherent in point light source systems. These should be fully investigated and evaluated by experiments described. (Author) (See also PB 150 310)

deFlorez Co., Inc., Englewood Cliffs, N. J.
THE APPLICATION OF POINT SOURCE PROJECTION TO AIR-TO-SURFACE OBSERVATION TRAINING, by Edwin K. Smith, Frank J. Anastasio and others. Rept. on Contract Nonr-1628(00). June 59, 45p. 9 refs. Technical rept. NAVTRADEVCEN 1628-8; AD-233 913.
Order from LC mi$3.30, ph$7.80 PB 150 310

This report released for sale to the public 19 Sep 60.

An effort was made to determine if a satisfactory visual presentation can be obtained with point light source techniques for application to an air-to-surface observation trainer. It includes an analysis of the training task to determine the skills to be developed and the cues required for its performance. A very promising point source projection system has been devised for use in air-to-surface observation training. It is recommended that his system be evaluated through the experiments described. (Author) (See also PB 150 309)

Human Resources Research Office, George Washington U., Washington, D. C.
BASIC ELECTRONICS FOR MINIMALLY QUALIFIED MEN: AN EXPERIMENTAL EVALUATION OF A METHOD OF PRESENTATION, by S. James Goffard, Norman W. Heimstra and others. Rept. on Limit I, Contract DA 49-106-qm-1. Feb 60, 29p. 3 refs. HumRRO Technical rept. 61; AD-233 596.
Order from LC mi$2.70, ph$4.80 PB 149 460

Methods of training were designed to improve the achievement in technical course of men with minimal qualifications for technical training. The three-week Basic Electronics section of the Field Radio Repair course (MOS 296.1) was reorganized according to the principle of "functional context." No item of information or training was presented until it could be fitted into a context of material already learned; training was in whole-to-part rather than in the conventional part-to-whole order. One group of standard input classes (a total of 184 men) was trained by the functional context method and another group (a total of 202 men) was trained by the conventional method. A battery of 10 tests on basic electronics was administered after the three weeks of training. The functional context training proved to be superior, particularly for men at the lower levels of aptitude for electronics training. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
DETERMINING TRAINING REQUIREMENTS FOR ELECTRIC SYSTEM MAINTENANCE: DEVELOPMENT AND TEST OF A NEW METHOD OF SKILL AND KNOWLEDGE ANALYSIS, by Edgar L. Shriver. Rept. on Contract DA 49-106-qm-1. June 60, 108p. 5 refs. Technical rept. 63.
Order from LC mi$5.70, ph$16.80 PB 149 202

The object of this study was to develop methods of analysis that would (1) accurately define the skills and knowledges needed for the operation and repair of electronic systems, and (2) be applicable to such systems in preproduction stages so that they could be used in forecasting training needs. Methods of analyzing the operation and maintenance (through fourth echelon) from the system itself were developed for the M33 radar system, and a cue-response training content was derived. A nine-day performance test (including about the same number and type of field malfunction problems that an average MOS 232.1 repairman would encounter during his first 8 to 12 months on the job) was used to evaluate the proficiency of about 40 students trained by the experimental and the standard courses. Although the experimental training required less than half as much time as the standard course, there was no practical difference in the proficiency of the two groups. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
EXPERIMENTAL COMPARISON OF TWO BASIC ELECTRONICS COURSES FOR FIRE CONTROL TECHNICIANS, by Lloyd Hitchcock, Jr. Rept. on Maintrain I, Contract DA 49-106-qm-1. Feb 60, 25p. 5 refs. HumRRO Technical rept. 60; AD-233 597.
Order from LC mi$2.70, ph$4.80 PB 149 459

Data is provided on the effectiveness of an experimental subcourse in basic electronics developed in earlier research as part of a training program for air defense electronics technicians. One class of trainees was given the standard 12-week subcourse in basic electronics and another received the shorter experimental course; both groups completed the standard program of instruction for maintenance of M33 equipment. Results of performance and written tests revealed no significant differences of proficiency between graduates of the two courses. The shorter basic electronics subcourse is recommended for adoption as standard preliminary instruction in electronic fire control maintenance courses and for possible application to maintenance training programs for other electronic equipment. (Author)

Naval Personnel Research Field Activity, San Diego, Calif.
DEVELOPMENT OF A DEVICE FOR SELECTING RECRUITERS, by Leonard Wollack and David Kipnis. Mar 60, 23p. 6 refs. BuPers Technical Bulletin 60-1.
Order from LC mi$2.70, ph$4.80 PB 149 318

Scores on the Persuasive Scale of the Kuder Preference Record were found to be statistically associated with success as a Navy recruiter, although the absolute magnitude of correlation was relatively small. Operational utility of the test would depend upon the numbers of applicants available who meet current eligibility requirements. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
DEVELOPMENT OF PROBABILITY TABLES FOR PREDICTING GRADUATION FROM RADIOMAN CLASS "A" SCHOOL, by Bert T. King and Estella H. Gregory. Nov 59, 21p. 2 refs. BuPers Technical Bulletin 59-34.
Order from LC mi$2.70, ph$4.80 PB 149 349

In each week of the 24-week course given at Class "A" Radioman (RM) School, Bainbridge, large and significant differences in speed of reception of Morse Code messages were found between trainees who were eventually graduated and those who were dropped at some intermediate point. Probability tables were constructed which present, for each week and each code score, the chances in 100 that a given trainee would fail to graduate. Analysis indicated that such a predictions were reliable. Cumulative percentage curves were also presented which show the proportion of cases in the groups of Graduates and Drops

who earned code scores at or below a given point. These curves indicated that in any week of the course code scores could be used to screen out trainees who would be dropped in some later week.

Naval Personnel Research Field Activity, Washington, D. C.
SCHOOL GRADES AS CRITERIA FOR VALIDATION OF ENLISTED SELECTION TESTS, by John J. La Gaipa and David Kipnis. Dec 59, 23p. 9 refs. Technical Bulletin 59-31; AD-235 301.
Order from LC mi$2.70, ph$4.80 PB 147 791

Research was conducted on the criteria and predictors at Class A Schools in order to improve selection and classification processes. Analyses were made of Navy Basic Test Battery scores and school grades at the Yeoman Class A School, Bainbridge, for the year 1957. Ability to type and fleet experience were factors associated with higher school grades. It is suggested that typing ability testing be continued in the selection of applicants for the Yeoman School. Separate validity analyses of Fleet and Recruit input data confirm the use of separate standards for the two groups. (Author)

New York U., N. Y.
A STUDY OF THE LEARNING OF SELECTED DRIVING SKILLS THROUGH EXPOSURE TO A SPECIALLY PRODUCED MOTION PICTURE FILM, by Leon Brody. Rept. on Contract N61339-78. Apr 60, 20p. 3 refs. Technical rept. NAVTRADEVCEN 78-2.
Order from LC mi$2.40, ph$3.30 PB 148 798

The purpose of this study was to determine to what degree a relatively complete and complex skill might be learned by the sole use of an instructional film. Four driving skills were selected for investigation. Subjects were 51 male high school students, divided into an experimental and a control group. Both groups showed a significant and substantial increase in knowledge, after instruction, as measured by the Written Achievement Test. The group subjected to live instruction demonstrated statistically significant superiority over the film-instructed group on the road-performance tests held immediately after the experimental sessions, and again, one month later. In a practical sense, these absolute differences were quite small. No significant differences between the groups were found on the Written Achievement Test. Learning achieved by instruction was retained by both groups without significant loss as measured by the road performance re-test.

New York U., N. Y.
THE USE OF CONTEXT CUES IN TEACHING MACHINES, by Robert E. Silverman. Rept. on Contract N61339-507. 17 Mar 60, 32p. 14 refs. Technical rept. NAVTRADEVCEN 507-1.
Order from LC mi$3.00, ph$6.30 PB 148 755

Three experiments were conducted to investigate context cues in teaching machines. Experiment I with 120 subjects tested whether ancillary, background cues of colors and designs facilitated learning of paired-associates. It was found that these background cues interfered with learning. Experiment II, performed on 60 students, determined if isolating some items by making them vivid facilitated learning, and if such influence is enhanced when a given vivid context is consistently associated with a given work. Data showed that isolated vivid words are learned faster and that the entire list is also learned faster. Experiment II was comparable to Experiment I, only very difficult words were learned. The results showed no facilitations of learning. (Author)

Ohio State U. Research Foundation, Columbus.
BEHAVIOR TRAIT RATINGS BY PEERS AND REFERENCES, by Robert J. Wherry, Norman E. Stander, and John J. Hopkins. Technical rept. on Contract AF 41(657)222. Dec 59, 55p. 7 refs. WADC-TR-59-360.
Order from LC mi$3.60, ph$9.30 PB 149 293

Experience has shown that reliable trait ratings by peers can be secured during officer training that have appreciable validity for later ratings of officer effectiveness. This investigation tests the hypothesis that equally reliable and valid ratings can be secured from individuals listed as references by applicants for officer training. Four rating forms were developed, each using the same descriptive adjectives selected by factorial analysis of peer nominations. From the results of tryouts with college students, a check-list form and a modified forced-choice form were selected for mailing to references listed by the criterion sample of male under-graduate college students. Results from a 71-per-cent return of reference ratings showed that: (a) reliability, assuming an equal number of raters, was consistently lower than for peer ratings; (b) correlation with the criterion of peer nominations was markedly lower than for peer ratings, but was reasonably high for one class of raters (educators); (c) the check-list rating form brought a higher proportion of returns and yielded a higher validity than the modified forced-choice form. (Author)

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.
A FACTOR-ANALYTIC STUDY OF THE USAF OFFICER ACTIVITY INVENTORY, by Lonnie D. Valentine, Jr. Mar 60, 25p. 13 refs. WADD-TN-60-40.
Order from LC mi$2.70, ph$4.80 PB 149 292

This analysis was designed to determine the actual number of distinct fields of interest that can be identified by an interest inventory scaled for 16 officer career fields. Two factor-analytic techniques were applied to the 16 job-interest scores from the USAF Officer Activity Inventory for a sample of new officers. The analyses each yielded five significant factors (Combat and Operations Interest, Administrative Interest, Technical Interest, Quantitative Interest, and Administrative (Personnel) Interest) with corresponding factors defined by almost identical clusters of interest scales. In each analysis, one of the factors, Administrative (Personnel), was a subset of scales included in the broader Administrative factor. Thus, four distinct interest areas were defined, whose definition established their equivalence to the four interest measures included in the Air Force Officer Qualifying Test, and confirmed the judgment that four interest scales were adequate in the officer test battery. The factor analyses, presented in detail in the appendixes, are of special interest in showing how an incomplete hierarchical

structure can be handled by the Schmid-Leiman hierarchical factor model. (Author)

Richardson, Bellows, Henry and Co., Inc., New York
THE ACCEPTABILITY AND EFFECTIVENESS OF THE CASUAL USE OF AUDITORY TRAINING AIDS, by Harold Edgerton. Rept. on Contract N61339-373. Mar 60, 76p. 21 refs. Technical rept. NAVTRADEVCEN 373-1.
Order from LC mi$4.50, ph$12.30 PB 148 797

This study investigated the acceptability and effectiveness of recorded lesson reviews as supplementary aids to instruction in naval schools. Trainees from two schools, AN(P) and AE(A), at the Naval Air Technical Training Center, Jacksonville, Florida, participated in the study. In the AN(P) program, the total running time required for a single presentation of all the lesson reviews was 628 minutes. Each trainee listened, on the average, a total of 226 minutes, or 36% of the time. In the AE(A) program, the total running time was 198 minutes, with each trainee listening, on the average, a total of 120 minutes, or 61% of the time. Little relationship was found between the amount trainees listened to the lesson reviews and their intellectual ability. The groups who had the lesson reviews available did no better in course examinations than comparable groups who did not have the reviews available. Further, the trainees who listened most to the lesson reviews did no better in course examinations than those who listened least.

St. Louis U., Mo.
SOCIOMETRIC STATUS AND ATTITUDE CHARACTERISTICS OF SUCCESSFUL AND UNSUCCESSFUL WAVE RECRUITS, by Marilyn K. Rigby, Elizabeth D. Ossorio, and Walter L. Wilkins. Technical rept. no. 11 on Contract [Nonr-1304(04)] Sep 59, 42p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 148 886

Two instruments intended to discriminate successful from unsuccessful Wave recruits and to describe the Wave recruit group were administered to nine successive companies. A sociometric questionnaire discriminated successful from unsuccessful recruits in two independent samples. It is now in use at the Naval Training Center. An opinion survey was administered to four companies for the purposes of developing a key; when the papers from five additional companies of recruits were scored with the key, no significant discrimination between criterion groups was found. Neither were relationships found between scores derived from the opinion survey and sociometric standing. The opinion survey was subjected to both a linkage and a cluster analysis; descriptions of various recruit attributes were derived from the analyses of the resulting nine types and 13 clusters. Two clusters and two types from the linkage analysis also discriminated the criterion groups of the second sample. Among the discriminators were a cluster and a type both of which described women who are likely to complain at almost every opportunity. It was suggested that these women could be readily identified during an interview with a recruiter. (Author)

Psychology

Air Force Command and Control Development Div., Bedford, Mass.
THE EFFECT OF STIMULUS VARIABILITY ON PREDICTION OF MAGNITUDE, by Anne W. Story. June 60, 20p. 9 refs. AFCCDD-TN-60-20.
Order from LC mi$2.70, ph$4.80 PB 149 212

According to probability matching experiments Ss' asymptotic probability of predicting an event equals the frequency with which that event has occurred. Such events have been invariant: An alternative, however, frequently varies over time. Apparently the more variable the alternative, the less will be its predicted magnitude. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
A CONTINUOUS TRACKING DEVICE FOR PRIMATES, by Frederick H. Rohles, Jr. and Marvin E. Grunzke. Apr 60, 14p. 2 refs. AFMDC-TR-60-10.
Order from LC mi$2.40, ph$3.30 PB 149 175

A tracking task was designed that requires a primate to track a continuously moving target in order to avoid electric shock. The device itself and the training procedures employed are described. (Author)

Applied Mathematics and Statistics Lab., Stanford U. Calif.
FOUNDATIONS OF STATISTICAL LEARNING THEORY. II. THE STIMULUS SAMPLING MODEL, by W. K. Estes and Patrick Suppes. Technical rept. no. 26 on Contract Nonr-225(17). 22 Oct 59, 143p. 8 refs. AD-229 275.
Order from LC mi$7.20, ph$22.80 PB 149 509

Principal axioms and general theorems of stimulus sampling theory are given. A few results for particular experimental cases are given for illustrative purposes, but the systematic working out of special cases, especially those involving various types of reinforcement and discrimination schedules, is deferred for later presentation. (Author) (See also PB 137 998)

Army Medical Research Lab., Fort Knox, Ky.
AN OBSERVER CONSTANT IN THE PERCEPTION OF STEREOSCOPIC DEPTH, by W. C. Gogel. 3 Feb 58, 27p. 4 refs. Rept. no. 316; AD-160 344.
Order from LC mi$2.70, ph$4.80 PB 146 315

Two experiments were conducted to determine whether the amount of binocular disparity necessary to perceptually duplicate a frontal extent in depth is proportional to the angular size of the frontal extent, is independent of convergence distance and is particular for a subject. The following results were obtained: The magnitude of the adjusted binocular disparity required for the depth duplication (1) increased with the increase in the magnitude of the horizontal extent being duplicated, (2) showed no statistically significant change with a 2^{o} change in convergence, (3) was relia-

bly different between subjects. The results suggest that an observer constant occurs which specifies the amount of binocular disparity perceptually equivalent to an angular unit of frontal extent. (Author)

California U., Los Angeles.
THE OBSERVING RESPONSE IN DISCRIMINATION LEARNING, by Richard C. Atkinson. Technical rept. 4 on Contract Nonr-233(58). 1 Sep 59, 25p. 9 refs. AD-225 664.
Order from LC mi$2.70, ph$4.80 PB 148 888

Observing responses in discrimination learning are analyzed. The experimental situation consists of a sequence of discrete trials as follows: [1] ready signal to which S (subject) makes either an O_1 or O_2 (observing) response; [2] following the observing response, one of three cues, s_1, s_2, or s_c (stimulus events) is presented; [3] to the onset of s_i, S makes an A_1 or A_2 (discrimination) response; and [4] either E_1 or E_2 (reinforcing events) occurs and terminates the trail. E_1 indicates that A_1 was the correct response on that trial. The model provided a fairly adequate account for such measures as (1) the asymptotic probability of an O_1 response; (2) the asymptotic probability of an A_1 response on an S_i trial and (3) the asymptotic probability of the joint event of an O_k response and an A_1 response. An analysis of certain sequential effects indicates marked differences between theory and observation. The observed proportions of observing responses conditionalized on correct and incorrect A_1 responses were markedly different from theoretical predictions.

Educational Testing Service, Princeton, N. J.
DIMENSIONS OF SOCIAL DESIRABILITY, by Samuel Messick. Rept. on Contract Nonr-2214(00). Apr 59, 28p. 22 refs.
Order from LC mi$2.70, ph$4.80 PB 147 806

Attempted controls in personality inventories for the tendency to respond in a socially desirable way usually assume that the domain of desirability is unidimensional. The present study attempted to evaluate this assumption and to explore the nature of any multidimensional structure uncovered. Ratings of the desirability of personality items from the Edwards Personal Preference Schedule were intercorrelated and factor analyzed. Nine factors were extracted and rotated to oblique simple structure. The factors were labeled and interpreted in terms of different "points of view" as to what is desirable. The finding of several dimensions of desirability suggests that the equating of items in terms of a single average desirability scale would leave much of the consistent variance of the ratings uncontrolled. Such a control method would provide inconsistent effectiveness for individual assessment, depending upon the subject's conformity to the group consensus of desirability. (Author)

Fels Group Dynamic Center, U. of Delaware, Newark.
THE MINORITY NEWCOMER IN OPEN AND CLOSED GROUPS, by Robert C. Ziller, Richard D. Behringer and Jacqueline D. Goodchilds. Technical rept. no. 1 on Perception Variables and Communication Efficiency, Contract Nonr-2285(02). 19 Oct 59, 18p. 8 refs. AD-228 089.
Order from LC mi$2.40, ph$3.30 PB 149 473

This laboratory experiment was concerned with the assimilation of the newcomer under conditions where the host group expected membership changes (an open group) or did not expect membership changes (a closed group) and the perceived relative status of the donor group or culture (represented by a Negro or White newcomer). While the results with reference to the initial hypotheses were not statistically significant there was some evidence that under the closed-Negro conditions the newcomer was the least well assimilated. However, it was noted that the Negro newcomer and confederate tended to be rated significantly higher than the White counterparts. Moreover, the "halo effect" between ratings tended to be more pronounced with reference to the Negro newcomer. Finally, the relationship between attitude toward the confederate and actual change of opinion on a given task was more pronounced under the Negro conditions. It was concluded that interpersonal orientation is a more critical consideration in interracial groups or in groups where there are distinct differentiating characteristics among the various subgroups. The higher ratings of the Negro confederates were attributed to "overcorrection for possible prejudice." (Author)

Michigan U., Ann Arbor.
ATTITUDE CHANGE AND ATTITUDE STRUCTURE, by Helen Peak. Final rept. on Contract Nonr-1224(10). Oct 59, 35p. 25 refs. AD-230 479.
Order from LC mi$3.00, ph$6.30 PB 149 519

Contents:
Attitude change and psychological structure
  Effects of aroused motives on attitudes
  Some personality and information correlates of change
  Generalization within opposites structures
  Generalization within serial structures
  Correlates of opposites structures
  Opposites, defenses and attitudes
Determining the nature of structures
  Observation of existing structure
  Building structures
The problem of attitude changes
  Attitude change as a change in performance
  Structural change-learning and attitude change
  Structural targets of change
  Conditions of structural change
Generalization theory

Michigan U. [Ann Arbor]
ATTITUDES, OPPOSITES STRUCTURING AND F SCORES, by Helen Peak. Technical rept. no. 5 on Contract Nonr-1224(10). 1 May 59, 18p. 9 refs.
Order from LC mi$2.40, ph$3.30 PB 146 604

Evidence is presented in support of the hypothesis that people tend to be consistent in structuring different situations as opposites. There was little evidence that a tendency toward opposites structuring was related to direction of attitude toward the ingroup and the outgroup as has been suggested by some writers (Adorno, et al. 1950). There was a tendency for opposites measures to correlate with the extremeness of attitude rather than its direction as had been expected. F scores were not related to general opposites structuring. However, there was a significant positive relation between F and the attitude difference score (ingroup minus outgroup attitude scores.) The prediction that a combination of high F and high opposites would yield the most favorable ingroup attitudes and the least favorable outgroup attitudes was not borne out. The theory of displacement of hostility from the ingroup to the outgroup implies that there should be a negative correlation between ingroup and outgroup attitudes in those situations where displacement might be expected to occur; namely among Ss with high F scores. The only sign of a negative correlation (and this was not significant) occurred in the high F-low opposite groups. There was no support for the displacement hypothesis but it is suggested that it needs testing in a sample with a wider range of attitudes.

Michigan U. [Ann Arbor].
CORRELATES OF OPPOSITES STRUCTURES, by Helen Peak. Technical rept. no. 7 on Contract Nonr-1224(10). 1 June 59, 52p. 18 refs.
Order from LC mi$3.60, ph$9.30 PB 147 260

The Report describes a pretest and a major study, Opposites IIIb, which has attempted to predict attitudes toward the ingroup and outgroup from a combination of information about opposites structure and defense preferences.

Michigan U., Ann Arbor.
THE EFFECTS OF AROUSED MOTIVATION ON ATTITUDES, by Helen Peak. Technical rept. no. 8 on Contract Nonr-1224(10). 1 Sep 59, 18. 5 refs. AD-230 477.
Order from LC mi$2.40, ph$3.30 PB 148 864

Two hypotheses were investigated: (1) attitudes toward situations or objects will be a function of subjects' perception of the good or bad consequences of the situation; and (2) attitudes are a function of the degree of arousal (intensity) of those consequences. Hypothesis I was supported clearly. The analysis of hypothesis II based on achievement scores and change in achievement scores showed no significant relations of any kind. Another test of the hypothesis was possible through observing the significance of change in attitude from neutral to arousal conditions in those who regarded a given policy as instrumental when compared to those who did not see any relevance of a policy to making good grades. When tested by this method Hypothesis II was supported.

Ohio State U. Research Foundation, Columbus.
A STUDY OF SELECTED FACTORS AFFECTING THE MEASUREMENT OF TOTAL TEAM PRODUCT IN GUNFIRE SUPPORT TRAINING, by John E. Horrocks, Emil Heermann, and Michael Kalk. Rept. on Contract Nonr-1939(00). 25 Nov 59, 19p. 2 refs. Technical rept. NAVTRADEVCEN 1939-0-4.
Order from LC mi$2.40, ph$3.30 PB 146 994

A summed error score in which cancelling-out effects of errors were eliminated did not provide a more consistent predictable measure of team performance than did the resultant error score in which cancelling-out errors were present. A technique for the measurement of team performance is recommended.

Research Center for Mental Health, New York U., N. Y.
RESEARCH ON THE EFFECTS OF ISOLATION ON COGNITIVE FUNCTIONING, by Robert R. Holt and Leo Goldberger. Rept. for 15 Oct 58-14 Oct 59 on Biophysics of Flight, Contract AF 33(616)6103. Mar 60, 26p. 5 refs. WADD Technical rept. 60-260.
Order from OTS $0.75 PB 161 922

The study was undertaken to compare the effects of 100 gamma of LSD-25 with those of 8 hours of perceptual isolation, carried out in the McGill style. Fifteen civilian subjects (actors) showed impairment on only 1 of 9 cognitive tests after the 8-hour isolation. The same test (Robinson's Rhymes) was not quite significantly impaired by LSD, but the time score for Serial Sevens was significantly impaired. On a questionnaire designed to elicit reports of the main symptoms of the drug, there was almost no overlap between the post-isolation and post-LSD scores, the latter being very much higher. The qualitative patterns of symptoms were quite different also. LSD produces a state subjectively more striking and qualitatively different from the effects of 8 hours of isolation. A battery of cognitive tests did not prove differentially sensitive to the reported deleterious effects of both conditions on mental functions. (Author)

Rochester U., N. Y.
THE EXPERIMENTAL ANALYSIS OF MOOD [and] A FACTOR ANALYTIC STUDY OF THE DOMAIN OF MOOD WITH INDEPENDENT VALIDATION OF THE FACTORS, by Vincent Nowlis and Russel F. Green. Technical repts. no. 3 and 4 on Research Program on Mood and Attitude Change, Contract Nonr-668(12). 21 Sep 57, 26p. 19 refs. AD-231 243.
Order from LC mi$2.70, ph$4.80 PB 148 900

A discussion is presented of (1) the development of hypotheses about mood and about the main dimensions of the verbal report of mood; (2) the development of an instrument of eliciting verbal report of mood in quantifiable form; (3) repeated factor analyses of the verbal reports to develop the most useful hypothetical factors; (4) search for lawful changes in mood in response to controlled changes in important environmental factors; and (5) search for relations between induced changes in mood and other behavioral factors.

Rochester U., N. Y.
LEVEL OF HOSTILITY AND ATTITUDE CHANGE, by Sheldon Alexander (U. of Illinois). Doctoral thesis. Technical rept. no. 2 on Research Program on Mood and Attitude Change, Contract Nonr-668(12). 21 Sep 59, 12p. 13 refs. AD-231 244.
Order from LC mi$2.40, ph$3.30 PB 148 899

An experiment was conducted to examine the effect of personality hostility on attitude change and the interaction between externally-induced hostility and personality hostility. Four messages were given to 357 male high school students. These included: (1) a high hostility arousal message; (2) a moderate hostility arousal message; (3) a low hostility arousal message; and (4) a control message, on another topic, designed to produce no emotion arousal. Results were interpreted as providing no support for the hypothesis of an inverse and as providing some support for the hypothesis of a direct relation.

Rochester U., N. Y.
THE RELATIONSHIP OF MOOD AND MOOD SHIFT TO ATTITUDE, by Joel Axelrod (Dancer-Fitzgerald-Sample, Inc.). Technical rept. no. 5 on Research Program on Mood and Attitude Change, Contract Nonr-668(12). 21 Sep 59, 15p. 7 refs. AD-231 245.
Order from LC mi$2.40, ph$3.30 PB 148 901

An experiment was designed (1) to determine the validity of using moods as goals in predicting attitude structure; and (2) to determine if shifts in mood can be systematically related to shifts in attitude. The results generally tend to support the use of moods as goals, and to indicate a systematic relationship between mood shift and attitude shift. (Author) (See also PB 148 900)

Texas A. & M. Research Foundation, College Station.
ADAPTIVE BEHAVIOR AND ADAPTATION LEVEL THEORY, by Warren C. Bonney and Clay E. George (Arizona State U.). Technical rept. no. 3 on Contract Nonr-2119(01). Sep 59, 22p. 6 refs. AD-226 432.
Order from LC mi$2.70, ph$4.80 PB 148 858

An experiment was designed to determine the relationship involved in affective adaptation, and a second experiment was designed to measure the relationship between affective adaptation and improvement in reading during a course in remedial reading, both being measured by the pictorial preference series. In addition, an investigation of group adaptation trends was made which included analysis of data, based on responses to form-color stimuli presented in a variety of serial orders and collected from several widely differing groups. Results indicated that nonauthoritarian subjects of low peer status are much less readily bored than are the subjects in the other categories. The results further indicated that the most adaptable subjects were those characterized by at least 2 of the following attributes: (1) high in peer acceptance; (2) above the reference group median on the SCAT; and (3) below the reference group medium on the F-scale. Data from achromatic, appropriate, and inappropriate slides indicated that throughout the slide series, the high peer group with low F scores tended to have an increasing dislike for outline and appropriate slides, and an increasing like for inappropriate slides, while the low peer status group with low F scores tended to like the outline and appropriate slides and tended to increasingly dislike the inappropriate slides.

BIOLOGICAL SCIENCES

Brooke Army Medical Center, Fort Sam Houston, Tex.
RADIATION AND THERMAL BURNS, by R. S. Goldsmith, B. W. Evans and others. Annual research progress rept. on Proj. 6X59-06-001. 30 June 60, 182p. 57 refs.
Order from LC mi$8.40, ph$28.80 PB 149 149

The projects reported are: serotonin metabolism in burned patients and experimental animals; a study of serum haptoglobin levels in man following thermal injury; environmental factors in burns; ventilation studies in the burned patient; riboflavin metabolism in burned rats; effect of varying the calorie: nitrogen ratio on predetermined levels of nitrogen required by the burned patient; wound management and nitrogen metabolism in burned rats; role of the eschar on post-burn weight of rats; studies of urinary tract infections in burned patients; limited use of antibiotics in the seriously burned patient; in vitro evaluation of new antibiotics concerned in treatment of burned patients; the hemagglutination inhibition test for serologic diagnosis of pseudomonas endotxemia in the burned patient measurement of pseudomonas antibody in normal and burned patients by a mouse protection test; serodiagnosis and bacteriophage typing of pseudomonads; serologic demonstration of existence of a "burn toxin" in the serum of newly burned individuals and the antibody of this toxin in convalescent burned patients; determination of properdin levels in the serum of burned individuals as a measurement of host response in eventuating bacteremia; bacteriophage typing of staphylococcus aureus; clinical operation, burn center; the effect of massive occlusive dressings on normal adult male; early excision and grafting of extensive areas of full-thickness burns; clinical-pathological study of fatal burn injuries.

Brooke Army Medical Center, Fort Sam Houston, Tex.
TRAUMATIC SURGERY AND SHOCK, by Paul E. Teschan, Thomas F. O'Brien and others. Annual research progress rept. for 1 July 59-30 June 60, on Proj. 6X59-01-001. 30 June 60, 183p. 56 refs.
Order from LC mi$8.40, ph$28.80 PB 149 148

The projects reported are: clinical operation, renal center; prophylactic hemodialysis in the treatment of acute renal failure; dialyzer testing; acute renal insufficiency in experimental animals; persistance of antibiotic activity in serum of anuric patients (less than 100 cc. of urine per 24 hours), after a single intramuscular does; humoral factors in kidney regeneration; behavioral factors in acute renal failure; surgical management of upper abdominal trauma (pancreatic injury); experimental investigation of intra-abdominal hemorrhage control - "canine survival following intraluminal occlusion of the aorta above the celiac artery"; energy metabolism in tissues.

Naval Ordnance Test Station, China Lake, Calif.
WATER FLOW ABOUT A SWIMMING FISH, by Moe William Rosen. Master's thesis. May 59, 100p. 9 refs. NOTS TP 2298.
Order from LC mi$5.40, ph$15.30 PB 148 351

A series of experiments were conducted with a very small fish in an attempt to determine the nature of the water flow about the swimming animal's variable form. The endeavors were failing until discovery was made of a very sensitive method which showed the entire field of water flow without inhibiting the action or the life processes of the fish. The experiments discovered a flow process and phenomena that are unfamiliar and surprising, involving discrete unit quanta of fluid energy. The observed flow is not in conformance with presently accepted ideas of laminar or of turbulent flow about a fish. Easily distinguishable particles flowed about the fish. A flow pattern was observed about a dolphin as it leaped into the air, emerging at high speed from below the water surface. This experiment showed a remarkable flow similarity with the small fish experiments. The observed behavior of the water on the small fish's body exhibits correlation with the actions of a fish when taken out of the water. A method was developed, making possible the construction of the relative streamlines about the fish's undulating body. A simple mathematical equation was derived relating the speed of a fish or dolphin to its body motions. The equation was reasonably verified by the measurements made in the experiments.

Naval Research Lab., Washington, D. C.
A FORCE-AREA STUDY OF CATALASE FILMS, by J. D. Bultman and J. M. Leonard. Final rept. 27 July 60, 7p. 18 refs. NRL rept. 5490.
Order from LC mi$1.80, ph$1.80 PB 146 162

An investigation of the surface chemical behavior of the enzyme, beef liver catalase, was undertaken. Monomolecular layers were deposited on ammonium sulfate solutions, the surface concentration varying from 7.8×10^{13} to 16.4×10^{13} molecules per film. Force-area (F-A) curves obtained by compression of these films show two inflections corresponding to different orientations of the catalase molecule. Extrapolation of the linear portions of the curves to zero film pressure gave cross-sectional areas per molecule of $(25.6 \pm 1.0) \times 10^3$ Å^2 and $(7.9 \pm 1.6) \times 10^3$ Å^2, respectively, as calculated at these two inflections.

Quartermaster Research and Engineering Center, Natick, Mass.
A VEGETATION TRANSECT OF THE THULE PENINSULA, by Ronald A. Nelson. Apr 58, 16p. 16 refs. Research Study Rept. RER-18.
Order from LC mi$2.40, ph$3.30 PB 150 004

This report released for sale to the public 26 Aug 60

Vegetation of the Thule Peninsula was sampled along a 16-mile transect between Thule Air Base and Camp Tuto. The general vegetation is small and sparse. Grasses and sedges, found in marshy areas, are the largest plants; most of the trees and other plants are less than five inches high. The vegetation may be used in an emergency for fuel, food, and insulation by individuals or small groups; it is of no value for providing opportunities for cover or concealment. (Author)

Anatomy and Physiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
NONOGRAPHS FOR MULTIPHASE ACCELERATION PROFILES, by Hubert C. Feder. June 60, 85p. 7 refs. AFMDC-TR-60-9.
Order from LC mi$4.80, ph$13.80 PB 149 176

Experimental investigations of the technological and physiological effects of unidirectional accelerations require the computation of the parameters of the acceleration pattern. This report develops explicit equations between distance, velocity, acceleration, and time, thus greatly reducing the computational work of test analysis and evaluation. Two nomographs were designed which permit reading distance with an error of less than 2 percent and velocity with error less than 0.2 percent. The three principal phases of the acceleration pattern are used to define a set of descriptive parameters. An impulse-dependent onset parameter, called relative onset rate, is discussed and, if used as a standard, would facilitate the comparison of tests made by different investigators. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE BLOOD CHEMISTRY OF THE CASTRATED MALE GOAT, by Paul F. Robinson. Apr 60, 8p. 16 refs. CWLR-2386; AD-236 946.
Order from LC mi$1.80, ph$1.80 PB 148 909

Biochemical analysis of the blood of forty-four castrated male angora goats, of uniform size and condition, yielded values that did not seem to differ markedly from those obtained by other authors in goats of a different physiological status. The mean value obtained for plasma sodium was 148.8 mEq/L; for plasma potassium 4.9 mEq/l; for total plasma cholesterol 44.8 mg/100 ml; for whole blood glucose 81.4 mg/100 ml; for plasma chloride 106.8 mEq/L; and for plasma protein 7.2 gm/100 ml. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE RESISTANCE OF RABBIT EYE TO STEEL SPHERES AND CUBES, by George M. Stewart. Jan 60, 16p. 6 refs. CWLR 2332; AD-231 038.
Order from LC mi$2.40, ph$3.30 PB 147 236

The resistance of the rabbit eye to penetration by steel spheres and cubes in the weight range of 0.85 grain through 225.0 grains was studied. Rabbits varying in age from 5 to 7 mo were killed and their eyes were removed and mounted in gelatin for ballistic evaluation. Cubes striking at velocities near the ballistic limit were frequently rejected even after penetrating the cornea. Under the same conditions of test, spheres were often retained. Partially penetrating missiles, except very small ones, were almost always rejected. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
X-IRRADIATION AND ACCELERATION STRESS, by John W. Taylor. Rept. no. 1 on Task MR005.15-0002.14. 1 Mar 60, 9p. 3 refs. NADC MA-6003; AD-234 596.
Order from LC mi$1.80, ph$1.80 PB 146 962

It was determined whether a correlation existed between the stress due to ex-irradiation and the stress due to acceleration. Sprague-Dawley rats were exposed to an acute dose of 600 r ± 20% x-irradiation

and then centrifuged at 20 G for 7 minutes. The data resulting from this procedure was then compared with data for two control groups, one centrifuged and one irradiated. There appeared to be no significant correlation between irradiation stress and acceleration stress at the experimental levels used in the study. (Author)

California U., Los Angeles.
AN ENGINEERING ANALYSIS OF CARGO HANDLING. X. ENERGY EXPENDITURE OF LONGSHOREMEN, by Frank C. Hale and John J. O'Hara. Rept. on Contract Nonr-233(07). June 59, 58p. 59 refs. Dept. of Engineering rept. no. 59-20; AD-230 108.
Order from LC mi$3.60, ph$9.30 PB 147 573

A study was carried out of longshoring in the maritime cargo transport industry in the Los Angeles - Long Beach harbors, combining the methods of physiological measurement of energy cost and industrial engineering methods of activity measurement. Energy cost was assessed by the indirect methods of oxygen consumption, heart rate and ventilatory responses. Activity measurements were made by systematic work sampling techniques. (See also PB 143 700)

California U., Berkeley School of Medicine.
POSSIBLE EFFECT OF REDUCTION IN BODY TEMPERATURES ON CELLULAR FUNCTION DURING HYPOTHERMIA, by S. F. Cook. Rept. for 1 Feb-30 Apr 59 on Contract AF 41(657)184. June 59, 8p. 3 refs. AAL-TN-59-12; AD-233 845.
Order from LC mi$1.80, ph$1.80 PB 146 625

An investigation to determine what effect, if any, a reduction in body temperature might have on cellular function. The data obtained forms the basis of the present report. Two tissues, liver and kidney, have been run. The results are given in tables.

Duke U. [Durham, N. C.]
THE PHYSIOLOGICAL RESPONSE TO PRESSURES GREATER THAN 1 ATMOSPHERE, by Kenneth E. Penrod. Final rept. for 1 July 51-30 June 59, on Contract Nonr-473(00). [1959] 6p. 3 refs.
Order from LC mi$1.80, ph$1.80 PB 146 693

[Hammersmith Hospital] London (Gt. Brit.)
FUNCTION OF THE HUMAN ADRENAL CORTEX, by C. L. Cope. Annual technical status rept. for 1 Feb 59-31 Jan 60 on Contract DA 91-591-EUC-1055. [1960] 15p. AD-234 400.
Order from LC mi$2.40, ph$3.30 PB 146 957

Effort was directed toward the development of analytical methods for aldosterone metabolism. The purity and stability of the tritiated aldosterone was determined. The behavior of aldosterone on a variety of chromatographic systems was measured. A major metabolite of aldosterone was recovered from urine samples; measurements were made of its running rate on a variety of chromatographic systems, its concentration in urine, and also its stability. The reagent ^{14}C-acetic anhydride was used to estimate the quantities of both aldosterone and of aldosterone metabolite. Doses of tritium-labeled aldosterone were administered intravenously to suitable subjects and the distribution of this tritium in various fractions of the excreted urine was measured. The aldosterone metabolite was extracted and its specific activity in various urine samples measured.

Quartermaster Research and Engineering Center, Natick, Mass.
THE COMPARATIVE EFFECTIVENESS OF SOME PSYCHOLOGICAL AND PHYSIOLOGICAL MEASURES IN RANKING THE IMPACT OF DIVERSE ENVIRONMENTAL CONDITIONS, by Edward J. Fine. Jan 58, 11p. 13 refs. Research Study Rept. PB-15.
Order from LC mi$2.40, ph$3.30 PB 150 000

This report released for sale to the public 13 Sep 60.

Two studies are presented, both of which compare the effectiveness of a subjective rating scale with two physiological measures, mean weighted skin temperature and average increase in metabolic rate, in ranking eight environmental conditions (varying in ambient temperature, humidity and wind speed) from warmest to coldest. The results of both studies indicate a high degree of consistency between individual responses on each measure and a very high degree of agreement between the subjective rating method and both mean weighted skin temperature and metabolic rate methods of ranking the conditions. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
MEASUREMENT OF RELATIVE BODY SURFACE TEMPERATURE VARIATION AND A CONCEPT OF SKIN TEMPERATURE STRESS, by Warren H. Teichner. June 58, 10p. 3 refs. Research Study Rept. PB-22.
Order from LC mi$1.80, ph$1.80 PB 150 001

This report released for sale to the public 26 Aug 60.

The skin temperature of ten body points taken from nude men after 45 minutes of rest in an environment of 80°F., 50 percent R.H., still air was defined as a general standard against which it was proposed that all other similar measures be compared in studies of surface temperature variation, skin temperature stress, comfort, and performance. Two procedures for making such comparisons were proposed; one involved the use of a skin temperature profile based upon general standard and the other involved the use of the standard error of fit of experimental measure- to the general standard as a measure of amount of relative skin temperature variation or stress. Data were presented illustrating application of the concepts under a variety of experimental conditions. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
OXYGEN CONSUMPTION AND BODY TEMPERATURE DURING SLEEP IN COLD ENVIRONMENTS, by M. B. Kreider and P. F. Iampietro. Mar 60, 9p. 10 refs. Technical rept. EP-127; AD-236 834.
Order from LC mi$1.80, ph$1.80 PB 147 796

Six young soldiers slept at the following ambient temperatures: 25.5 to 26°C (78 to 80°F), 15 to 18.5°C (60 to 65°F) and -32 to -34.5°C (-25 to -30°F). Rectal (T_r) and skin temperatures were recorded and mean weighted skin temperature (T_s) was calculated at half-hour intervals every night; oxygen consumption (VO_2) was measured at 6-min intervals on occasional nights. During sleep at a comfortable temperature (25.5°C) T_r, T_s and VO_2 decreased below the resting levels measured just before retiring. During sleep in cold environments, T_r and T_s dropped to still lower levels, with the lowest values recorded at an earlier hour of the night. VO_2 during sleep in the cold did not differ from values recorded during sleep at 25.5°C. Lowest values measured during sleep in the coldest environment were 35.5°C, 30.5°C, and 78 Cal/m^2 for T_r, T_s and body heat debt, respectively. These values may represent the limits of body cooling compatible with substantially continuous sleep in the cold. (Author)

Texas U., Austin.
RELATIONSHIP BETWEEN ALTERNATE BINAURAL BIFREQUENCY LOUDNESS-BALANCE TEST AND THRESHOLD TONE-DECAY TEST RESPONSES IN NORMAL AND SUBNORMAL EARS, by Lennart L. Kopra, Roger W. Fullington, and Lee E. Strickland. Apr 60, 13p. 12 refs. AFSAM 60-19.
Order from LC mi$2.40, ph$3.30 PB 149 351

The alternate binaural bifrequency loudness-balance test (500 cps versus 4000 cps) and the threshold tone-decay test were administered to 20 male subjects with bilateral normal hearing and to 14 subjects with significant bilateral high-frequency sensori-neutral loss. Results showed that (a) when a span difference of 30 db was used as the criterion for abnormal loudness increase, 13 of the subnormal subjects demonstrated abnormal loudness at 4000 cps in both right and left ears, and one of the normal subjects showed abnormal loudness increase in one ear; (b) in the threshold tone-decay test the differences between median sensation levels required for 60-second awareness by normal and subnormal subjects were not significantly different at any test frequency from 250 cps through 6000 cps; and (c) no systematic interrelationships were observed between alternate binaural loudness balance test results and threshold tone-decay test results. (Author)

University Hospitals, Iowa City.
SHEARING MOTION IN SCALA MEDIA OF COCHLEAR MODELS, by Juergen Tonndorf. Apr 60, 11p. 14 refs. AFSAM rept. 60-41.
Order from LC mi$2.40, ph$3.30 PB 149 243

The occurrence of shearing motion within the cochlear duct, together with the fact that it is this mode of motion which constitutes the adequate stimulus for hair cells, was first reported by Bekesy in 1953. Two modes of shearing motion were reported: (1) radial, directed in the region proximal to the place of maximal amplitude of the traveling-wave pattern; and (2) longitudinal. directed distal to that point. This phenomenon was studied in cochlear models. The envelopes over both modes of shearing motion were found to be much smaller than that over the traveling-wave pattern. A simple explanation presented itself: The direction of the shearing motion in each domain coincides with the dominant curvature produced by the traveling waves in that section of the cochlear duct.

Yale U., New Haven, Conn.
DEVELOPMENT OF CRITERIA OF PHYSICAL PROFICIENCY, by Edwin A. Fleishman. Annual rept. for 15 Nov 58-15 Oct 59 on Contract SAR/Nonr-609(32). 15 Oct 59, 6p. AD-228 843.
Order from LC mi$1.80, ph$1.80 PB 149 479

This study is designed to develop improved measures for the assessment of physical proficiency. These measures may be useful in providing a more comprehensive evaluation of students in physical education programs. Other implications would be possible use in classification and selection programs, especially for jobs that require physical strength, coordination, and endurance.

General Biology

Air Crew Equipment Lab., Naval Air Material Center, Philadelphia, Pa.
WAVE ANALYSIS OF TISSUE NOISE AND MUSCLE ACTION POTENTIAL, by Keith J. Hayes. 22 June 59, 16p. 5 refs. NM 17 01 13 1; NAMC-ACEL-404; AD-218 206.
Order from LC mi$2.40, ph$3.30 PB 146 703

The sensitivity attainable in bio-electric measurement may commonly be limited by tissue noise, rather than by amplifier noise. The spectrum level of tissue noise increases with decreasing frequency down to at least 2.5 c/s where it may exceed amplifier noise by 5 to 25 db. It is ordinarily weaker than amplifier noise at frequencies above 1000 c/s. The spectrum of muscle action potentials is characterized by a rather narrow maximum in the region of 30 to 100 c/s. Amplifiers for surface electromyography may advantageously be designed with a pass-band as narrow as one octave, for maximum signal-to-noise ratio. However, extending the upper frequency limit to 1000 c/s facilitates audio and oscilloscopic monitoring. (Author)

Pacific Science Board, National Research Council, Washington, D. C.
ATOLL RESEARCH BULLETIN NO. 71. MICROCLIMATIC OBSERVATIONS AT ENIWETOK (WITH A SPECIAL SECTION ON VEGETATION) by David I. Blumenstock, Daniel F. Rex, and Irwin E. Lane. Rept. on Eniwetok Microclimatic Project, Contract [Nonr]-2300(12). 30 June 59, 166p. 19 refs.
Order from LC mi$7.80, ph$25.80 PB 148 666

Quartermaster Research and Engineering Center, Natick, Mass.
THE USE OF SHORT WAVE ULTRA-VIOLET RAYS FOR THE SEGREGATION OF COMMINGLED SKELETAL REMAINS, by Thomas W. McKern. Aug 58, 13p. 5 refs. Technical rept. EP-98.
Order from LC mi$2.40, ph$3.30 PB 150 003

This report released for sale to the public 26 Aug 60.

When bone surfaces are exposed to short wave ultraviolet irradiation, most of them reflect a variety of

colors. The wide range of color emission, as well as the fixed relationship of these colors to the substances that emit them, is justification for attempting to apply these qualities to the segregation of commingled skeletal remains. After demonstrations of the results of ultra-violet exposure on a large sample of skeletal material, it is suggested that short wave ultra-violet lamps can be used in certain instances for the accurate sorting of commingled remains. (Author) (Color photographs will not reproduce)

Medical Specialties and Equipment

Avco Corp., Wilmington, Mass.
RESEARCH IN THE INVESTIGATION OF THE FEASIBILITY OF AN OPTICAL DENTAL DRILLING DEVICE. Final rept. on Contract Nonr-2681(00). [1959] 18p. RAD-SR-59-50; AD-227 144.
Order from LC mi$2.40, ph$3.30 PB 148 887

The feasibility of developing an electro-optic monitoring system for observation of the oral cavity was investigated. Such a system would incorporate a closed circuit television arrangement so that dental procedures could be simultaneously presented to others. Two concepts were taken under investigation for attainment of the goal. The first pertained to an examination of miniaturized vidicon tubes which might be incorporated directly on or into the handpiece or contra-angle. This approach was abandoned after demonstrating that miniaturized vidicon tube development had not progressed sufficiently, whereby direct application could be obtained. One approach introduced the concept of fiber bundles linked with a closed circuit television system. These bundles are made up of a multitude of individual flexible fibers which transmit light as a result of multiple total internal reflections from one end to the other. Attachment of the distal end of the bundle to the handpiece or contra-angle, or held separately, and the proximal end linked to a television camera, provided the methodology whereby selected portions of the oral cavity could be portrayed on a standard television monitor. Experimental studies utilizing this method are presented and the feasibility of developing an operational device demonstrated. Recommendations pertaining to a suitable development program providing for the synthesis of an operational device are incorporated. (Author)

Medical Coll. of Virginia, Richmond.
A BIBLIOGRAPHICAL SOURCEBOOK OF COMPRESSED AIR, DIVING AND SUBMARINE MEDICINE, VOLUME II, by Ebbe Curtis Hoff and Leon Jack Greenbaum, Jr. Rept. for 1 Jan 50-31 Dec 51 on Contract Nonr-199(00). Nov 54, 379p. 3,807 refs. NAVMED P-5033.
Order from LC mi$11.10, ph$57.60 PB 149 819

This report released for sale to the public 26 Aug 60.

The literature cited in the present volume comprises pertinent unclassified reports and documents as well as published books, monographs, and papers appearing between January 1946 and December 1951.

Pharmacology and Toxicology

[Army Chemical Warfare] Labs., Army Chemical Center, Md.
COLLECTION OF GB VAPOR FROM EXPIRED AIR DURING SIMULATED RESPIRATION AND THE DETERMINATION OF LOSSES OF GB BY SORPTION ON SURFACES OF A ONE-WAY VALVE SYSTEM, by James W. Crook, William S. Koon and others. Mar 54, declassified 17 Oct 58, 16p. 8 refs. Medical Labs. Research rept. no. 252.
Order from LC mi$2.40, ph$3.30 PB 146 547

No direct evidence was found indicating an appreciable loss of GB from air passing through the one-way valve system. The rate of airflow was from 1-50 l./min., and the GB vapor concentration was from 0.12 to 1.3 mg./m^3. The use of cotton gauze treated with isopropyl alcohol is an excellent media for collecting GB vapor from expired air. The resistance offered against breathing is low and is not perceptible to man. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
CUMULATIVE TOXIC EFFECTS OF REPEATED DOSES OF INHALED GB VAPOR IN DOGS, by Paul Cresthull, Leslie Williams, and others. Apr 60, 20p. 11 refs. CWLR-2384. AD-236 945.
Order from LC mi$2.40, ph$3.30 PB 148 908

Dogs were given repeated exposures to GB vapor by inhalation for approximately 2 minutes in order to determine the cumulative toxic effects when exposures were daily or every other day. Doses averaging 10 to 13, 20, and 23 to 28 μg/kg per exposure were given. A detailed record of toxic signs and RBC-ChE effects resulting from each exposure was kept. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
EFFECTS OF 1-1'-TRIMETHYLENEBIS(4-FORMYLPYRIDINIUM BROMIDE) DIOXIME (EA 1814) ON ChE ACTIVITY AND NEUROMUSCULAR BLOCK IN RATS FOLLOWING POISONING WITH GB AND DFP, by Joseph H. Fleisher, Paul J. Killos and others. Apr 60, 24p. 23 refs. CWLR-2392.
Order from LC mi$2.70, ph$4.80 PB 148 910

Neuromuscular blockade following poisoning with DFP is rapidly antagonized by the bis-quaternary oxime, EA 1814, in vitro and in vivo. Concurrent study of the ChE activity of rat diaphragm following the addition of EA 1814 shows greater recovery of ChE activity of intact than of homogenized diaphragm muscle. No reactivation of brain ChE activity was found following EA 1814 treatment of GB poisoned rats, a result consistent with the apparent inability of quaternary compounds to penetrate the blood barrier, and the potentiating action of atropine on the chemotherapeutic effectiveness of EA 1814 demonstrated previously. (Author)

[Army] Chemical Warfare Labs., Army Chemical Center, Md.
INHIBITION OF RED BLOOD CELL CHOLINESTERASE AND RETENTION OF GB IN ANESTHETIZED DOGS EXPOSED TO GB VAPOR AT VARIOUS RATES OF PULMONARY VENTILATION, by Francis N. Marzulli, John F. Callahan, and Doris L. Steiner. Technical rept. 3 May 56, declassified 19 Aug 59, 25p. 10 refs. Chemical Warfare Labs. rept. no. 2020.
Order from LC mi$2.70, ph$4.80 PB 146 459

Anesthetized dogs, exposed in the laboratory to 4 to 10 μg. GB vapor/kg. by the oronasal route, retained 96 to 98% of the inhaled agent independent of ventilatory rate. Tracheal valves employed during the administration of the vapor served to eliminate mask dead space. In experiments involving a retained dose of 10 μg. GB/kg., RBC ChE (Red blood cell cholines terase) was significantly less inhibited where the ventilatory rate was increased 2-fold or greater. This effect was not found at a dose of only 4 μg. GB/kg. Both laboratory and field results demonstrated that the amount of intoxication is directly related to the minute volume at the time of the inhalation exposure. (Author)

[Army Chemical Warfare] Labs., Army Chemical Center, Md.
QUANTITATIVE PHYSIOLOGICAL STUDIES OF GB, by Francis N. Marzulli, Paul F. Robinson and others. Sep 51, declassified 28 Mar 58, 40p. 16 refs. Medical Labs. Research rept. no. 85.
Order from LC mi$3.00, ph$6.30 PB 146 548

In the first series of experiments, 17 anesthetized dogs were subjected to the inhalation of GB. Dosages from 0.2 to 37 micrograms (mmg.)/kg. were inhaled directly into the lower respiratory tract. The calculated retained GB varied from 27 to 97%, the average retention for all experiments being about 73%. In a second series of experiments, inhaled air was passed through one lumen, so that it contacted the animal at the bifurcation of the trachea. The animals retained 89 to 99% of the inhaled agent, the average retention for all members of the group being 95%. The Ct (Lethal index) values ranged from 48 to 121 mg. min./m^3. These dosages reduced the RBC-ChE (Red blood cell cholinesterase) to 15-84% of the initial value. In experiments involving 9 anesthetized dogs, gas-laden air, inhaled in the upper respiratory tract, was led through a by-pass from the trachea to a GB adsorber, back to the lower trachea and thence to the lungs. It was found that 95-100% of the inhaled GB, varying from 160 to 916 gamma, was retained by the upper respiratory tract. Dosages of GB up to about 3 mmg./kg. produced no fall in RBC-ChE when GB was injected or when it was inhaled.

Pfleiderer, Gerhard.
CHEMISTRY OF SNAKE VENOMS, by Gerhard Pfleiderer. Final technical status rept. for 1 Mar 59-29 Feb 60 on Contract DA 91-591-EUC-1089. [1960] 7p.
Order from LC mi$1.80, ph$1.80 PB 149 337

The investigations were concerned with the chemistry of the cobra and rattlesnake venoms in the following three specific research areas: (1) isolation and study of the cobra (Naja nivea) venom toxic peptides; (2) isolation of two phosphoric acid ester hydrolyzing enzymes from cobra venom and investigation of their biochemical and toxic properties; (3) separation of rattlesnake (Crotalus atrox) venom proteinases and determination of their specificities.

Radiobiology

Institute of Engineering Research, U. of California, Berkeley.
THE MEDICAL PROBLEM OF EXPOSURE TO EXTERNAL RADIATION IN A FALLOUT FIELD: THE CONCEPT OF PARTIAL EXPOSURE AND FRACTIONIZATION AND PROTRACTION OF DOSAGE COMPARED TO THE CONCEPT OF WHOLE BODY RADIATION AND ACUTE EXPOSURE, by Crawford F. Sams. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 30 June 59, 207p. 280 refs. Series no. 2, issue no. 24.
Order from LC mi$9.30, ph$31.80 PB 149 930

Analysis of the dosimetry factors indicate the need for a new method of computing dosage through integration of varying energy levels absorbed at more than one point within the body. Emphasis was given to the effect of energy absorption on the more highly specialized tissues in the body, such as the central nervous system and the endocrine glands. The application of external energy to these highly specialized tissue results in an initial accelerating effect through a change in dissociation constants. In the central nervous system this affects the rate at which the conversion of chemical into electrical energy occurs. In hormonal glands, which together with the central nervous system, control entire body metabolism, the rate of synthesis of hormones from substrates is correspondingly affected. In low dose exposures, it appears that the acceleration phase of the biologic response curve may not go into the depressive phase. A new list of the comparative radio-sensitivity of tissues responding functionally to radiation has been presented. The functional response of highly specialized tissues may account for the preventive effect of various substances injected prior to radiation and their subsequent non-effectiveness when injected during the depressive phase of the biologic response curve. Analysis of available data on partial exposures, and fractionation or protraction of dosage, indicate that in terms of lethality the order of magnitude of lethal dosages is increased by greater than a factor of 10.

Radiobiological Lab., U. of Texas, Austin.
THE EFFECT OF ACUTE DOSES OF NUCLEAR RADIATION ON THE PERIPHERAL BLOOD PICTURE OF THE MONKEY (MACACA MULATTA), by Thomas P. Leffingwell, George S. Melville, Jr. and Quentin L. Hartwig. Apr 60, 13p. 19 refs. AFSAM rept. 60-43.
Order from LC mi$2.40, ph$3.30 PB 149 244

Male Macaca mulatta monkeys were exposed to three different doses of combined neutron and gamma radiations which derived from an uncontrolled nuclear reaction. Changes which were observed in the peripheral blood picture may be attributed solely to the effects of the ionizing radiations to the 1 percent confidence limit.

Results, compared with those obtained by other investigators, show the hematologic effects of neutron-gamma exposure to be similar to those resulting from exposure to x-radiation. (Author)

Radiobiological Lab., U. of Texas, Austin.
EFFECTS OF RARE-EARTH NITRATE AND OXIDE ON IRRADIATED AND NONIRRADIATED RATS, by George S. Melville, Jr. and Robert W. Riess. June 60, 10p. 4 refs. AFSAM 60-26.
Order from LC mi$1.80, ph$1.80 PB 149 352

Two salts of a rare-earth mixture were given to rats both intraperitoneally and subcutaneously: In addition, certain of the groups so treated received 800 r of gamma rays regardless of route of administration of the chemical. With or without irradiation, rare-earth nitrate was more damaging to the animals than rare-earth oxide. Animals which received the more soluble nitrate deomonstrated diarrhea, anorexia, and "fluffing." These symptoms, which were not seen in the rare-earth oxide animals, subsided in approximately 7 days. When given subcutaneously, the nitrate caused abscesses which healded in 30 days and the oxide caused nodules which disappeared slowly. Mortality was higher in the irradiated groups of animals. (Author).

CHEMISTRY

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
LITHIUM HYDRIDE, by M. A. Hyla. 20 Feb 48, 27p. 20 refs. NEPA 425.
Order from LC mi$2.70, ph$4.80 PB 149 769

This report released for sale to the public 25 Aug 60.

Contents:
Property data
Fabrication data
Preparation
Analysis
Equilibrium studies with other elements and compounds
Structural studies and changes in properties under exposure to radiation
Nuclear data
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Analytical Chemistry

Fowles, G. W. A.
A STUDY OF THE CHEMICAL PROPERTIES OF THE COMPLEX NITROGEN, PHOSPHORUS, OXYGEN, AND SULPHUR COMPOUNDS OF THE TITANIUM, VANADIUM, AND CHROMIUM SUB-GROUP METALS, by G. W. A. Fowles and E. Cartmell. Annual Final technical rept. no. 2, 1 May 59-30 Apr 60, on Contract DA 91-591-EUC-1126, continuation of Contract DA 91-508-EUC-307. [1960] 21p.
Order from LC mi$2.70, ph$4.80 PB 149 423

The work is divided into two sections, one dealing with complexes of quinquevalent molybdenum, and the other with complexes of ter- and quadri-valent titanium. In each case the complexes are those prepared by reacting the halides of the metals with amines - usually aliphatic. Work is described on the reaction of molybdenum (V) chloride with tertiary amines (NR_3, with R = Me, and Et), with secondary amines (NHR_2, with R = Me, Et, and n-Pr), and with primary amines (NH_2R, with R = Me, Et, n-Pr, and n-Bu). The interaction of molybdenum (V) chloride with several aromatic amines, and oxygen and sulphur compounds is briefly reported. A number of complex oxychloro compounds of molybdenum (V) have been made. The reaction of titanium (IV) chloride with primary (NH_2R, R = Me, Et, and Pr^n), and secondary amines (NHR2, R = Me, and Et) and of titanium (IV) bromide with methylamine and dimethylamine are reported. (See also PB 143 110)

North Carolina U., Chapel Hill.
APPLICATIONS OF COMPLEMENTARY TRISTIMULUS COLORIMETRY, by Charles N. Reilley and Ellis M. Smith. UNC Technical rept. Chem. no. 5 on Contract AF 49(638)333. 9 May 60, 34p. 4 refs. AFOSR-TN-60-497; AD-240 176.
Order from LC mi$3.00, ph$6.30 PB 149 582

The principles of complementary tristimulus colorimetry have been extended in mathematical form to several problems of analytical interest. Colorimetric analysis of multicomponent mixtures is one possible application. While the analysis of a single component is trivial, the use of complementary tristimulus colorimetry in the case of two and three components with overlapping spectra is feasible. The technique has the advantage that more than the minimum number of wavelengths can easily be employed. While the tristimulus approach is limited to a maximum of three components, an analogous multi-stimulus approach can be used for a system containing more components more components. Other applications include calculation of the pK's of acids, and the formula and stability constant of complex ions. As an aid in computation, an inexpensive analog computer was built which permits calculation of chromaticity coordinates (by the weighted ordinate method at 10 selected wavelengths) in about 2 to 3 minutes. (Author)

Organic Chemistry

Fordham U., New York.
SYDNONES. III. PREPARATION AND INTERCONVERSATION OF MERCURATED DERIVATIVES OF N-(3-PYRIDYL)SYDNONE, by Jack M. Tien and L. Moyer Hunsberger. Rept. on Contract AF 18(603)127. 31 May 60, 19p. 33 refs. AFOSR-TN-60-583; AD-239 167.
Order from LC mi$2.40, ph$3.30 PB 148 877

Mercuration of N-(3-pyridyl)sydnone (II) has produced either the sydnone-mercuric chloride "adduct" (V), C-chloromercuri-N-(3-pyridyl)sydnone (VI), or C,C'-mercuri-bis-[N-(3-pyridyl)sydnone] (VII), depending on the reaction conditions. The adduct (V) has been converted to VI and to VII. Transformation of VI to VII was accomplished in pyridine solution at room temperature, while VII was converted to VI with excess mercuric chloride. All reactions proceeded in high yield. Sydnones undergo electrophilic substitution virtually as easily as thiophene. Objections to the tropone-like formulation (XI) of sydnones are presented. Preparation of N-(3-pyridyl)glycine hydrochloride via a Strecker-type reaction between 3-aminopyridine and glycolonitrile is more convenient than the earlier process and permits the preparation of large quantities of sydnone II. (Author)

Gates and Crellin Labs. of Chemistry, Calif. Inst. of Tech., Pasadena.
THE IONIZATION OF CITRIC ACID STUDIES BY THE NUCLEAR MAGNETIC RESONANCE TECHNIQUE, by A. Lowenstein and John D. Roberts. Technical rept. no. 5 on Contract Nonr-220(26). 1 Sep 59, 24p. 12 refs. AD-225 556.
Order from LC mi$2.70, ph$4.80 PB 148 860

The chemical shift of the methylene hydrogens in citric acid was measured as a function of the pH and the concentration of the solution. From these measurements it was possible to evaluate the chemical shifts associated with each ionization step in citric aicd. Measurements were also made of methylene resonance line positions for ionized and non-ionized methyl esters of citric acid. Analysis of the results indicates that the first and second ionizations of citric acid take place predominantly at the terminal carboxyl groups. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
THE MECHANISM OF THE REIMER-TIEMANN REACTION, by Jack Hine and James M. Van Der Veen. Technical rept. no. 4 on Contract Nonr-991(03). 6 May 59, 23p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 146 605

Chloroform reacts with aqueous sodium phenoxide only very slowly at 35°, but in the presence of sodium hydroxide it reacts rapidly to give ortho- and para-hydroxybenzaldehydes (the Reimer-Tiemann reaction). This observation shows that the Reimer-Tiemann reaction is not initiated by the nucleophilic attack of phenoxide ion on chloroform. The reaction instead appears to involve the reaction of chloroform with hydroxide ion to give dichloromethylene which then reacts with phenoxide ion. From the effect of sodium phenoxide concentration on the yields of aldehydes, the relative rate constant for the combination of dichloromethylene with the oxygen atom as well as the ortho and para carbon atoms of the phenoxide ion may be calculated (relative to the rate constant for combination with water). (Author)

Southampton U. (Gt. Brit.)
A STUDY OF THE EFFECT OF SUBSTITUENTS AND OF SOLVENT ON THE REACTIVITY OF THE NORMAL AND ABNORMAL POSITIONS OF UNSYMMETRICAL ORGANIC EPOXIDES, by R. E. Parker. Annual technical rept. for 1 May 59-30 Apr 60 on Contract DA 91-591-EUC-1127. 25 May 60, 13p. 16 refs; AD-238 719.
Order from LC mi$2.40, ph$3.30 PB 149 424

For the investigation of the effect of substituents on the reactivity of the normal and abnormal positions of unsymmetrical epoxides, a kinetic study has been made of the reactions of various m- and p- substituted styrene oxides with benzylamine in ethanol. For the investigation of the effect of the solvent on the reactivity of the normal and abnormal positions of unsymmetrical epoxides, the reaction between styrene oxide and benzylamine has so far been studied kinetically at three temperatures in methyl cyanide and methanol, and at one temperature in tert-amyl alcohol.

Washington, U., Seattle.
UNIMOLECULAR DECOMPOSITION OF CHEMICALLY ACTIVATED ETHYL-d_2 RADICALS FROM H ATOMS PLUS trans-ETHYLENE-d_2, by B. S. Rabinovitch, D. H. Dills and others. Technical rept. no. 3 on Contract Nonr-477(14). 15 Sep 59, 24p. 18 refs. AD-226 337.
Order from LC mi$2.70, ph$4.80 PB 148 859

Addition of H atoms to trans-ethylene-d_2 produces chemically activated ethyl-d_2 radicals. This choice of the reactant ethylene permits all subsequent secondary processes of the hot ethyl radicals to be counted. The system has been studied between -78° and 160°C, and in most detail at room temperature, as a function of ethylene pressure. Experimental details are similar to those given in previous work on butyl. The relative energy spread of the formed ethyl radicals is here effectively greater than that observed for butyl radical since the thermal spread is not superimposed upon a minimum excess above the critical energy, as was the case for butyl. Nevertheless, relative to high temperature thermal decompositions, the product ethyl radicals are comparatively mono-energetic, especially at the lowest temperature. The observed rate constant for decomposition k_a was evaluated from the amounts of stabilization vs decomposition by C-H rupture. The decomposition rate is compared with theoretical expressions. A very crude average isotopic rate ratio for transfer of H and D in the disproportionation of ethyl-d_2 radicals is 6:1 at 25°. (Author)

Physical Chemistry

Aircraft Propulsion Lab., U. of Michigan, Ann Arbor.
RECENT RESULTS OF STANDING DETONATION WAVES, by J. A. Nicholls and E. K. Dabora. Rept. on Contract AF 49(638)562. May 60, 32p. 19 refs. 2874-5-T; AFOSR-TN-60-441; AD-238 393.
Order from LC mi$3.00, ph$6.30 PB 148 528

The objective of this report is to present the aerodynamic and chemical criteria important to the establishment of standing detonation waves, and to present some recent experimental data. (Author)

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DEPOSITION OF A SINGLE CRYSTAL THIN FILM OF GERMANIUM ON ROCK-SALT BY EVAPORATION, by Donald J. Kay. Master's thesis. Sep 59, 50p. 26 refs. GE-59-B-#10; AD-228 288.
Order from LC mi$3.30, ph$7.80 PB 149 291

Thin films of germanium deposited by evaporation in a vacuum on a rock-salt substrate possess single crystal characteristics. Electron diffraction patterns obtained show this single crystal structure of the deposit. The (100) plane of rock-salt has a 0.355% degree of misfit to the (100) plane of germanium. This is within the 9% maximum misfit allowed for epitaxial growth. Temperature control of the rock-salt substrate is necessary to insure orientation and continuity of the film. Various forms and materials for an evaporation source were unsatisfactory because the molecular ray did not include the desired area for the deposition nor could the materials withstand the desired temperatures. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
MEASUREMENT OF LAMINAR FLAME SPEEDS OF ETHYLENE-AIR AND PROPANE-AIR MIXTURES BY THE DOUBLE KERNEL METHOD, by S. D. Raezer and H. L. Olsen. Rept. on Contract NOrd 7386. June 59, 23p. 8 refs. CM-951; AD-225 994.
Order from LC mi$2.70, ep$6.30 PB 150 324

A new method of measuring laminar flame speeds of combustible gas mixtures is described. Flame speeds thus obtained for a range of ethylene-air and propane-air mixtures were compared with those obtained by the flame-kernel technique. The results suggest that the calculated adiabatic flame temperatures may be higher than the actual values by as much as 15 per cent for both gas mixtures. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
MOLECULAR DIFFUSION STUDIES IN BINARY GAS SYSTEMS, by Ronald E. Walker (Doctoral thesis) and Arthur A. Westenberg. Rept. on Contract NOrd-7386. Aug 58, 62p. 43 refs. Bumblebee Series rept. no. 279; AD-227 550.
Order from LC mi$3.90, ph$10.80 PB 149 556

Experimental apparatus and technique for a new method of measuring the diffusion coefficients of gases are described and critically discussed. The method makes use of the steady injection of a trace gas from a fine, hypodermic tube (essentially a point source) into a slow, uniform, laminar stream of a second (carrier) gas. Measurements of the trace gas concentrations downstream permit the binary diffusion coefficient to be determined. Results of about ±1% precision over the temperature range 300-1150°K are presented for the systems He-N_2 and CO_2-N_2. These results are discussed in terms of intermolecular potential energies. The He-N_2 data, including extremes of concentration, can be satisfactorily represented by a purely repulsive potential. At their upper temperature limit, the data come within 150° of overlapping the range of validity for the diffusion coefficient predicted from the repulsive potential obtained by Amour et al. from molecular scattering experiments. A slight extrapolation indicates remarkable agreement between the types of experiments. A modified Buckingham (Exp-Six) potential is obtained which covers both the diffusion and scattering potentials. For CO_2-N_2, the data are fitted with a Lennard-Jones (6-12) potential. For both gas systems the predictions derived from viscosity parameters for the pure components and simple combining rules are quite unreliable at high temperatures. (Author)

Arizona State U., Tempe.
THERMOELECTRIC MATERIALS AND DEVICE RESEARCH, by B. R. Gossick and H. B. Whitehurst. Quarterly progress rept. no. 2, 18 Dec 59-17 Mar 60, on Contract DA 36-039-sc-85249. [1960] 11p. 5 refs. AD-236 106.
Order from LC mi$2.40, ph$3.30 PB 149 381

A description is presented of the methods which were developed for making and testing sintered pellets of polycrystalline rutile. The problems encountered in making these samples to contain dispersed metallic phases of colloidal dimensions are described together with the possible methods of overcoming these difficulties. A description of the device to measure thermoelectric power is included with a schematic diagram of the experimental apparatus now under construction. (Author) (See also PB 148 342)

Atlantic Research Corp., Alexandria, Va.
ELEMENTARY TREATMENT OF EXTINCTION OF A GASEOUS DIFFUSION FLAME, by Raymond Friedman. Rept. on Project Squid, Contract Nonr-1858(25). Feb 59, 16p. 6 refs. Technical rept. ARC-4-P.
Order from LC mi$2.40, ph$3.30 PB 146 543

A complete mathematical description is made of an extremely crude approximation of a flame which is nevertheless self-consistent and includes the features of finite reaction rate, diffusion coefficient, and heat transfer coefficient.

Boston U., Mass.
NONDEGRADATIVE REACTION OF "ACTIVE NITROGEN" WITH CONJUGATED DIENES, by Akira Tsukamoto and Norman N. Lichtin. Rept. on Contract AF 49(638)2. 3 June 60, 4p. 4 refs. AFOSR-TN-60-607. AD-239 940.
Order from LC mi$1.80, ph$1.80 PB 149 219

Brown U. Div. of Engineering, Providence, R. I.
FINAL REPORT, by J. Kestin. Technical rept. no. 13, 1 Oct 53-1 Oct 59, on Contract AF 18(600)891. Mar 60, 9p. AF 891/13; AFOSR-TR-60-53; AD-238 994.
Order from LC mi$1.80, ph$1.80 PB 148 819

A completely new analytic theory has been developed for the oscillating disk type viscometer. Two viscometers were designed and built in the laboratory. One was adapted for work at moderate pressures but room temperatures. The second instrument was adapted for work at elevated temperatures (up to 300°C). Measurements were made and reliable data were collected on the viscosity of about 15 gases and one system of mixtures (N_2-CO_2).

Cornell U., Ithaca, N. Y.
KINETICS OF REACTIONS IN SHOCK TUBES, by S. H. Bauer. Rept. on Research in Molecular Energy Exchange Processes, Contract AF 33(616)3839. Apr 60, 109p. 9 refs. WADD Technical rept. 60-107.
Order from OTS $2.50 PB 161 904

The objective of this research program was to measure the rates, study the mechanisms of the pyrolysis of gases at high temperatures, and to obtain experimental data on the efficiencies of energy transfer between molecules during collisions. The following papers are included: Intense Schumann-Runge source, pub. in J. Opt. Soc. Am., 49, 102 (1959); kinetics of the production of C_2 during the pyrolysis of ethylene; the equilibrium composition of the C/H system at elevated temperatures; a survey of the methods for the chemical analysis of transient species with mocrosecond resolution; and the rate of dissociation of cyanogen, estimation of the C-C bond dissociation energy.

Florida U. Engineering and Industrial Experiment Station, Gainesville, Fla.
FLUOROCARBON NF COMPOUNDS, by J. A. Young and R. D. Dresdner. Quarterly technical rept. no. 4 for 1 Apr-30 June 60, on Contract DA 01-009-ORD-772. [1960] 16p. 2 refs. ARPA Order no. 40-59, Task 3; [OOR rept. 007.4-C]
Order from LC mi$2.40, ph$3.30 PB 148 884

Nuclear magnetic resonance data are given for the compound previously obtained by CsF catalyzed addition of c-$C_5F_{10}NF$ to $CF_3CF{=}CF_2$. The product, obtained in good yield, was identified as perfluoro-N-methylpiperidine. No reaction was observed between NF_3 and SF_4 at 100-150° in a closed vessel or at 300 to 500° in a flow system. It was found, however, that NF_3 and SF_4 form a solid addition compound at low temperatures. Thermal decomposition of the mercury derivative of N,N'-bis(trifluoroacetyl) hydrazine under vacuum at 350-400° gives a product very tentatively identified as a substituted oxadiazolone. Formation of N-F compounds by cleavage of acyl groups from nitrogen has been extended to perfluorodimethylacetamide. As usual, both the fluoroamine and the coupled product are found. Fluorination of N-bromoperfluoroglutarimide gives a fairly stable silver fluoride complex, which may then react further to give $FCO(CF_2)_3NCO$. Evidence is given regarding the identification of the rearrangement product of the bromoimide as the ω - bromoacyl isocyanate, $Br(CF_2)_3CONCO$. (Author) (See also PB 147 006)

Gas Dynamics Lab., Northwestern U., Evanston, Ill.
THE KINETICS OF GASES, by Thomas P. Anderson, Richard F. Hoglund and Ali Bulent Cambel, eds. Rept. on Contract AF 40(600)748. July 60, 156p. 135 refs. AEDC-TN-60-130.
Order from OTS $3.00 PB 161 908

The fundamental features of real gas effects are reviewed with emphasis on high temperature effects. Topics considered include the thermal and caloric equations of state, basic effects in flow processes, and the speed of sound in reacting gases. The kinetics of the processes of dissociation and recombination and ionization and charge neutralization are discussed along with some applications. Analyses are presented describing chemical non-equilibrium effects in some flow situations, among them inviscid flow after sudden changes in fluid properties and the mixing of parallel streams. (Author)

George Washington U., Washington, D. C.
THE REACTION BETWEEN METALLIC POTASSIUM AND CARBON MONOXIDE I. PRECURSERS OF POTASSIUM SALT OF HEXA-HYDROXYBENZENE, by W. F. Sager, Alexander Fatiadi and others. Rept. on Contract AF 49(638)325. 5 July 60, 16p. 9 refs. AFOSR-TN-60-653; AD-239 216.
Order from LC mi$2.40, ph$3.30 PB 148 881

Measurement of heats of fusion, melting points and magnetic susceptibilities have been made on potassium-carbon monoxide reaction products of various compositions. These measurements indicate consecutive formation of two intermediate reaction products of empirical formulae $K_3C_2O_2$ and KCO which form prior to the reported final product which is the potassium salt of hexahydroxybenzene. (Author)

Louisiana State U., Baton Rouge.
DOUBLE LAYER STRUCTURE AND ELECTRODE PROCESSES WITH A PRECEDING CHEMICAL REACTION, by Hiroaki Matsuda. Technical rept. no. 36 on Contract Nonr-300(00). July 59, 16p. 11 refs. AD-225 752.
Order from LC mi$2.40, ph$3.30 PB 148 730

An analysis is made of the influence of the double layer structure on electrode processes with a pseudo-first order preceding chemical reaction in which a non-reducible (non-oxidizable) substance (Y) is transformed into a reducible (oxidizable) one (O) in presence of a large excess of another reactant (X).

Louisiana State U., Baton Rouge.
DOUBLE LAYER STRUCTURE AND RELAXATION METHODS FOR FAST ELECTRODE PROCESSES: THE DOUBLE PULSE GALVANOSTATIC METHOD, by Hiroaki Matsuda and Paul Delahay. Technical rept. no. 35 on Contract Nonr-300(00). July 59, 20p. 13 refs. AD-225 751.
Order from LC mi$2.40, ph$3.30 PB 148 731

An equation is derived for the overvoltage-time characteristic in the double pulse galvanostatic method, the structure of the double layer being considered in the boundary value problem. Abnormally high transfer coefficients recently reported by other investigators are interpreted. A detailed mathematical analysis is given.

Louisiana State U., Baton Rouge.
INFLUENCE OF REACTANT ADSORPTION IN TRANSIENTS METHODS FOR FAST ELECTRODE PROCESSES, by Hiroaki Matsuda and Paul Delahay. Technical rept. no. 39 on Contract Nonr-300(00). Oct 59, 23p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 149 477

The effect of adsorption of the discharged species is considered in galvanostatic and potentiostatic methods, the reaction products being not adsorbed. It is shown that extrapolation methods for the determination of exchange current densities still apply but that the slopes of the resulting linear plots differ from their values in the absence of adsorption. Exchange current densities obtained by such extrapolation methods are formal quantities which depend on adsorption charac-

teristics. Separation of the adsorption terms appears quite difficult. The following results are derived for application of the extrapolation methods: equation of potential-time curves in the single pulse galvanostatic method; equation for the potential at the end t_1 of the first pulse for potential-time curves with a horizontal tangent at t_1 in the double pulse galvanostatic method; and equation of current-time curves in the potentiostatic method. (Author)

Louvain U. (Belgium).
EXPERIMENTAL INVESTIGATION ON THE KINETICS OF FLAME INHIBITION, by A. Van Tiggelen. Final technical rept. no. 2, 1 Mar 59-29 Feb 60, on Contract DA 91-591-EUC-1072. Mar 60, 45p. 17 refs. AD-234 395.
Order from LC mi$3.30, ph$7.80 PB 147 254

The influence of Cl in H-O flames: Small amounts of Cl inhibited H-O flames more efficiently than conventional diluents such as N, but larger amounts accelerated the flame in rich mixtures. Almost no inhibition was observed when the composition corresponded to the mixing of two separate binary flammable mixtures (one of which contained Cl and H) which had compositions corresponding to the maximum burning velocity. The results were too erratic to allow definite conclusions to be drawn. Inhibition effects in ethylene-vinyl chloride-O flames: Small inhibition was observed. A continuous change occurred in the activation energy of the branching process passing from a pure ethylene to a pure vinyl chloride flame. Comparative study of ionization in ethylene and vinyl chloride flames: The total concentration of ions in both flames was nearly the same at a flame temperature of about 2500°K. At lower temperatures, ethylene flames contained more ions, while the vinyl chloride flame was more completely ionized at higher temperatures. Analysis of the flames by mass spectroscopy revealed HO_1^+ and $H_3O_2^+$ ions in the vinyl chloride flames, which were not present in the ethylene flames. This indicated a change in the reaction mechanism caused by the Cl. A new method is described for the determination of flammability limits which is based on the appearance of a stronger ionization in the premixed flames as compared to the diffusion flames.

Michigan U. Research Inst., Ann Arbor.
STABILIZATION OF GASEOUS DETONATION WAVES WITH EMPHASIS ON THE IGNITION TIME DELAY ZONE, by J. A. Nicholls. Technical note on Contract AF 49(638)562. June 60, 167p. 46 refs. 2874-6-T; AFOSR-TN-60-442; AD-240 064.
Order from LC mi$7.80, ph$25.80 PB 149 305

The characteristics of gaseous detonation waves are considered insofar as they influence the dynamic conditions that must be met in order to generate a standing gaseous detonation wave. Experiments are described werein stationary shock wave-combustion configurations were realized. A theoretical analysis of the ignition delay zone of hydrogen-oxygen combustion is presented. The main results of this study are: (1) standing detonation waves have been successfully generated; such waves offer many advantages to the study of combustion processes and represent a possible mode of combustion in hypersonic ramjets; (2) a new experimental technique for the study of ignition time delays of gaseous mixtures at high temperatures has evolved; other applications to chemical kinetic problems are possible; (3) a theoretical prediction of ignition time delay of hydrogen-oxygen mixtures is presented which is consistent with the experimental results of this investigation as well as those of other investigations.

Midwest Research Inst., Kansas City, Mo.
THERMAL PROPERTIES OF METHYL BORATE, by C. E. Hansen and R. L. Hughes. Rept. on Project Zip, Callery Chemical Co. Contract NOa(s) 58-454-d. 2 Feb 59, 48p. 11 refs. CCC-454-TR-303.
Order from LC mi$3.30, ph$7.80 PB 150 307

This report released for sale to the public 19 Sep 60.

This report is a continuation of the physical properties program for methyl borate. Pressure-temperature-enthalpy data are presented here, together with the Joule-Thomson effect and the heat of vaporization. Thermodynamic charts and tables have been prepared from the experimental data, and these data have been extrapolated over regions not covered experimentally. (Author)

Midwest Research Inst., Kansas City, Mo.
VAPOR PRESSURE AND CRITICAL CONSTANTS OF METHYL BORATE, by R. L. Hughes, A. R. Pittaway, and F. T. King. Rept. on Project Zip, Callery Chemical Co. Contract NOa(s) 58-454-d. 27 Mar 59, 16p. 3 refs. CCC-454-TR-307; AD-220 684.
Order from LC mi$2.40, ph$3.30 PB 150 308

This report released for sale to the public 19 Sep 60.

The vapor pressure versus temperature for methyl borate was measured from the normal boiling point to the critical point. The critical temperature was observed to be 229°C ± 0.5°C, and the critical pressure 502 psia (34 atmospheres). Log $P_{(mm.Hg)}$ vs. reciprocal temperature fits the equation:

$$\log P_{(mm.Hg)} = 7.6949 - \frac{1648.8}{T^{\circ}C}$$

The compressibility data of methyl borate were calculated from a modification of the generalized Beattie-Bridgemann equation of state. (Author)

National Bureau of Standards, Washington, D. C.
RAPID DETERMINATION OF THE ORDER OF CHEMICAL REACTIONS FROM TIME-RATIO TABLES, by Joseph H. Flynn. Aug 60, 23p. 7 refs. Technical note 62.
Order from OTS $0.75 PB 161 563

A table of ratios of reaction times corresponding to 15%/5%, 20%/10%, ..., 95%/85% reaction for orders of chemical reaction from -10 to +10 is presented. Use of this table allows the rapid calculation of the order of chemical reactions that are kinetically simple and involves only one subjective step. Methods are discussed for interpreting deviations from constant order resulting from errors in the initial times and concentrations, from errors in stoichiometry, and from the reaction following a more complicated rate expression. (Author)

Pennsalt Chemicals Corp., Wyndmoor, Pa.
AN INVESTIGATION OF CERTAIN THIOARSENATES, THIOANTIMONATES, THIOTUNGSTATES AND THIOMOLYBDATES, by Clair W. Graver and R. P. Block. Technical rept. no. 8 on Contract Nonr-2687(00). 1 Sep 59, 11p. 8 refs. AD-227 025.
Order from LC mi$2.40, ph$3.30 PB 148 865

Compounds with the composition $MM'S_4$, in which M and M' are As(III) and As(V), Sb(III) and As(V), Fe(III) and Sb(V), As(III) and Sb(V), Sb(III) and Sb(V), Pb(II) and Mo(VI), Zn(II) and Mo(VI), Ni(II) and Mo(VI), and Cu(II) and Mo(VI), have been prepared. Attempts to make $FeAsS_4$ and $ZnWS_4$, however, were unsuccessful. Thermal treatment alone or thermal treatment under pressure did not produce elastomeric plaques and in some cases led to decomposition. The compounds made, although undoubtedly polymeric, are not good prospects for elastomers. (Author)

Purdue U., Lafayette, Ind.
DISSOCIATION CONSTANTS OF THE ACID SALTS OF ETHYLENEDIAMETETRAACETIC ACID, by D. C. Olson and D. W. Margerum. Rept. on Contract AF 49(638)60. [1960] 14p. 11 refs. AFOSR-TN-60-603.
Order from LC mi$2.40, ph$3.30 PB 149 225

The fully protonated salt of EDTA, H_6YCl_2, is prepared. Its dissociation constants at 25.0° and an ionic strength of 2.0 are $K_{H_6Y^{++}} = 0.55$ and $K_{H_5Y^{+}} = 0.11$. The betaine structure for H_4Y is consistent with these and the other EDTA constants, while the constants do not fit the proposed tetra acetic acid structure for H_4Y. (Author)

Rome U. (Italy).
PRODUCTION OF DYE FREE ANODIC ALUMINUM COATINGS WITH THE USE OF ALTERNATING CURRENT. Rept. for 15 Feb 59-30 Apr 60 on Contract DA 91-591-EUC-1073. [1960] 14p.
Order from LC mi$2.40, ph$3.30 PB 149 426

The main object of this research has been the preparation of aluminum blacks by means of a circuit having a pre-established initial polarization with its different variants. The investigation aimed at studying the dependence of the degree of blackening of the aluminum blacks upon the following parameters: (1) pre-established initial polarization under variable initial current density; (2) initial current density variableness of the electrode upon which a deposit of the aluminum black type should form (owing to the variation of the electrode area ratio); (3) duration of an initial pulsing voltage of polarization equalling the initial polarization normally employed and followed by an alternating voltage after some cycles; (4) amplitude control of the peak voltages of the positive and negative half cycles; (5) aluminum quality; (6) chromic acid quality; (7) chromic acid contents of the bath at an approximately constant initial current density; and (8) sulphuric acid content of the bath.

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE MEASUREMENT OF THE VAPOR PRESSURE OF ATOMIC SPECIES FROM SPECTROMETRIC MEASUREMENTS OF THE ABSORPTION OF THE RESONANCE LINE. III. THE THERMODYNAMICS OF VAPORIZATION OF SODIUM FROM SODIUM SILICATE GLASSES, by G. L. Vidale. Rept. on Contract AF 04(647)269. June 60, 37p. 19 refs. Technical Information Series R60SD390.
Order from LC mi$3.00, ph$6.30 PB 148 764

The equilibrium constant of the reaction $Na_2O \cdot SiO_2(s, sol) = 2Na(g) + 1/2\ O_2(g) + SiO_2(sol)$ has been determined for sodium orthosilicate and for four glasses containing a molar excess of SiO_2. The vapor pressure of sodium atoms has been determined by absorption spectrophotometric measurements on the sodium 5890 Å resonance line. The results obtained are compared with other thermodynamic data avaliable for this system and are found to be consistent with them. The value of $P_{Na}\,P_{O_2}^{1/4}$ is given from 1200 to 2000°K for four glass compositions having a molar ratio of SiO_2 to Na_2O varying from 1.69:1 to 3.88:1. (Author)

Western Reserve U., Cleveland, Ohio.
BORON-NITROGEN COMPOUNDS, by Charles A. Brown and Lewis J. Schupp. Terminal rept. for Aug 52-June 54 on [Subcontract to Contract NOas-52-1023c] Aug 54, 36p. 9 refs. Technical research rept. MCC-1023-TR-65.
Order from LC mi$3.00, ph$6.30 PB 150 295

This report released for sale to the public 19 Sep 60.

The behavior of boron trifluoride and boron trichloride as Lewis type acids is demonstrated further by the formation of the addition compounds acetamide-BF_3, urea-BF_3, and urea-BCl_3. The low thermal stability of urea-BCl_3 compared to urea-BF_3 is due primarily to the ease with which hydrogen chloride is formed as a decomposition product as condensation occurs. The thermal decomposition of urea-BF_3 does not produce hydrogen fluoride, and the formation of boron-nitrogen polymers from this or similar substances does not appear to be promising. The phenylenediamines react readily with boron trichloride. In view of the ease with which hydrogen chloride is evolved from these adducts, the formation of new substances containing boron-nitrogen bonds appears to be possible.

EARTH SCIENCES

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
THE CRYOCONITE OF THE THULE AREA, by R. W. Gerdel and Francis Drouet. Nov 58, 20p. 6 refs. Research rept. 50; AD-217 599.
Order from LC mi$2.40, ph$3.30 PB 147 183

This report is also included in PB 146 026.

Allied Research Associates, Inc., Boston, Mass.
AN INTERPRETIVE CODE FOR THE WEATHER RADAR, by Roland J. Boucher. Scientific rept. no. 6 on Contract AF 19(604)5204. 10 Feb 60, 26p. 7 refs. AFCRC-TN-60-451.
Order from LC mi$2.70, ph$4.80 PB 149 152

An alpha-numerical code consisting of three basic six-letter-digit groups and two supplemental groups is described. The code is an operational one designed to supply the synoptic meteorologist with significant information on the immediate state of that portion of the synoptic situation within range of the radar. The code omits transitory details of echo configuration but gives general areas where echoes are found and a measure of their density. Stress is laid on the over-all echo character such as the texture on the PPI and the structure on the RHI, since these features relate to the dynamic processes. Two supplemental groups provide a means of transmitting accurate positions of squall lines and the position of the hurricane eye, as well as the speed and direction of movement of these important phenomena. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
BALLOON ASCENT RATE, LAPSE RATE, AND WIND CORRELATION, by J. T. Kurman and M. B. Sharenow. 20 Apr 59, 9p. USASRDL Technical rept. 2023; AD-220 786.
Order from LC mi$1.80, ph$1.80 PB 147 564

This report covers work completed in an effort to determine whether a correlation exists between balloon-ascent rate and the factors of lapse rate, winds speed, and wind direction. Balloon tests made and evaluation methods used are described. Further, an attempt was made to discover a possible relation between the passage of certain types of cold fronts and an increase in average ascent rate of a balloon. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
BALLOON BEHAVIOR EXPERIMENTS, by Gwendolyn L. Killen. 15 Jan 60, 29p. USASRDL Technical rept. 2093. AD-237 033.
Order from LC mi$2.70, ph$4.80 PB 148 539

A study was made of the balloon as a device for wind measurement. Experiments were conducted in which the trajectories of meteorological balloons were tracked when released in still air inside a closed building. It was found that the balloons developed aerodynamic lift forces which caused them to develop considerable horizontal components of velocity, and that these velocities varied with the amount and location of ballast below the balloon. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
AN IMPROVED VERSION OF A SIMPLE THUNDERSTORM WARNING DEVICE, by Joseph J. Krieg. 30 Mar 60, 14p. 3 refs. USASRDL Technical rept. 2105.
Order from LC mi$2.40, ph$3.30 PB 148 542

The device is based on the fact that the amplitude of the radiation component of the electric field associated with a lightning stroke decreases at a rate of 1/r. Sample results are discussed. (Author)

Cloud Physics Lab., U. of Chicago, Ill.
CLOUD REFRACTIVE INDEX STUDIES. PART III, by Edward L. Harrington. Final rept. on Contract AF 19(604)1931. 2 May 60, 101p. 4 refs. Cloud Physics Lab. Technical note no. 21; [AFCRC] TR-60-266.
Order from LC mi$5.70, ph$16.80 PB 149 310

Statistical analysis of refractive index gradients has been applied to some measurements made in the subcloud layers at altitudes from 1,000 ft to 3,000 ft over the Caribbean Sea. The data were arranged in bivariate frequency tables of ΔN versus ΔS and tests were made to determine if these distributions changed with respect to altitude and horizontal location, and to see if the distributions representing cloud air were different from the clear-air distributions. The distributions of ΔN show that over ninety per cent of the values are less than one N unit, reflecting the high humidity encountered at these altitudes. Autocorrelograms of three low-altitude passes are inconclusive because lag sizes were too large to detect the gradient activity and the records were too short for meso-scale variation to be verified. The integrated refractive index change along the aircraft flight path in cloud has been computed for a number of clouds from both the subtropical oceans and the continental United States. Gross refractive index measurements have been made on additional cloud samples. (See also PB 137 910)

Electrical Engineering Research Lab., U. of Texas, Austin.
RESEARCH DIRECTED TOWARD THE STUDY AND APPLICATION OF DIGITAL DATA-PROCESSING METHODS TO THE PROBLEM OF SENSING AND RECORDING METEOROLOGICAL VARIABLES AT VARIOUS LEVELS ON AN EXISTING 1400-FOOT TOWER, by W. S. Mitcham and J. R. Gerhardt. Final rept. on Contract AF 19(604)3498. 30 Apr 60, 19p. GRD-TR-60-283.
Order from LC mi$2.40, ph$3.30 PB 149 442

This report gives a broad survey of the operating, design and data utilization features of the meteorological tower system.

Free U. of Berlin (Germany).
WIND AND DENSITY DISTRIBUTION IN THE FREE ATMOSPHERE. Final technical rept. for 15 Apr 59-15 Apr 60 on Contract DA 91-591-EUC-1124. [1960] 13p; AD-238 746.
Order from LC mi$2.40, ph$3.30 PB 149 432

Complete basic data were compiled for a climatological study of the free atmosphere over several European areas. The available data were checked according to scientific principles, errors were corrected and missing reports supplemented as far as possible. The available sources of data are of different quality: original recordings and evaluations of soundings are first-

ranking; such records could only be secured from Berlin-Tempelhof. Publications based on original sounding records also give good data. Other sources, however, which are mainly a collection of data as received by radio or teletype facilities, are subject to a variety of errors, among which those arising with communication and printing are the most frequent. Since there is always a deadline to be met, these sources contain all kinds of other errors in addition. Thus, a careful checking is unavoidable. Even the official weather maps have often to be completed in a limited time and quite frequently with incomplete data coverage. A subsequent checking, therefore, with enough time given the employ all corresponding scientific principles, would result in a considerable improvement of the basic data.

Hawaii Inst. of Geophysics [Honolulu]
TROPICAL METEOROLOGY: RESEARCH AND TEACHING, by C. S. Ramage. Final rept. for 16 Aug 56-15 Mar 60 on Contract AF 19(604)1942. May 60, 30p. 21 refs. AFCRC-TR-60-249.
Order from LC mi$2.70, ph$4.80 PB 149 082

Investigations were made into problems of evapotranspiration, typhoon development and movement, geostrophic winds, analysis of wind-weather relationships, forecasting of upper winds, and the compilation of a most extensive Pacific and Far East synoptic data file. Classes in Advanced Tropical Meteorology were attended by experienced U. S. Government and SEATO meteorologists.

Ionosphere Research Lab., Pennsylvania State U., University Park.
IONOSPHERIC ELECTRON DENSITIES FOR WASHINGTON D. C., PANAMA, TALARA, AND HUANCAYO FOR OCTOBER-NOVEMBER-DECEMBER, 1958, by E. R. Schmerling. Scientific rept. no. 136 on Ionospheric Research, Contract AF 19(604)3875. 1 Aug 60, 262p. 3 refs. GRD-TN-60-497.
Order from LC mi$11.10, ph$41.10 PB 149 790

See also PB 142 411

Lees, Sidney, Cambridge, Mass.
STUDY ON WIND SHEAR MEASUREMENTS, by Sidney Lees. Final rept. for 1 Apr 57-30 Apr 58 on Contract DA 36-039-sc-73204. 31 May 58, 140p. 5 refs. AD-203 442.
Order from LC mi$6.90, ph$21.30 PB 149 409

The first chapter is a statement of the concepts and limitations of wind shear measurement in the atmosphere. The range of wind shear is estimated to be 0.001 to 0.1 inverse seconds. The uncertainty of wind shear measuring systems should be no greater than 0.001 inverse seconds. The second chapter reviews the work included in previous reports. The wind shear probe is described in Chapter 3. A program for developing the wind shear probe is given in Chapter 4. Various aspects of the theory are presented in Chapters 5, 6, 8, 9 and 10. Multiple airborne vehicle systems are discussed in Chapters 7, 12, and 13. A theory has been developed based on second differences that offers the possibility of measuring the change in displacement between two targets. The information can be obtained directly in Cartesian coordinates, so that all nine components of the velocity variation matrix can be computed. A program is presented in Chapter 7 for further work in this area.

MacDonald Physics Lab., McGill U. (Canada).
THE QUANTITATIVE DISPLAY OF RADAR WEATHER PATTERNS ON A SCALE OF GREY, by T. H. Legg. Doctoral thesis. Rept. on Contract AF 19(604)6617. June 60, 117p. 28 refs. Stormy Weather Group Scientific rept. no. MW-31; AFCRC-TN-60-466.
Order from LC mi$6.00, ph$18.30 PB 149 167

At 100 miles range, radar can detect variations of 10^4 in rainfall intensity; the signals cover 64 db in power of which many radars can display less than 16 db at a time. Equipment has been designed and studied which displays successive factors of signal power, corrected in a known way for distance, as equally discernable steps of grey. One gain control adjusts the factors to display at a given time all or a chosen fraction of the 64 db. The control is inserted between a logarithmic receiver and an exponential amplifier. Photographs of a radar screen, corrected optically to improve uniformity, have enough contrast for seven grey steps. A test pattern appears in each picture (Author)

McGill U. (Canada).
TEMPERATURE AND WIND FREQUENCY TABLES FOR EURASIA. VOL. 2. APRIL-JUNE, by J. N. Rayner. Rept. on Contract DA 19-129-qm-1447. May 60, 209p. Arctic Meteorology Research Group Pub. in Meteorology no. 20.
Order from LC mi$9.30, ph$31.80 PB 148 325

See also PB 148 324

Stanford Research Inst., Menlo Park, Calif.
CLOUD SHIELD AND RADAR PRECIPITATION ECHO RELATIONSHIPS WITH SATELLITE APPLICATIONS, by F. L. Ludwig and R. E. Nagle. Scientific rept. no. 1 on Contract AF 19(604)5982. Apr 60, 106p. 6 refs. AFCRC-TN-60-478.
Order from LC mi$5.70, ph$16.80 PB 149 791

Fifteen mid-United States composite radarscope pictures are presented showing radar precipitation echoes, frontal positions, and total cloud cover. These are accompanied by analyses of the low, middle, and high cloud shields. Thirteen other composites from West Coast and Picket Ship pictures are presented in an Appendix. These latter are without cloud analyses. Three strip composites using radarscope pictures, taken during aircraft reconnaissance flights over the eastern Pacific, are included with their corresponding cloud and frontal analyses. The fifteen cloud-analyzed continental composites and the reconnaissance composites are discussed in the text with respect to the cloud-precipitation relationships. The probable character of satellite photographs is discussed. Characteristics of the cloud patterns which seem, from the composite analyses, to be associated with precipitation or storm systems are discussed in terms of the likelihood that they could be discerned from satellite photographs. (Author)

Texas A. and M. Coll., College Station.
FORECASTING MICROMETEOROLOGICAL VARIABLES, by Guy A. Franceschini. Final rept. on Contract AF 19(604)2250. Dec 59, 73p. 4 refs. Reference 59-9F; AFCRC-TR-60-225.
Order from LC mi$4.50, ph$12.30 PB 149 010

An objective evaluation was conducted on the utility of a specialized analogue for micrometeorology. Values of parameters simulated by the computer are compared with values observed. Parameters of concern were: air temperature at a height equal to the roughness parameter (z_0); air temperature at 2 m; temperature difference between 1/2 m and 4 m; wind speed at 2 m; vapor pressure at 2 m; and relative humidity at 2 m. Results are shown in graphs of simulated and observed values as a function of time, and tables of statistical parameters of the verification. Comparisons were made for five (5) different periods involving four (4) locations. The locations, all in Texas, represented appreciably different surfaces. Meteorological conditions were varied and included the following air mass types: arctic, maritime polar, continental polar and maritime tropical. A brief description of each site with a summary of its attendant meteorological conditions is given. (Author)

Texas A. and M. Coll., College Station.
MICROMETEOROLOGICAL OBSERVATIONS OVER NON-IDEAL SURFACES, by Guy A. Franceschini. Scientific rept. no. 1 on Contract AF 19(604)2250. Dec 59, 197p. 1 ref. Reference 59-6S; AFCRC-TN-60-254.
Order from LC mi$8.70, ph$30.30 PB 149 009

The measurements reported herein were made primarily for the purpose of furnishing a basis for the evaluation of an analogue computer designed to simulate certain micrometeorological parameters in the "surface layer" of the atmosphere. A secondary purpose for making the observations was to furnish data on conditions over micrometeorologically non-ideal surfaces. (Author)

Woods Hole Oceanographic Institution, Mass.
MARINE METEOROLOGY: CLOUD AND ENVIRONMENT VERTICAL VELOCITIES, TEMPERATURES, HUMIDITIES AND WATER CONTENTS ASSOCIATEL WITH A SHEAR ZONE IN THE TRADE WINDS, by Andrew F. Bunker. Technical rept. no. 44 on Contract Nonr-1721(00). Sep 59, 34p. 18 refs. Reference no. 59-42; AD-226 030.
Order from LC mi$3.00, ph$6.30 PB 148 892

Airplane measurements of turbulent and convective vertical velocities of gusts with sizes from 60 to 6000 m were made during a 160 km flight through a clear area and a cloudy shear zone at a level about 50 m above cloud base. During the straight, level flight, 19 parcels, identified as cumulus clouds, were penetrated. These parcels were cooler than both the shear zone air and the clear air. Some clouds were observed with only downdrafts while others were observed with internal ascending parcels warmer than the cloud air. These and other characteristics substantiate the concept of one type of cumulus cloud as a semi-permanent mass of inactive air with occasional bubbles of buoyant air. The environment is nearly as turbulent as the cloudy air and contains extensive regions of updrafts and downdrafts. An east-west shear zone at 10°N was established by the penetration of a cold front into the North Atlantic Ocean trade winds. North of the shear line, the air was diverging, subsiding, and forming an oval area about 100 by 200 km which was free of cumulus clouds. The southern boundary of this area was defined by cumulus clouds building up to 2 km. From ship reports of wind velocity, the air in the clear area was found to be subsiding several tenths cm sec^{-1} while the air of the southern wall was ascending faster than 1 cm sec^{-1}. The divergence pattern in this area is found to be an extension of a larger pattern covering a part of the North Atlantic Ocean. (Author)

Frost Science

American Geographical Society; New York.
RECENT GLACIER VARIATIONS IN SOUTHERN SOUTH AMERICA, by Donald B. Lawrence and Elizabeth G. Lawrence. Technical rept. on American Geographical Society Southern Chile Expedition, 1959, Contract Nonr-641(04). Sep 59, 52p. 37 refs. AD-227 124.
Order from LC mi$3.60, ph$9.30 PB 148 893

Contents:
Glacier Fitz Roy
Glacier San Rafael
The historical evidence of glacier variation
The topographic and biologic evidence
Tree ring studies
Development of vegetation following recession of glaciers
Glacier Del Rio Manso
Comparison with Ameghino glacier, Argentina

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
EXPERIMENTAL STUDY OF FROST HEAVING, by Akira Higashi. Rept. on Dynamics of Frost Heaving. Aug 58, 24p. 6 refs. Research rept. 45; AD-214 672.
Order from LC mi$2.70, ph$4.80 PB 147 353

Laboratory studies on the effects of the soil-temperature regime on the type of ice segregation and the rate of frost heaving are described in detail, and the results are analyzed quantitatively on the basis of thermodynamic and hydraulic theory, assuming that suction is created by ice formation. The heaving rate varied with the type of ice segregation, which in turn depended on the rate of frost penetration. Ice-filament layers or sirloin-type freezing were observed at low penetration rates and concrete-type freezing at high penetration rates. The heaving rate decreased with increasing frost-penetration rate, and varied, in the case of filament-type freezing, according to the amount of sensible heat lost at the freezing interface. The sensible heat loss was 0.62 cal/cm-sec in the case of maximum heaving (7 mm/day); higher values resulted in thermal conditions favoring sirloin-type freezing. The moisture content of frozen soil was found to be related to the heaving ratio, inasmuch as the amount of heaving is attributed to the amount of segregated ice. (Author)

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
THE FLOW LAW FOR ICE, by T. R. Butkovich and J. K. Landauer. Rept. on Mechanics of Plastic Deformation on Ice, Aug 59, 11p. 18 refs. Research rept. 56; AD-235 263.
Order from LC mi$2.40, ph$3.30 PB 149 131

The results of laboratory creep tests in a shear apparatus at ±5°C on 2 x 2 x 3/8 in. samples of commercial ice, artificial single crystals, and 6 types of ice from the Greenland Ice Cap, at shear stresses of about 0.5 - 3 kg/cm^2 are reported. Some uniaxial tests were made at stresses from 6 - 28 kg/cm^2 to supplement the shear tests. Creep data could usually be represented approximately by one or more linear sections on a log-deformation vs log-time plot. The linear sections of the double logarithmic curve imply a creep curve of the form $\epsilon = ct^m$, where ϵ is the strain. For all samples tested, except single crystals sheared in easy glide, m averaged 0.5 for shear deformations up to about 1% and approached unity for more deformation. For single ice crystals oriented for easy glide, m averaged 1.7, implying a strain softening. Single crystals oriented for hard glide behaved similarly to polycrystals, indicating a rate-controlling process such as dislocation climb. For all but single easy-glide crystals, the minimum creep rate was tangent to the deformation curve at the end of the experiment. Creep rates for single easy-glide crystals were several hundred times larger than for the other crystals, the flow laws being similar. (Author)

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF ICE. PART I. GEOMETRY OF DEFORMATION, by Ukichiro Nakaya. Rept. on Thickness and Strength of Ice Surface Layers. Oct 58, 94p. 19 refs. Research rept. 28; AD-216 992.
Order from LC mi$5.40, ph$15.30 PB 147 352

Bending tests were performed on nearly 300 rectangular bars of glacier ice cut from large single crystals (up to 16 in.) at varying orientations, and deformation was studied through measurements of vertical displacement of a median loaded wedge by means of a screw micrometer. The phenomena observed can be explained by assuming that: single crystals of ice have a layer structure stacked in the direction of the optic axis; plasticity is due to gliding between these elementary layers; a small-angle boundary is likely to occur at the point of intense stress concentration and the elementary layer is flexible but not stretchable.

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
ON THE MECHANICAL PROPERTIES OF SEA, ICE THULE, GREENLAND, 1957, by T. R. Butkovich. Aug 59, 27p. 6 refs. Research rept. 54; AD-235 872.
Order from LC mi$2.70, ph$4.80 PB 149 130

The investigations on sea ice, conducted at Thule, Greenland, during February and March 1957 included: unconfined compressive strength, ring tensile strength, and flexural strength tests on simple beams for borth horizontal and vertical test specimens. Additional tests were made to determine the modulus of elasticity with the simple beams in flexure. Tests were also made for creep in uniaxial compression. Although there is a high scatter of results, a dependence of strength and creep on temperature and brine volume is evident. Higher compressive, tensile, and flexural strengths, along with higher values of the elastic modulus were obtained at lower temperatures or brine volumes. The minimum creep rate decreases with decreasing temperature and brine volume. (Author)

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
SEISMIC SURVEY 1957, THULE AREA, GREENLAND, by Hans Roethlisberger. Rept. on Approach Roads, Core Drilling in Permafrost, and Elastic and Visco-Elastic Properties of Snow and Ice. Sep 59, 17p. 10 refs. Technical rept. 64; AD-235 203.
Order from LC mi$2.40, ph$3.30 PB 149 125

Seismic reflection soundings were carried out in the vicinity of Camp TUTO, Thule, Greenland, on the edge of the ice cap. Ice thicknesses ranging from 200 to 800 ft were determined. With a short shot point to geophone distance only sporadic results could be obtained, while with a long distance, up to 3.5 times the ice thickness, very strong reflection signals were recorded. Evidence was found that some of the reflections did not occur at a single clear interface, indicating the presence of alternate layers of moraine and ice at the bottom of the ice cap. At one location, where the result of the seismic sounding could be compared with drilling results, the error was found to be less than 10 ft, the depth at the place being about 200 ft. Later reflection signals on the seismic records are analyzed by means of a master chart. The usefulness of the refraction method was established along the ice tunnel. (Author)

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
SOME STRUCTURAL PROPERTIES OF GREENLAND SNOW, by Alfred Fuchs. Rept. on Structure of Snow and Ice. Dec 59, 28p. 7 refs. Research rept. 42.
Order from LC mi$2.70, ph$4.80 PB 149 129

The results of petrofabric studies in the laboratory on 5 samples of high-density snow collected in 1954 and 1955 at depths of 8.0, 15.5, 23.0, 34.2, and 46.3 m in a pit at Site 2 are reported. The porosity of the samples, the number of grains/sq. cm, the mean number of adjacent grains per grain, the mean grain cross section, the size distribution of grain cross sections, and the orientation of c-axes were determined from enlarged photomicrographs of thin sections, using reflected light and transmitted polarized light. The number of adjacent grains per grain, the ratio of free to occupied grain surface, and the sphericity clearly depended on porosity and on each other. There was no strong relation between these data and the number of grains/sq. cm. Hence, the structure of high-density snow can be satisfactorily described by the porosity and the number of grains/sq cm. Conclusions from a two-dimensional thin section can be applied to a spatial sample only if the sample is isotropic by strata. (Author)

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
STRENGTH DATA ON LAKE ICE, by Guenther E. Frankenstein. Rept. on Bearing Capacity of Floating Ice Sheets. Dec 59, 24p. Technical rept. 59.
Order from LC mi$2.70, ph$4.80 PB 149 124

The results of in-place cantilever beam tests and small-beam tests with center loading, conducted in 1956-57 on lake ice in Minnesota, Wisconsin, and Michigan, are reported; the testing procedures and equipment used are described; and the data are tabulated and graphed. The tests were made on clear ice, snow-ice (dense, medium, and rough), and a combination of clear ice and snow-ice.

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
VISCO-ELASTIC PROPERTIES OF PROCESSED SNOW, by Ukichiro Nakaya. Rept. on Elastic and Visco-Elastic Properties of Snow and Ice. Sep 59, 26p. 6 refs. Research rept. 58; AD-235 329.
Order from LC mi$2.70, ph$4.80 PB 149 133

The results of investigations at Site 2 (Greenland) on rectangular samples of Peter snow (2 x 20 x 1.0 - 1.6 cm) of varying ages are reported, and the methods of study are described. Young's modulus was obtained from the frequency of resonance vibration and viscosity from the rate of damping, using a new visco-elastic meter. A simple relation was obtained between Young's modulus and density when the specimens were grouped according to structure, and the results of the experiments were analyzed for each of the groups, taking age as the parameter. Peter snow 2-3 yr old had almost the same modulus of elasticity as snow naturally compacted for 10 yr. The modulus of elasticity vs density curve for new Peter snow was similar to that of naturally compacted snow, except that the absolute value of the modulus of elasticity was smaller for the same density. Young's modulus however, increased with time, and the curve approached that of naturally compacted snow. When the grain-size distribution was heterogeneous, Young's modulus was larger than for naturally compacted snow of the same density. Mechanical vibration immediately after processing effected an increase in snow density, but did not accelerate age hardening. (Author)

Barodynamics, Inc.
EXCAVATIONS IN FROZEN GROUND. PART II. EXPLOSION TESTS IN FROZEN GLACIAL TILL, FT. CHURCHILL, by C. W. Livingston and Glenn Murphy. Final rept. on Contract DA 11-190-ENG-17. July 59, 43p. 8 refs. SIPRE rept. 30; AD-233 474.
Order from LC mi$3.30, ph$7.80 PB 149 121

Explosion tests were conducted in frozen ground near Fort Churchill, Manitoba, Canada, as an extension of previous tests in Keweenaw silt. Atlas 60 Percent Straight Gelatin Dynamite, Demolition Block M5 Composition C-3, and Atlas Coalite 7S Ammonia-Base Permissible Dynamite were used as the explosives in amounts ranging from 0.5 to 20 lb. Approximately 150 craters were produced. The charges were cylindrical with height-diameter ratios ranging from 0.12 to 9.12, but the majority were in the interval between 2.5 and 4.0. The depths of charges varied, some being quite shallow and others sufficiently deep that no surface effect was observed. In general the results verify scaling laws and show that the critical depth varies as the cube root of the weight of charge. Consistent differences in performance of the explosives were observed. The shape of the charge also influenced the results, but scatter of the data preclude establishing conclusive trends of the influence. (Author)
(See also PB 124 727)

Denver U., Colo.
TEMPERATURE DISTRIBUTION OF SNOW WITH GAMMA RAY RADIATION, by Chi Tien. Rept. on Thermal Properties of Snow and Ice. Rept. on Contract DA 11-190-ENG-34. Jan 60, 7p. 2 refs. SIPRE Research rept. 67; AD-237 172.
Order from LC mi$1.80, ph$1.80 PB 149 135

The temperature distribution in snow subjected to gamma radiation from an operating nuclear reactor is analyzed mathematically, assuming that the effect of radiation is equivalent to a continuous heat source, the intensity of which is a function of the radial distance from the reactor. Steady-state solutions are derived for two cases: when the radial distance is 13 ft and when it is 19.1 ft. The results indicate that the temperature of the snow in certain regions in the several feet immediately below the foundation will exceed the design limit of 20F. Increasing the shielding of the reactor will reduce the snow temperature. Other possible ways to reduce the snow temperature include the use of refrigeration coils and the forcing of atmospheric air through the snow. (Author)

Engineer Corps, Washington, D. C.
GREENLAND ICE CAP RESEARCH PROGRAM. STUDIES CONDUCTED IN 1955-1957, VOL. I. June 60, 254p. 7 refs.
Order from LC mi$11.10, ph$39.60 PB 149 194

Contents:
Trafficability of snow, Greenland studies, 1955-1957. AEWES TM-3-414, rept. no. 3. Also available separately as PB 149 196, mi$8.10, ph$27.30.
Glaciological investigations in the Tuto area of Greenland, 1960, SIPRE TR-47.
Snow beams and abutments using Peter snow, 1959. SIPRE TR-55.
(See also PB 146 022)

Geodesy

Aeronautical Chart and Information Center, St. Louis, Mo.
COMPUTATION OF SHORAN DISTANCE. Jan 60 (Revised), 99p. 56 refs. ACIC Technical rept. no. 76, rev., supersedes PB 139 981.
Order from LC mi$5.40, ph$15.30 PB 149 880

This report is concerned with computations of the distances between shoran ground stations and the airborne shoran transmitter receiver. It takes account of such parameters as the height of the aircraft above the earth and the curve of the electronic wave path in the atmosphere; however, it does not consider other elements of the bombing problem such as ballistic trajectories, wind velocity, etc.

Naval Photographic Interpretation Center, Washington, D. C.
EXPLICIT INTERIOR-EXTERIOR ORIENTATION OF THE CAMERA IN SPACE, by E. L. Merritt. 9 Aug 50, 24p. 1 ref. Rept. no. 121-50.
Order from LC mi$2.70, ph$4.80 PB 149 824

This report released for sale to the public 25 Aug 60.

The purpose of this paper is to describe an explicit solution to the elements of interior and exterior orientation of the camera in space. This solution is presented (1) as an expedient means of obtaining camera data in the field and (2) as a means of partially answering the questions posed above.

Naval Photographic Interpretation Center, Washington, D. C.
EXPLICIT EXTERIOR ORIENTATION OF THE CAMERA IN SPACE, by E. L. Merritt. 20 Apr 51, 12p. 3 refs. Rept. no. 105-51.
Order from LC mi$2.40, ph$3.30 PB 149 826

This report released for sale to the public 25 Aug 60.

Exterior orientation of the camera in space is defined as the determination of the space coordinates (XL, YL, ZL) of the lens and the space orientation (tilt, swing, azimuth) of the camera coordinate system with respect to a geographic coordinate system. The solution described in this paper is an implicit one, in that functions of the elements of exterior orientation are uniquely determined with the given data without recourse to iteration. The explicit functions are then equated directly for the desired unknowns.

Naval Photographic Interpretation Center, Washington, D. C.
EXTERIOR ORIENTATION BY ITERATION, by Everett L. Merritt. 30 May 51, 18p. 13 refs. Rept. no. 117-51.
Order from LC mi$2.40, ph$3.30 PB 149 827

This report released for sale to the public 25 Aug 60.

Two solutions are given in this report; each requires three imaged survey stations in conjunction with certain approximations: (1) One is based on a preliminary determination of the length of the photographic pyramid edges by Finsterwalder's method of iteration. (2) The second is based on a determination of tilt, swing, and altitude by iteration. Initial values are approximated by any means whatsoever.

Naval Photographic Interpretation Center, Washington, D. C.
FOCAL LENGTH DETERMINATION BY VANISHING POINT METHOD ON LOW-OBLIQUE PHOTOGRAPHY, by G. T. McNeil. 15 Aug 49, 5p. Rept. no. 111-49.
Order from LC mi$1.80, ph$1.80 PB 149 823
This report released for sale to the public 25 Aug 60.

The purpose of this report is to determine the approximate focal length of low-altitude low-oblique photography solely by means of vanishing points. No known dimensions are required. A perpendicular system of parallel lines, such as streets and buildings, are required in the photographic perspective to determine two horizontal and one vertical vanishing point. Occasionally, terrestrial and aerial photographs are received whose focal lengths are unknown. This report demonstrates an elementary solution for this special case. (Author)

Naval Photographic Interpretation Center, Washington, D. C.
ITERATIVE DETERMINATION OF THE INTERIOR-EXTERIOR ORIENTATION OF THE CAMERA IN SPACE, by Everett L. Merritt. 29 Aug 51, 15p. 2 refs. Rept. no. 126-51.
Order from LC mi$2.40, ph$3.30 PB 149 829

This report released for sale to the public 25 Aug 60.

See also PB 149 824

Naval Photographic Interpretation Center, Washington, D. C.
LATITUDE DETERMINATION AND CAMERA CALIBRATION WITH STAR EXPOSURES, by Everett L. Merritt. 22 Aug 51, 14p. Rept. no. 125-51.
Order from LC mi$2.40, ph$3.30 PB 149 828

This report released for sale to the public 25 Aug 60.

The purpose of this report is to describe a procedure for determining latitude without chronometer time and calibration data with plane calibration equations from measurements made on star exposure plates.

Naval Photographic Interpretation Center, Washington, D. C.
STAR EXPOSURE METHOD OF CAMERA CALIBRATION, by E. L. Merritt. 15 Nov 50, 51p. 6 refs. Technical Bulletin 131-50, supersedes PIC repts nos. 121-48, 124-48, 104-49 and 105-49.
Order from LC mi$3.60, ph$9.30 PB 149 825

This report released for sale to the public 25 Aug 60.

The purpose of this technical bulletin is to present a method of calibrating cameras from zenithal exposures of stars. The method consists of making exposures of the zenith and calculating the camera constants ($f, \Delta x, \Delta y$) and residual lens distortion, with the plate and celestial coordinates of the stars imaged as given data. The concept of a negative exposure of the zenith for calibrating purposes is illustrated. Reasonable accurate camera calibration data can be calculated because of the multiplicity of star images and the relatively high accuracy of the star's celestial coordinates.

Geography

Coastal Studies Inst., Louisiana State U., Baton Rouge.
PROCESSES OF DELTAIC SEDIMENTATION IN THE LOWER MISSISSIPPI RIVER, by Frank A. Welder. Technical rept. no. 12 on Contract N7onr-35608. 1 July 59, 99p. 69 refs. Contribution no. 59-7; AD-219 944.
Order from LC mi$5.40, ph$15.30 PB 147 181

The Mississippi delta and related alluvial processes are physiographically described and the principles and processes of deltaic sedimentation are analyzed. Physiographically the area consists of active and abandoned river channels, their respective natural levee ridges and inter-levee basins and a limited beach section. The problem was to map and describe these features and to study the processes of nature by which they were created. A restricted area of active deltaic sedimentation was periodically subjected to concentrated field observation. The results make it possible to understand many of the processes associated with the formation of the Mississippi delta, as well as the hydraulic and sedimentary principles involved.

Quartermaster Research and Engineering Center, Natick, Mass.
A QUANTITATIVE SYSTEM FOR CLASSIFYING LANDFORMS, by Walter F. Wood and Joan B. Snell. Feb 60, 24p. 5 refs. Technical rept. EP-124; AD-233 221.
Order from LC mi$2.70, ph$4.80 PB 149 763

A landform classification system based on quantitative terrain data was devised, and tested in a part of Central Europe. Measurements for 6 terrain factors - grain, relief, average elevation, elevation-relief ratio, average slope and slope direction changes - were taken for 413 sample areas within a larger area of over 100,000 square miles. The individual samples were grouped into 25 homogeneous regions in accordance with the similarity of the above measurements. A map of Central Europe delineating these 25 regions was drawn and was found to compare favorably with physiographic maps of the same area drawn solely from qualitative interpretations. The similarity of the quantitatively-described landform regions with those described qualitatively is further proof of the validity of quantitative terrain analysis and demonstrates the usefulness of earlier qualitative geographic work. (Author)

Geology

Armour Research Foundation, Chicago, Ill.
FEASIBILITY STUDY OF A MAGNETIC FIELD SURVEY TO 1 GAMMA, by D. E. Wiegand. Rept. no. 1 (Final) on Contract DA 44-009-eng-1103. 23 Oct 53, declassified 16 May 58, 12p. 7 refs. ARF Proj. no. A 037-1; AD-162 097.
Order from LC mi$2.40, ph$3.30 PB 150 212

This report released for sale to the public 15 Sep 60.

A system for surveying the total magnetic field vector, to a limiting and relative accuracy of 1γ is described. The following points represent the desired goal of a magnetic field survey: (1) contour map of total field strength, (2) contour map of vertical component of field strength, (3) points to be measured and plotted every 6 in. where rate of change of field strength with distance equals or exceeds 2γ per ft or where gradient is less than 2γ per ft points are to be plotted at 1γ spacings, and (4) sensitivity of measurements of 1γ.

The detecting device must be an instrument which lends itself to the requirements of field survey work, namely portability, mechanical ruggedness, ease of operation, quick setup time, and detection of field at or close to the earth's surface. The most likely instrument adaptable to the proposed survey is the AN/ASQ-3A magnetic airborne detector. The instrument aligns to and measures the total component of the earth's field. The data would consist of continuous profiles of total magnetic field of fixed length which, when indexed and laid parallel in proper order and spacing, would permit immediate and adequate interpretation for most all investigations. Magnetic anomalies of mines and other objects could be immediately determined by re-surveys.

Pennsylvania State U., University Park.
BIBLIOGRAPHY ON METHODS FOR DETERMINING SOIL MOISTURE, by Mark D. Shaw and William C. Arble. Rept. on Contract DA 36-039-sc-78125. June 59, 153p. 629 refs.
Order from LC mi$7.50, ph$24.30 PB 148 336

This survey of literature consists of references to technical papers and patents relating to soil moisture determination and measurement, with abstracts or brief summaries of their content. No attempt is made to evaluate the work or the methods described. References are grouped under the principal methods of soil moisture determination; chemical, electrical, gravimetric, lysimeter, nuclear, penetrometer, tension, and thermal. (Author)

Oceanography

Air Force Cambridge Research Center, Bedford, Mass.
SCIENTIFIC STUDIES AT FLETCHER'S ICE ISLAND, T-3, 1952-1955, VOLUME III, by Vivian Bushnell. Apr 60, 122p. 169 refs. Geophysical Research Papers no. 63; AFCRC-TR-59-232(3); AD-216 815.
Order from OTS $2.75 PB 161 939

Contents:
Arctic Ice Island and Ice Shelf studies
Seismic studies
Structure and stratigraphy of T-3 and the Ellesmere Ice Shelf
Petrographic evidence on the source area and age of T-3
Macroscopic plant materials
Palynological studies of organic sediments and of coated slides
Airborne viable micro-organism spores collected near sea-level
Detailed descriptions of rock specimens
Details of aeropalynological collection
Details of collecting and processing living microorganisms
Mollusks collected at the surface of the Ice Island
(See also PB 161 289, PB 161 691)

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
EDGE WAVE MOTION OVER A SHELF, PART I, by R. M. Durstine. Rept. on Contract Nonr-1866(20). June 59, 66p. 7 refs.
Order from LC mi$3.90, ph$10.80 PB 147 258

The purpose of the present paper is to give an analysis of the problem for a hypothetical ocean which has constant depth B out to a certain distance A from the shoreline. Beyond this point, a constant but greater depth L is assumed. Thus the existence of a continental shelf is introduced into the analysis. In reality both the sloping beach and the shelf geometries show characteristics which are observed in the Atlantic Ocean off the coast of North America. The sloping beach is particularly suitable since the wave forms deduced have been shown to decay to a very small fraction for their shoreline magnitude at distances out to sea for which the continental shelf still exists.

Lamont Geological Observatory, Palisades, N. Y.
SOUNDING AND MAGNETOMETER EQUIPMENT FOR A DRIFTING ICE STATION, by A. C. Hubbard and B. Luskin. Technical rept. no. 19 on Contract NObsr-64547. Dec 59, 31p. 3 refs. CU-52-59-NObsr-64547-Geol.
Order from LC mi$3.00, ph$6.30 PB 149 163

The major objectives of the design were compactness in size, weight and power, and simplicity of circuit design and operation. The instruments described here have been in successful and near-continuous operation since July 1959 and provide a good foundation for design of future instruments of this type.

Navy Hydrographic Office, Washington, D. C.
PRELIMINARY REPORT OF SOUTHERN HEMISPHERE OCEANOGRAPHY, by E. C. Stephan. Rept. on Operation Deep Freeze 60 and Chiper Oceanographic-Hydrographic Observations. 25 July 60, 7p. Serial 5159.
Order from LC mi$1.80, ph$1.80 PB 149 531

Two phases of activity were conducted. Phase I was the underway program and consisted of hourly or half-hourly bathythermograph casts, continuous recording of sea surface and shade air temperatures, collection of surface water samples, and sea and swell (or ice) observations. Phase II, accomplished while hove to, consisted of standard oceanographic stations. These included the collection of temperature data and sea water samples at pre-selected depths extending from sea surface to the bottom. Dissolved oxygen analysis and salinity determination were completed on many samples.

Scripps Institution of Oceanography, U. of California [La Jolla].
FINAL REPORT. Rept. for 30 June 51-15 Mar 58 on Contract Nonr-233(04). 28 Oct 59, 31p. 76 refs. SIO Reference 59-64; AD-230 492.
Order from LC mi$3.00, ph$6.30 PB 149 499

Summaries of papers related to military oceanography of the Pacific.

Woods Hole Oceanographic Institution, Mass.
SOUNDINGS, BOTTOM PROFILES, AND DEEP SCATTERING LAYER OBSERVATIONS: ATLANTIS CRUISE 247, JANUARY-JUNE, 1959 FOR THE INTERNATIONAL GEOPHYSICAL YEAR OF 1957-1958, by Arthur R. Miller. Rept. on Contract Nonr-2196(00). [1959] 126p. Reference no. 60-16; AD-237 816.
Order from LC mi$6.30, ph$19.80 PB 148 126

Results from the Precision Graphic Recorder combined with the Echo Sounder, are presented in this report. These results consist of soundings, both corrected and uncorrected for the speed of sound; bottom profiles, and rough interpretations of the distribution of deep sound scatterers throughout the voyage.

Physics of the Atmosphere

Antenna Lab., Ohio State U. Research Foundation, Columbus.
SURVEY OF THE LITERATURE ON TEMPERATURE DETERMINATION AT ALTITUDES ABOVE 120,000 FEET, by James L. George and William H. Peake. Rept. on Contract DA 36-039-sc-84516. 15 Feb 60, 133p. 230 refs. Rept. 973-1; AD-235 897.
Order from LC mi$6.90, ph$21.30 PB 149 379

The first part of this analysis provides a brief introduction to properties of the atmosphere above 120,000 feet, a discussion of the concept of temperature at high altitudes, and a review of the several methods that have been used or proposed for temperature determination in the upper atmosphere. The second part of the analysis consists of the bibliography proper (each entry containing an abstract), itself divided into thirteen sections. The first five sections are concerned with properties of the upper atmosphere, the sixth with vehicles for research at altitudes above 120,000 feet, and the remainder with the various specific methods for temperature measurement, classified according to the quantity under consideration (e.g., scale height, "rotation" temperature, etc.). (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BALLISTIC INSTRUMENTATION AND SUMMARY OF INSTRUMENTATION RESULTS FOR THE IGY ROCKET PROJECT AT FORT CHURCHILL, by Harold Zancanata. Jan 60, 74p. 10 refs. Rept. no. 1091; AD-234 338.
Order from LC mi$4.50, ph$12.30 PB 147 790

A total of 82 rockets of various configurations were launched. Of this total, 60 rockets were instrumented with DOVAP and DOVAP telemetering and 5 rockets with ballistic cameras. Ballistic instrumentation performed well. Description of the instrumentation including photographs, discussion of the difficulties encountered and summary of ballistic instrumentation results for all instrumented rockets are given. (Author)

Denver U., Colo.
WATER VAPOR DISTRIBUTION ABOVE 90,000 FEET, by David G. Murcray, Frank H. Murcray and others. Scientific rept. no. 5 on Contract AF 19(604)2069. 24 May 60, 28p. 31 refs. AFCRC-TN-60-452.
Order from LC mi$2.70, ph$4.80 PB 149 811

The absorptions due to the 6.3μ band of water vapor have been measured for altitudes up to 92,000 ft. On the basis of these absorptions the humidity mixing ratio for the region above 92,000 ft has been calculated. The calculated values range from 1.5×10^{-4} gm/gm to 3.4×10^{-4} gm/gm. The mixing ratio from 40,000 to 92,000 ft has also been calculated and yields values at least an order of magnitude lower than the values obtained above 92,000 ft. It is concluded that there was at least 20 microns of precipitable water above 92,000 ft over Alamogordo, New Mexico on June 19, 1959. (Author) (See also PB 147 647)

Institute of Paper Chemistry, Appleton, Wis.
A STUDY OF THE FILTRATION AND PERMEABILITY CHARACTERISTICS OF IPC 1478 FILTER PAPER. Final rept. on Contract DA 29-044-XZ-549. 13 Feb 60, 178p. 6 refs. DASA 1168; AD-235 318.
Order from OTS $3.00 PB 161 917

A study was made of the filtration and pressure drop-flow rate characteristics of IPC 1478 filter paper over wide ranges in pressure and temperature. The project was done in two phases: In the first, a wind tunnel was designed and constructed for operation at a pressure of 1/20 atm., a temperature of 7°F and a flow rate of 5000 ft./min. at 1/20 atm. The aerosol was monodisperse spherical particles of SiO_2 whose size distribution function was narrow, peaking at about 0.02 micron. The retention of IPC 1478 paper for these particles was essentially 100%. The study revealed an apparently anomalously high diffusion of these particles in air. In the second phase, the wind tunnel was modified for operation at temperatures down to -40°F and a generator for the production of very small (about 40 A.) particles of aluminum oxide was developed. Retention for the aluminum oxide particles and pressure drop were determined over wide ranges in pressure, temperature, and flow rate. Data reduction theory was developed, and applied to the pressure drop-flow rate observations. Modern kinetic theory was applied to the diffusion of very small particles in a gas, and the theory of diffusion of particles from a streaming gas to the tube wall was evolved and applied to the estimation of particle size. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
CORRELATION STUDIES OF THE Es REGION, by Juhani O. Oksman and Sidney A. Bowhill. Scientific rept. no. 132 on Ionospheric Research, Contract AF 19(604)4563. 1 May 60, 52p. 15 refs. AFCRC-TN-60-484.
Order from LC mi$3.60, ph$9.30 PB 149 312

In studying the sporadic E region, two approaches are possible: either its world-wide occurrence, or the behavior of separate Es "clouds" may be studied. A dense network of observing stations is ideally needed for the latter approach. Since this network is not available, a statistical method is developed which gives the average time and space structure of Es clouds. Unlike conventional statistical methods, allowance is made for gaps in the measured sets of values of foEs caused by various complicating factors. The autocorrelation coefficients, as functions of time and space, of a new quantity fiEs, with an assumed Gaussian probability distribution, have been calculated from observed Es data. The results indicate that Es clouds have sharp edges; that Es occurrences last frequently for more than four hours; that correlation exists between Es occurrences at places more than 700 km apart; and that the direction of apparent Es movements is random, with a velocity of about 70 m/sec. Further use of this method on a world-wide basis is recommended. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
IONOSPHERIC ELECTRON DENSITIES FOR WASHINGTON, D. C., PANAMA, TALARA, AND HUANCAYO FOR JULY-AUGUST-SEPTEMBER, 1958, by E. R. Schmerling. Scientific rept. no. 130 on Ionospheric Research, Contract AF 19(604)3875. 1 Mar 60, 252p. AFCRC-TN-60-444; AD-237 684.
Order from LC mi$11.10, ph$39.60 PB 148 124

See also PB 144 164

Ionosphere Research Lab., Pennsylvania State U., University Park.
A PRELIMINARY STUDY OF SUNRISE EFFECTS IN THE D-REGION, by A. C. Aiken. Scientific rept. no. 133 on Ionospheric Research, Contract AF 19(604)4563, and National Science Foundation Grant G 5939. 1 June 60, 31p. 11 refs. GRD-TN-60-491.
Order from LC mi$3.00, ph$6.30 PB 149 784

A theoretical determination is made of the electron density distribution in the region between 60 and 100 km for times around sunrise. It is shown that the radiations responsible for ionization are Lyman alpha acting on NO and cosmic ray ionization of O_2 and N_2. This leads to a twilight D region consisting of two strata. The upper layer is under direct solar control, increasing as the optical depth at Lyman alpha decreases. After an initial increase due to photodetachment from O_2^- the lower region, formed by cosmic rays, remains constant. A comparison is made between this model and the behavior of the ionosphere deduced from low and very low frequency radio soundings. (Author)

Ionosphere Research Lab., U. of Pennsylvania, University Park.
STRUCTURE OF THE THERMOSPHERE, by Marcel Nicolet. Scientific rept. no. 134 on Ionospheric Research, Contract AF 19(604)4563. 1 July 60, 82p. 86 refs. GRD-TN-60-496.
Order from LC mi$4.80, ph$13.80 PB 149 785

The vertical distribution of the density in the thermosphere, deduced from satellite observations, must be explained by an increase of the scale height with altitude. An examination of the interrelationships between the absolute values of density in a dark atmosphere

and diurnal conditions of heat conduction reveals that the varying gradient of the scale height above 200km is essentially due to the decrease of the molecular weight, mg, of the atmospheric constituents subject to diffusion. In the night atmosphere the isothermy above a certain altitude (>200km) is the critical factor characterizing the vertical distribution of density. The effect of diffusion has been clearly shown by establishing a thermo-isobaric relation connecting the temperature of the isothermal region with an isobaric level where atomic oxygen has a specific concentration. The gradient of temperature in a sunlit atmosphere is related to the fraction of the ultraviolet sun's energy absorbed, which determines the magnitude of the variation of the scale height with altitude.

Johns Hopkins U., Baltimore, Md.
SOME ASPECTS OF GEOSTROPHIC AND AGEOSTROPHIC SPECTRA OF LARGE SCALE ATMOSPHERIC PHENOMENA, by Arthur B. Kahn. Doctoral thesis. Final rept., vol. 2, on Contract AF 19(604)2056. 15 Nov 59, 171p. 44 refs. AFCRC-[TR]-60-260.
Order from LC mi$8.10, ph$27.30 PB 149 080

The techniques of spectral analysis are used to probe some of the details of large scale atmospheric turbulence and the role it plays in the fundamental problem of the general circulation of the atmosphere. A considerable amount of data at 200 mb is presented and compared with previously available spectra at other levels. In computing such data, it is common practice to make use of data at a discrete number of points around a latitude circle, and also to use the geostrophic assumption. The effects of these procedures are investigated, and it is found that they are of secondary importance. Finally, the occurrence of contragradient fluxes in the atmosphere is investigated. It is found that the direction of the flux of dry enthalpy is explicitly dependent solely upon the tilt with height of synoptic systems, which must in turn be related to the meridional gradient. (Author)

Naval Ordnance Test Station, China Lake, Calif.
SLIDE RULE FOR COMPUTING THE DENSITY OF ATMOSPHERIC AIR AT GROUND LEVEL, by Paul H Miller. 18 Feb 59, 9p. NOTS TP-2185; NAVORD rept. 6465; AD-213 432.
Order from LC mi$1.80, ph$1.80 PB 146 469

A slide-rule calculator for determining the density of atmospheric air at ground level in slugs per cubic foot is described. Densities are determined as functions of pressure (in millibars), temperature (in degrees Fahrenheit) and relative humidity (expressed as a percent and with respect to water), and are accurate to the nearest 10^{-5} slugs/foot^3. (Author)

Ohio State U. Research Foundation, Columbus.
NUMERICAL EVALUATION OF RADIATION ERRORS OF RADIOSONDE TEMPERATURE ELEMENT ML 419 AT ALTITUDES UP TO 150,000 FEET, by J. H. Shaw. Technical rept. no. 3 on Contract DA 36-039-sc-78153. Mar 59, 52p. 7 refs. AD-218 344.
Order from LC mi$3.60, ph$9.30 PB 148 547

Typical and extreme values of the daytime and nighttime radiation errors (in °K) of the unshielded thermistor temperature element ML-419 currently used by the U. S. Army Signal Corps in radiosonde soundings are evaluated for pressure levels of 100, 12, and 1.2 mb (corresponding to altitudes of about 52,000, 97,000 and 149,000 ft. respectively) and for atmospheres of different temperature distributions. (Author)

Ohio State U. Research Foundation, Columbus.
THEORETICAL ANALYSIS OF RADIATION ERRORS OF RADIOSONDE TEMPERATURE ELEMENTS, by J. H. Shaw. Technical rept. no. 2 on Contract DA 36-039-sc-78153. Jan 59, 58p. 16 refs. AD-218 342.
Order from LC mi$3.60, ph$9.30 PB 148 546

Methods for estimating typical and extreme values of solar and thermal radiation fluxes for different atmospheric conditions and for altitudes above 50,000 ft are formulated. A theoretical investigation is then made of the factors which influence the equilibrium temperature of a body in the atmosphere exposed to this radiation flux and also exchanging heat by convection with the surrounding air. A relation is then developed from which a numerical evaluation of the radiation error of the ML-419 temperature element can be made. (Author)

Waters Associates, Framingham, Mass.
ADAPTATION OF AN ELECTROLYTIC WATER VAPOR DETECTOR FOR BALLOON MEASUREMENT OF WATER CONTENT OF THE ATMOSPHERE, by James L. Waters. Final rept. on Phase 2, Contract AF 19(604)5464. Apr 60, 13p. AFCRC-TR-60-45(II).
Order from LC mi$2.40, ph$3.30 PB 148 934

The adaptation of an electrolytic water vapor detector for the measurement of water content in the atmosphere between 6 and 16 kilometers is described. The instrument is designed for balloon operation. A discussion outlines present limitations of the instrument and how its performance can be improved. (Author)

Waters Associates, Framingham, Mass.
THE USE OF SELECTIVE DETECTORS FOR ATMOSPHERIC MEASUREMENTS, by James L. Pritchard. Final rept. on Phase 1, Contract AF 19(604)5464. Apr 60, 46p. 6 refs. AFCRC-TR-60-245(I).
Order from LC mi$3.00, ph$7.80 PB 148 933

An investigation of how the phenomena of pressure broadening would effect the use of the selective detector when used to measure the concentration of atmospheric gases has been investigated. Both self broadening and foreign gas broadening have been considered. It has been determined that changes in pressure cause changes in absorption of the same order of magnitude as changes in concentration within the range of concentration and pressure of interest. The use of the selective detector to measure "temperature" of atmospheric gases was explored, and the results indicate that its use in this application might be substantial. Finally, the question of using the selective

detector for the measurement of O_3 was studied. While this application is not as straightforward as with gases that are chemically inert, there seems to be no reason to believe that intelligent design cannot overcome the difficulties. (Author)

Seismology

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE COMPARISON OF STRAIN AND KINETIC ENERGY IN A PLASTIC WAVE MOVING THROUGH SAND, by A. A. Thompson. Apr 60, 12p. 1 ref. Memo. rept. no. 1263.
Order from LC mi$2.40, ph$3.30 PB 149 012

The time-histories of strain and kinetic energy for a unit volume of material have been measured in sand plastically deformed when traversed by a stress wave. Most of the total energy in the medium was strain-energy, practically of which was lost to the medium during propagation. Considerably less than 50% of the total energy appeared as kinetic energy. The dynamic stress-strain curve used for these strain-energy determinations showed that, in the very plastic region, most of the strain energy was applied to the medium after the time of peak stress. The above facts are quite different from phenomena encountered in elastic or viscoelastic propagation. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A COMPARISON OF THE DYNAMIC AND THE STATIC STRESS-STRAIN CURVE IN SAND UNDER CONFINED AND UNCONFINED CONDITIONS, by A. A. Thompson. Apr 60, 9p. Memo. rept. no. 1262.
Order from LC mi$1.80, ph$1.80 PB 149 011

Measurements of the dynamic and static stress-strain curves in sand show a very large change in shape with change in the rise time of the stress. When the sand is confined on all sides so as to minimize lateral expansion, the slope of the static stress-strain curve becomes much steeper after a 1% strain. If much of the air space in the sand is removed, the static loading curve becomes considerably steeper. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE RELATION OF SEISMIC ENERGY ATTENUATION TO THE AREA UNDER THE STRESS-STRAIN CURVE, by A. A. Thompson. Apr 60, 12p. 1 ref. Memo rept. no. 1261.
Order from LC mi$2.40, ph$3.30 PB 148 904

Seismic energy attenuation in a sand medium has been determined by measuring the total energy at various distances from an explosive source and also by measuring the area between the loading and unloading parts of the stress-strain curve. Theory and experiment show that the value of attenuation determined from the stress-strain curve may be less than the true value when the attenuation is very large. (Author)

ENGINEERING

Naval Civil Engineering Lab., Port Hueneme, Calif.
DEVICE FOR REPLACING TIE RODS IN PONTOON ASSEMBLIES, by J. V. Stalcup and R. C. Towne. Final rept. 26 May 60, 17p. 2 refs. Technical rept. 079.
Order from LC mi$2.40, ph$3.30 PB 148 554

Wedge clamps, which joins bottom pontoon angles, were tested as a replacement for tie rods. They are satisfactory for joining pontoon strings, especially pontoon structures wider than three strings but do not resist vertical shear between strings during side lauching. The clamps are not hindered by sea water corrosion. When they can be used, P-5 or AP-1 plates are better than clamps. An improved jacking device for installing and removing the wedge clamps is recommended as a further development study. (Author)

Aeronautical Engineering

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
DEVELOPMENT OF STANDARD TEST INDUCTOR CRITERIA, by J. D. Segrest. Phase 1, rept. no. 1. 23 July 59, 28p. 4 refs. TED Proj. ADC EL-5006; rept. no. NADC-EL-L5941.
Order from LC mi$2.70, ph$4.80 PB 148 065

This report covers the development of criteria upon which a series of standard 28-V d-c test inductors should be based. These criteria were developed from the results of an engineering investigation of the parameters encountered in 28-V d-c equipment, the present methods of inductive load testing, and the adequacy of the present AN3179 laboratory test inductors.

Armour Research Foundation, Chicago, Ill.
STUDIES AND INVESTIGATION OF AIR TRAFFIC CONTROL SYSTEMS, by G. W. Bond, K. S. Gale and others. Final rept. for 10 Jan 57-9 Jan 58, on Contract DA 36-039-sc-73104. 9 Jan 58, 38p. ARF Project E079.
Order from LC mi$3.00, ph$6.30 PB 147 944

Results of a systems analysis and simulation study of a postulated 1965 enroute traffic control system in the New York-Washington area are reported: (1) system description, (2) preliminary analysis, (3) traffic sample considerations, (4) assignment of traffic demand, (5) simulation model considerations, (6) graphical simulation, (7) computer simulation. (Author)

Armour Research Foundation, Chicago, Ill.
STUDIES AND INVESTIGATIONS OF TRAFFIC CONTROL SYSTEMS, by G. W. Bond, K. S. Gale, and J. W. Haake. Quarterly progress rept. no. 2, 9 Apr-9 July 57, on Contract DA 36-039-sc-73104. 9 July 57, 54p. 1 ref. ARF Proj. E079; AD-151 453.
Order from LC mi$3.60, ph$9.30 PB 147 943

A new traffic sample was made which reflects more realistically the available forecasts of 1965 air traffic. Graphical simulations were made of various airways within the study area. The entry and exit points and the climb and descent regions were heavily loaded. The climb and descent phases of enroute flight present the most difficult traffic control problems. A simulation of air traffic along an airway was programmed on the IBM 650 computer. Rules for use in simulating and/or controlling off-airways traffic were studied.

Avco Corp., Nashville, Tenn.
DESIGN, DEVELOPMENT AND FABRICATION OF A LIGHT WEIGHT AIRFRAME. Monthly progress rept. no. 1, 6 May-31 May 60, on Contract DA 33-008-ORD-1968. [1960] 39p.
Order from LC mi$3.00, ph$6.30 PB 149 302

The lightweight airframe structure consists of a tangent ogive of 195.0-inch radius 48-inches long. The diameter at Sta. 48.0 is 12-inches. The design is based on an aluminum honeycomb construction which design studies have shown best satisfies the optimum requirements of weight, shell stability, aerodynamic smoothness, deflection and strength criteria.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE PROPERTIES OF LADDER NETWORKS, by Keats A. Pullen, Jr. Apr 60, 64p. 13 refs. Rept. no. 1102.
Order from LC mi$3.90, ph$10.80 PB 148 902

The properties of the repetitive ladder (or L) network are analyzed in terms of their repetitive properties and of their associated tree relations. The relation of the transfer elements to the ladder network matrix, and methods of matrix reduction by use of partial uncoupling is considerd. Number relations for the ladders are derived and tables of numerical coefficients presented. (Author)

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth and D. L. Goldwater. Scientific rept. no. 8 on Contract AF 19(604)3904. 15 Apr 60, 21p. 6 refs. AFCRC-TN-60-385.
Order from LC mi$2.70, ph$4.80 PB 148 517

Life tests to date with thorium impregnated matrix cathodes have yielded the result that at least 10,000 hours is readily attainable at the 2.3 amp./cm^2 (1650^oC_B) level. Tests at higher levels are in progress. An investigation is described in which a high sensitivity analytical balance of standard design is used for determination of the surface density of that thorium layer which corresponds to maximum thermionic emission with the thorium-on-tungsten system. Metallographic studies are described of the polycrystalline specimens used in the above investigations and also of a single crystal tungsten ribbon to be used in future experiments. (See also PB145369)

Bell Telephone Labs., Inc., [New York]
GENERAL AIR-GROUND COMMUNICATION STUDY, by J. H. Craig, M. M. Ditta and others. Final rept. Task A, pt. 4, 1 Jan 56-31 Dec 57, on Air Traffic Control Communications, Contract DA 36-039-sc-64567. 31 Dec 57. 171p. 17 refs. AD-154 685.
Order from LC mi$8.10, ph$27.30 PB 147 945

Contents:
Chap. 1 Propagation loss
Chap. 2 Signal to noise considerations in air-ground voice communications
Chap. 3 Interpretation of grade of service
Chap. 4 Frequency spectrum utilization and siting
Chap. 5 Selective signaling arrangements for a multichannel voice communication system
Chap. 6 Data link or air traffic control signaling system
Chap. 7 Study of charges for ground network facilities from air route traffic control centers to radio sites in northeastern portions of United States

Bell Telephone Labs., Inc. [New York]
GENERAL AIR-GROUND COMMUNICATION STUDY [AND] EXPERIMENTAL AIR TRAFFIC CONTROL COMMUNICATION SYSTEM, by J. H. Craig, M. M. Ditta and others. Interim rept. Task A, pt. 4 and Task D, pt. 3, 1 July 56-15 May 57, on Air Traffic Control Communications, Contract DA 36-039-sc-64567. 15 May 57, 143p. AD-139 519.
Order from LC mi$7.20, ph$22.80 PB 147 947

Task A, part 4: The present air traffic control system is discussed with reference to the following: (1) the interrelation of airway structure, communication time, and delays to aircraft; (2) the number of VFR flights predicted versus IRF experience; (3) airway and fix usage; (4) air-to-ground radio channels; (5) the characteristics of air traffic in the New York terminal area; and (6) the relations between the number of operations during peak and average hours. An exploratory study was directed towards the development and provision of an experimental data link. Task D, part 3: Engineering assistance was provided in (1) the planning and establishing of an experimental arrangement which permits the routing of flight plans through an 81D1 teletypewriter switching system and the printing of appropriate flight strips; (2) a study of the flow of air traffic in the Indianapolis Center; and (3) the programming of a high-speed computer for use in the experimental system.

Bell Telephone Labs., Inc. [New York]
HIGH-VOLUME WEATHER INFORMATION COMMUNICATION SYSTEM, by E. E. Schwenzfeger. Final rept. Task D, pt. 2, 1 Jan 56-20 Nov 57, on Air Traffic Control Communications, Contract DA 36-039-sc-64567 20 Nov 57, 28p.
Order from LC mi$2.70, ph$4.80 PB 147 948

The proposed system is in effect based on the old telephone party line concept in which any or all subscribers could listen in on any or all conversations if they wished. It is a party line arranged for transmitting data and messages at the rate of 1,000 words per minute. There may be as many as 1,000 stations

which transmit data and perhaps as many as 5,000 which receive it. However, the proposed system is unlike the old telephone party line in that the transmitting stations get on the line only at the invitation of a master control station which is programmed by operating personnel to call in the stations as required. Receiving stations are programmed, that is to say, "instructed" by operating personnel to monitor the line and automatically cut in to receive desired data from transmitting points in which they are interested. The program at receiving stations may be arranged to select any number of transmissions from the line. This program may also be readily altered by non-technical operating personnel to meet changing data requirements.

Bell Telephone Labs., Inc. [New York].
STUDY OF AIR TRAFFIC IN THE HIGH-DENSITY AREA OF NORTHEASTERN USA AND FORECASTS FOR 1960-65, by J. H. Craig, C. C. Scanlan and others. Interim memo. Task A, pt. 4 on Air Traffic Control Communications, Contract DA 36-039-sc-64567. 31 Dec 56, 53p. 14 refs.
Order from LC mi$3.60, ph$9.30 PB 147 946

An essential element in the design of any communication system is knowledge of the number of subscribers to be served. In the absence of traffic data sufficiently complete for planning effort, work was initiated which has culminated in the preparation of traffic statistics covering a fairly large-sized area. These data cover the traffic for 1955 and are extended into forecasts for 1960 and 1965.

Bureau of [Naval Weapons] Washington, D. C.
A BRIEF DESIGN STUDY OF A GROUND-EFFECT-LIMITED FLIGHT VEHICLE, by H. O. Hollenberg. Aug 57, declassified 8 Apr 60. 20p. 1 ref. Rept. no. DR-1887.
Order from LC mi$2.40, ph$3.30 PB 146 983

Recent experiments by the NACA have shown that a thrust augmentation can be obtained from an annular nozzle in proximity to the ground when compared to a conventional circular nozzle of equal flow area. This principle led to the concept of the ground-effect flight vehicle. This machine flies close to the ground and achieves a large portion of its lift from the sustaining high pressures contained within the annular jet sheet.

Cook Research Labs., Morton Grove, Ill.
PRELIMINARY STUDY OF EMERGENCY LANDING SYSTEMS FOR NON-AUTOROTATING AIRCRAFT AND/OR CREW, by A. H. Solarski and J. A. Fratamico. Final study rept. for June 59-June 60 on Contract DA 44-177-TC-598. 3 June 60, 149p. 12 refs. Rept. P-1890.
Order from LC mi$7.20, ph$22.80 PB 149 441

A preliminary study has been conducted to determine the feasibility of providing emergency landing systems for non-autorotating aircraft and/or crew. Various emergency systems, and techniques are evaluated for their utility in emergency situations peculiar to VTOL aircraft operation. The systems are evaluated with respect to their operational limitations and to the weight penalty imposed on the aircraft. Minimum weight systems are derived in the instance of multiple element systems. Systems qualifying under the above evaluation are further assessed with respect to their utility relative to aircraft type and to material malfunction type. The relative applicability of the qualified systems under the latter considerations is estimated quantitatively. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A TEST APPARATUS FOR SMALL ROTORCRAFT. VOLUME I. DEVELOPMENT AND OPERATIONAL CHECK OUT, by Edward M. Sullivan. Rept. on Contract DA 44-177-TC-440. Nov 59, 51p. 2 refs. Rept. no. SG-1195-S-3; AD-235 202.
Order from LC mi$3.60, ph$9.30 PB 148 396

This report describes in detail the design features of a test apparatus that can be utilized to determine the full scale static and dynamic stability characteristics of small rotorcraft. The comparison that is made between the data obtained for a test rotorcraft mounted on the test apparatus and those obtained by NASA for a similar rotorcraft during wind tunnel tests indicates that accurate aerodynamic data can be obtained by the use of the C. A. L. test equipment. (Author) (See also PB 136 564)

David Taylor Model Basin, Washington, D. C.
A PRELIMINARY DESIGN TECHNIQUE FOR ANNULAR-JET GROUND-EFFECT MACHINES (GEM'S), by Harvey R. Chaplin. Sep 59, 15p. Rept. 1371; Aero rept. 966.
Order from LC mi$2.40, ph$3.30 PB 149 822

This report released for sale to the public 26 Aug 60.

Mathematical approach consists of "Mathematical Model" incorporating all of significant descriptive dimensions of vehicle. Provides formulas and curves sufficient to describe vehicle and its hovering performance. In addition, several efficiency factors have been introduced to account for effects to be encountered in operation. Method allows comparisons of different vehicle designs. (Author)

David Taylor Model Basin, Washington, D. C.
SHROUDED PROPELLER THRUST RATIO AS A MEASURE OF SHROUD AND PROPELLER STATIC PERFORMANCE, by Harvey R. Chaplin. Jan 59, 37p. 5 refs. Aero rept. 951; AD-212 203.
Order from LC mi$3.00, ph$6.30 PB 146 588

Formulas for shroud efficiency and propeller efficiency are derived from the one-dimensional momentum theory. These formulas provide a means for approximate evaluation of the static performance of the shroud and propeller individually, in addition to the over-all static performance, from measurements of the total thrust, the propeller thrust and the power input. The formulas are applied to a typical set of experimental data, and are found to provide a quite reasonable interpretation of the experimental results. An extension of the theoretical results to the case of forward flight with axially symmetric flow is presented in an appendix. The one-dimensional momentum theory is still, despite its obvious oversimplification of the flow processes, the keystone of our working knowledge of shrouded propellers. It has furnished the commonly accepted definitions of static efficiency (or "figure of merit") and the commonly accepted standards for ideal division of thrust between the shroud and the propeller. (Author)

De Havilland Aircraft Co., Ltd. (Canada).
PRELIMINARY DESIGN STUDIES TO APPLY HIGH FLOTATION ROUGH TERRAIN LANDING GEAR SYSTEM TO THE YAC-1 DH AIRCRAFT. Final rept. Subcontract on Contract DA 44-177-TC-580. July 60, 317p.
Order from LC mi$11.10, ph$48.60 PB 149 209

This report covers the feasibility and preliminary design of high flotation landing gear structure on YAC-1 DH Aircraft for operation under rough field conditions. Considering weight, aerodynamic drag, simplicity, rough field adaptability and necessary changes to existing aircraft structure, the final proposal pointed to a 4 wheel, independent suspended, non-retractable 54" dia. 12 psig tyred main gear mounted to the sides of the fuselage along with a two 35" diam. 10 10 psig tyred nose gear, fixed. Due to lack of advanced information at this time, this scheme presupposes that a suitable tyre rebound damping system is feasible. (Author)

Douglas Aircraft Co., Inc., El Segundo, Calif.
PROGRAMMING OF DIGITAL COMPUTERS FOR DETERMINATION OF STABILITY AND CONTROL CHARACTERISTICS. VOLUMES I AND II, by D. E. Drake, E. R. Keown, and J. R. Matlock. Rept. for 1 July 58-1 July 59 on Contract AF 33(616)5953. 1 July 59, 596p. 2 refs. WADC Technical rept. 59-290, Vol. I and II; AD-228 822.
Order from OTS $7.00 PB 161 924

The analysis of the stability and control characteristics of a flight vehicle configuration is a long, complicated problem. The compilation of the USAF Stability and Control Handbook (M-03671) represents a major contribution to the solution of this problem. The purpose of the research reported is to simplify the necessary computations by replacing the nomograms of M-03671 with numerical tables and procedures and to place the resulting calculation on a large-scale, digital computer. It was found that the graphical techniques of M-03671 lent themselves readily to numerical analysis and no special difficulties were encountered in programming the procedures. The entire calculation for the longitudinal characteristics of a given configuration requires approximately 6 seconds. (Author)

[Douglas Aircraft Co., Inc., El Segundo, Calif.]
PROGRAMMING OF DIGITAL COMPUTERS FOR DETERMINATION OF STABILITY AND CONTROL CHARACTERISTICS. VOLUME III, APPENDIX II, by D. E. Drake, E. R. Keown, and J. R. Matlock. Rept. on Contract AF 33(616)5953. 1 July 59, 417p. WADC Technical rept. 59-290, Vol. III; AD-228 823.
Order from OTS $6.00 PB 161 925

See also PB 161 924

[Douglas Aircraft Co., Inc., El Segundo, Calif.]
PROGRAMMING OF DIGITAL COMPUTERS FOR DETERMINATION OF STABILITY AND CONTROL CHARACTERISTICS. VOLUME IV AND V, APPENDIX III, by D. E. Drake, E. T. Keown, and J. K. Matlock. Rept. on Contract AF 33(616)5953. 1 July 59, 312p. WADC Technical rept. 59-290, Volume IV and V.
Order from OTS $5.00 PB 161 926

See also PB 161 924, PB 161 925

Garbell Research Foundation, San Francisco, Calif.
THE TIMING OF AIRPORT TRAFFIC CONTROL AS INFLUENCED BY WEATHER AND AIRCRAFT PERFORMANCE, by Maurice A. Garbell. Rept. on Contract Cwb-8175. Sep 51, 390p. 86 refs. Garbell Aeronautical Series no. 4.
Order from LC mi$11.10, ph$69.10 PB 147 951

The present study of airport traffic control timing as influenced by weather and aircraft performance was motivated by the established fact that "bad" weather reduces the acceptance rate of a given airport. The immediate objective of the present investigation is to supplement existing intuitive procedures by a substantial method of engineering planning. The first step undertaken was to assess dependably the extent to which meteorological phenomena and aircraft performance affect the timing of air traffic control in a crowded terminal area. A generalized method has been developed whereby meteorological data, both observational and prognostic, can assist effectively in the prediction of airport acceptance rates.

Kellett Aircraft Corp., Willow Grove, Pa.
PRELIMINARY DESIGN OF AN AIRBORNE SUPPORT PLATFORM (ASP). Rept. for 23 June 59-8 Jan 60 on Kellett Model no. K-28, Contract DA 44-177-TC-597. 7 Jan 60, 126p. 16 refs. Rept. no. 173X90-2.
Order from LC mi$6.30, ph$19.80 PB 149 817

Presented in this report are the results of a preliminary design study of a tandem unshrouded rotor aircraft which would satisfy the Army's concept of an aerial jeep; the Kellett version is a more versatile vehicle and is designated as an Airborne Support Platform. Special design considerations, such as low silhouette, narrow operating width, provisions for rotor protective guards, and a vehicle that can be readily transported by the C-130 airplane, are of primary importance. The design study considers the effect of payload (500 lbs. versus 1000 lbs.) on the size, weight and power plant, with particular emphasis placed on the 1000 lb. payload vehicle. The power plant recommended is the T-63-A-3 shaft turbine engine planned for the 1960 - 1963 time period.

Lansdale Tube Co., Pa.
DIFFUSED-BASE R. F. POWER OSCILLATOR JUNCTION TRANSISTORS, by James D. McCotter. Quarterly progress rept. no. 1, 20 June-30 Sep 58, on Contract DA 36-039-sc-78051. [1958] 46p. Philco no. R-220-1.
Order from LC mi$3.30, ph$7.80 PB 149 114

The equipment necessary to fabricate the diffused-base rf power oscillator junction transistor has been assembled, and the fabrication process has been substantially determined. Testing and evaluation of experimental model transistors has shown that an extremely thin base width, and consequently a low collector diode breakdown voltage, is necessary to obtain the electrical characteristics for this device. The suggested specification limits reflect this fact. A mechanized electrolytic clean-up etcher, being developed, should result in a much higher degree of reproducibility and, consequently, a greater yield. (Author)

Naval Air Material Center, Philadelphia, Pa.
THE XEE EXPERIMENTAL ELECTRIC CATAPULT, by J. B. London. 15 Oct 43, declassified 27 Sep 58, 91p. 6 refs. Rept., Part 1 of 2, on TED no. NAM-3404.
Order from LC mi$5.40, ep$16.80 PB 149 613

This report released for sale to the public 11 Aug 60.

Naval Research Lab., Washington, D. C.
STUDIES ON THE FUEL-IGNITION-SUPPRESSION CAPABILITY OF FOAM-COVERED RUNWAYS FOR AIRCRAFT, by H. B. Peterson, E. J. Jablonski, and R. L. Tuve. Final rept. 22 July 60, 68p. 22 refs. NRL rept. 5492.
Order from OTS $1.75 PB 161 783

A comprehensive study has been made of foam-covered runways as a means of suppressing fuel ignition by friction sparks produced by emergency landings of disabled aircraft. The effectiveness of foam as a spark suppressant was found to be dependent on many variables, such as the type of runway construction, the type of aircraft metal, the flammability of fuel, and the depth and age of the foam. Aluminum alloy was found to be the least hazardous of the aircraft metals, since no friction sparks could be produced with this metal. Titanium was the most hazardous aircraft metal tested with respect to fuel ignition by friction sparks, and foam was found to be entirely ineffective as a spark suppressant. Foam spark-suppression effectiveness varied from 57 percent to 100 percent for magnesium alloy, stainless steel, and other aircraft steels tested. Incendive-spark suppression was attributed to the coating effect of the water layer at the runway-foam interface resulting from the continuous drainage of water from the foam mass. Optimum results were obtained with a 2-in. depth of foam (expansion 12, containing 0.1 gal water per square foot) that was evenly laid on the runway surface and that had aged for a 10-15 period. Procedures for properly outfitting existing Navy field equipment (MB-1 and MB-5 crash vehicles) and the material requirements for runway foaming have been established. (Author)

[Pacific] Missile [Range] Point Mugu, Calif.
DEVELOPMENT OF THE KDG-1 AND KD3G-1 TARGET PILOTLESS AIRCRAFT, by W. C. Slowey. Final rept. on Proj. TED MTC PA-604 (formerly TED PAU 1803). 24 June 49, declassified 12 June 56, 39p. 11 refs. Technical rept. no. 51.
Order from LC mi$3.00, ph$6.30 PB 148 629

A total of 66 KD3G-1 and 44 KDG-1 flights were conducted to determine the controllability, maneuverability, stability, rate of climb, maximum air speeds, and endurance of the target P/A. Several modifications that appeared necessary as a result of these tests were incorporated in production versions of the KDG-1 and KD3G-1, which were later designated as the KDG-2 and the KD3G-2, respectively. (Author)

Princeton U., N. J.
THE EFFECT OF CONFIGURATION ON THE LIFT AUGMENTATION RATIO OF A TWO DIMENSIONAL OPEN PLENUM GROUND EFFECT MACHINE, by Dean E. Wright. Rept. on Contract DA 44-177-TC-524. May 60, 133p. 2 refs. Rept. no. 516.
Order from LC mi$6.90, ph$21.30 PB 149 527

This report deals with the base pressure distributions of a two-dimensional open plenum ground effect machine model in simulated hovering flight. The following design parameters were varied, nozzle area/base area, side depth, mass flow, side inclination, and flow diversion. The effect of the variation of these parameters on the pressure distribution, hence lift augmentation was investigated. Flow patterns have been deduced from these distributions and from smoke studies. Also included are a brief theoretical investigation and an investigation into the effect of inclining the model. (Author)

Stanford U., Calif.
ON THE OPTIMUM RESPONSE OF THIRD ORDER CONTACTOR CONTROL SYSTEMS, by I. Flügge-Lotz and Mih Yin. Rept. on Div. of Engineering Mechanics Contract AF 49(638)513. 25 Apr 60, 144p. 13 refs. Technical rept. no. 125; AFOSR-TN-60-476.
Order from LC mi$7.20, ph$22.80 PB 148 921

This investigation is concerned with the optimum response for contactor or relay control systems. The systems are described mathematically by second and third order differential equations with constant coefficients and with a discontinuous forcing term, $\pm$ N. The performance criterion is that the time interval required for the control system to reduce an initial disturbance to zero should be minimum. Significant results toward the solution of the problem have been obtained either intuitively or rigorously by various previous investigators. In the present investigation an attempt toward the optimum solution is made with the aid of the maximum principle for systems with three characteristic roots.

Transistor Applications, Inc., Boston, Mass.
RESEARCH DIRECTED TOWARD THE STUDY, ANALYSIS AND DESIGN OF TRANSISTOR by A. W. Carlson. Scientific rept. no. 3, 1 Nov 59-29 Feb 60, on Contract AF 19(604)4089. Apr 60, 29p. AFCRC-TN-60-395.
Order from LC mi$2.70, ph$4.80 PB 148 556

This report describes work with nonlinear lines having a constant series inductance and voltage dependance shunt capacitance (such as a reverse biased junction diode). Experimentally, it is found that a signal applied to such a line acting to decrease line capacitance has its slope increased as it progresses

down the line. A solution for a wave traveling along a uniform lossless distributed line having a voltage dependent shunt capacitance or a current dependent series inductance is obtained. (Author) (See also PB 145 283)

Westinghouse [Electric Corp., East Pittsburgh, Pa.]
THE ELECTRIC CATAPULT. Rept. on Contract NOas-8114. 15 Dec 44, declassified 27 Sep 58, 41p.
Order from LC mi$3.30, ep$9.30 PB 149 612

This report released for sale to the public 11 Aug 60.

Westinghouse Electric [Corp.] East Pittsburgh, Pa.
ELECTRIC CATAPULT: DESCRIPTION OF APPARATUS, PERFORMANCE, AND STATUS OF PRODUCTION TO DATE. Rept. on Contract NXsa-15165 (NOas-684). 10 May 43, declassified 27 Sep 58, 46p.
Order from LC mi$3.30, ep$9.30 PB 149 614

This report released for sale to the public 11 Aug 60.

Wichita U., Kansas.
SHROUDED PROPELLER INVESTIGATIONS: SHROUD AND CENTERBODY PRESSURE DISTRIBUTIONS OF A SHROUDED PROPELLER WITH A 17-BLADED ROTOR, INLET AND EXIT STATORS AND LONG CHORD SHROUD, by Vernon O. Hoehne. Rept. on Contract Nonr-201(01). Oct 59, 100p. 1 ref. Engineering rept. no. 213-9; AD-230 440.
Order from LC mi$5.40, ph$15.30 PB 149 484

The static pressure distribution on the surface of the shroud and centerbody of a shrouded propeller model was measured in the wind tunnel. The shrouded propeller model embodied 18 adjustable inlet guide vanes, 17 propeller blades, and 19 exit stator vanes; and was equipped with a centerbody or hub having a hub-tip ratio of 0.4. The model incorporated 3 interchangeable shroud inlets: 2 designed for static and low speed operation, and 1 for high speed flight. Pressure distributions were obtained for a range of external advance ratios from approximately 0.20 through 1.50. at angles of attack from zero to 90° and with 3 inlet vane settings. Results are presented as pressure coefficient plotted against model axial location in per cent of chord at various constant values of advance ratio. (Author) (See also PB 140 348)

Wichita U., Kansas.
A METHOD OF DESIGN OF SHROUDED PROPELLERS, by Vernon O. Hoehne and Richard E. Monical. Rept. on Contract Nonr-201(01). Oct 59, 37p. 9 refs. Engineering rept. no. 213-8; AD-228 388.
Order from LC mi$3.00, ph$6.30 PB 149 483

One method of designing shrouded propellers using information derived by several authors was developed and used to design several wind tunnel models. An outline of the resultant design procedure is included along with appropriate discussion pertaining to the method. Results of tests of one of the models designed by these procedures are compared with predicted data to establish, for one case only, the validity of the method. The comparison shows that this system of design predicted performance within the range of normal design accuracy. Predicted efficiency was several percentage points lower than achieved efficiency. (Author)

Chemical Engineering

California Inst. of Tech., Pasadena.
VISCOSITY OF FLUIDS AT HIGH PRESSURES. A ROTATING CYLINDER VISCOMETER AND THE VISCOSITY OF n-PENTANE, by H. H. Reamer, G. Cokelet, and B. H. Sage. Rept. on Project Squid, Contract Nonr-1858(25). Jan 59, 36p. 34 refs. Technical rept. CIT-4-P.
Order from LC mi$3.00, ph$6.30 PB 146 540

A rotating cylinder viscometer suitable for measurements at pressures up to 25,000 pounds per square inch in the temperature interval between 0° and 500°F. is described. Experimental measurements which have been obtained for n-pentane are included as an example of the results to be expected with this instrument. (Author)

Cornell U., Ithaca, N. Y.
AN INTEGRAL PROCESSING UNIT USING A SECONDARY REFRIGERANT, by H. F. Wiegandt. Rept. on Saline Water Conversion by Freezing, Contract 14-01-001-107. Aug 60, 51p. 13 refs. Saline Water Research and Development Progress rept. no. 41.
Order from OTS $1.50 PB 161 906

Large sea water conversion plants which in their operating cycle produce ice with the use of a direct-contact, immiscible refrigerant should ultimately be able to produce potable water with a work-energy requirement of less than 6 Btu per pound of product. The present design for a 10 million gallon per day plant shows a requirement of 11.8 Btu per pound of product with an estimated product cost of $0.38 per thousand gallons. The plant cost is equivalent to $0.67 per daily gallon. An integral unit is projected in which a washing zone serves as a hydraulic seal between the freezing and melting zones. A rapid direct-freezing step, a washing operation in which the ice bed is propelled by a hydraulic piston action, and a melting step in which refrigerant is condensed directly on dumped bulk ice are the major contributions of this work. (Author)

Dow Chemical Co., Midland, Mich.
A STUDY OF VAPORIZABLE EXTINGUISHANTS, by David L. Engibous and Theodore R. Torkelson. Rept. for 1 July 58-Aug 59 on Contract AF 33(616)5838. Jan 60, 124p. 73 refs. WADC Technical rept. 59-463.
Order from OTS $2.75 PB 161 942

Bromochloromethane (CB) is now used as the vaporizing liquid fire extinguishing agent on crash trucks as a supplement to mechanical protein foam, which is the primary means of combatting flammable liquid fires. CB is recognized to present a toxicity problem of ill-defined magnitude. Other agents have been proposed as replacements for CB and this study evaluated the

following compounds for this purpose: Dibromodifluoromethane, Halon 1202; Bromochlorodifluoromethane, Halon 1211; Bromotrifluoromethane, Halon 1301; 1, 2-Dibromotetrafluoroethane, Halon 2402; CB was used as a standard of comparison throughout. A comprehensive survey and analysis of existing literature on these agents which covers effectiveness, toxicity, physical properties, test methods, and dispensing techniques is included. As a result of this study, Bromochlorodifluoromethane (Halon 1211) appears as a promising agent for optimum ground fire protection.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
APPARATUS FOR ZONE REFINING HIGHLY REACTIVE METALS, by G. E. Spangler, M. Herman, and J. L. Rutherford. Rept. on Contract AF 18(600)1581. July 60, 12p. Interim rept. I-A1878-5; AFOSR-TN-60-693.
Order from OTS $0.50 PB 161 929

The development of improved apparatus for the purification of highly reactive metals by the floating zone technique is described. The resultant design consists of a hermetically sealed, all-glass system using a static inert atmosphere which is internally gettered. The apparatus is simple to construct, easy to operate, and provides an absolute minimum of contamination from gaseous impurities. (Author)

Civil Engineering

Arctic Inst. of North America, Washington, D. C.
POLAR HOUSE. Technical rept. on National Science Foundation Grant no. 8987. [1960] 35p.
Order from LC mi$3.00, ph$6.30 PB 148 963

This report covers the planning, development, construction, shipment and erection procedures for the Polar House.

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 2. INSPECTION GUIDES-ELECTRICAL. 2 June 58, 64p. 16 refs. Technical pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from OTS $1.50 PB 161 959

Previously announced in USGRR, v. 34, no. 4, 14 Oct 60, as PB 147 652.

See also PB 147 655

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 3. INSPECTION GUIDES-MECHANICAL. June 58, 78p. 22 refs. Technical pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from OTS $2.00 PB 161 960

Previously announced in USGRR, v. 34, no. 4, 14 Oct 60, as PB 147 653.

See also PB 161 959

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 4. INSPECTION GUIDES-STRUCTURAL. June 58, 48p. 16 refs. Technical Pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from OTS $1.25 PB 161 961

Previously announced in USGRR, v. 34, no. 4, 14 Oct 60, as PB 147 654.

See also PB 161 960

Naval Civil Engineering Lab., Port Hueneme, Calif.
HOLD-DOWN CLAMP FOR 3 x 15 PONTOON CAUSEWAY, by J. V. Stalcup. Final rept. 28 June 60, 21p. Technical rept. 076.
Order from LC mi$2.70, ph$4.80 PB 149 156

Hold down clamps secure causeways to an LST during side carry operations. Ten hold down clamps were tested and all held a greater load then 32,000 lb. BuDocks No. 2, PHIBCB Two No. 1, and NCEL No. 3, appeared comparable on the basis of strength weight, cost, and ease of installation. It is recommended that these three clamps be in-service tested for securing 21-ft wide causeways for side carry. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
NEW AND MODIFIED ANCHORS FOR MOORINGS, by R. C. Towne and J. V. Stalcup. Final rept. 14 Mar 60, 141p. 9 refs. Technical rept. 044.
Order from LC mi$7.20, ph$22.80 PB 149 998

This report released for sale to the public 9 Sep 60.

This report describes the design and development of a family (200 lb, 6,000 lb, 9,000 lb, 12,000 lb) of new mooring anchors which is lightweight, performs efficiently in sand or mud bottoms, and provides a range of holding powers of 6,000 to 10,000 lb. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
WAREHOUSE AND PRESERVATION METHODS AND ECONOMICS FOR STORING MATERIAL, by R. J. Zablodil and J. C. King. Interim rept. 28 June 60, 114p. 9 refs. Technical rept. 075.
Order from LC mi$6.00, ph$18.30 PB 149 233

To evaluate storage and preservation methods, paired equipment is being stored for 5 years in open air, shed and standard, 40% R H and 50% RH warehouses. One of each pair is domestic and the other contact preserved. Results after 2-1/2 years show open air poor, shed fair, standard warehouse good and the RH warehouses best in protective ability. Contract preservation prevents rust better than domestic preservation, and it is cheaper to store non-automotive, metal equipment in the 50% RH warehouse. The test will continue for 2-1/2 more years. (Author)

Electrical and Electronic Engineering

Aberdeen Proving Ground, Md.
PROCEEDINGS OF THE CONFERENCE ON RELIABILITY AND MAINTENANCE OF ELECTRONIC EQUIPMENT, 4-5 OCTOBER 1955, AT THE ABERDEEN PROVING GROUND, Maryland. [1955] 107p. 3 refs.
Order from LC mi$5.70, ph$16.80 PB 149 200

This report released for sale to the public 31 Aug 60.

Contents:
Are reliability and complexibility incompatible
A practical approach to reliability
Electron tube reliability in antiaircraft fire control equipment at Fort Bliss
Conductance technique as applied to the vacuum tube reliability problem
Reliability through semi-conductors
Component reliability specifications
A reliability test program for electronic equipment
Diagnosis of radar fire control maintenance during World War II and its effect on reliability
Preventive maintenance - keep it simple and effective
Reducing the time required for troubleshooting complex systems
A modern approach to the maintenance support of a guided missile system
Design consideration affecting reliability
Achieving reliability in complex electronic equipment
Sound engineering - the foundation of equipment reliability

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
ANALYSIS OF TINKERTOY TECHNIQUES AS APPLIED TO RADAR SET AN/APN-22. Phase rept. on TED Proj. ADC EL-44020. 25 Jan 55, 16p. 2 refs. Rept. no. NADC EL-L5502
Order from LC mi$2.40, ph$3.30 PB 146 966

The Tinkertoy technique, i.e. the Modular Design of Electronics (MDE), is the assembly of electronic equipment by the use of modules which are dimensionally standardized yet have a wide range of electronic applications. A module is a stacked assembly of ceramic wafers imprinted with circuit patterns and bearing miniature electronic parts. The automatic method of manufacturing wafers, processing the imprinted circuits, applying the parts and components, assembling the modules, and performing complete inspections and tests, are referred to as Mechanized Production of Electronics (MPE), but more specifically as the application of Tinkertoy techniques.

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
EVAPORATIVE COOLING OF AIRBORNE ELECTRONIC EQUIPMENT BY SPRAY AND PACKED CHAMBER TECHNIQUES, by Leonard F. Tomko. Phase rept. on TED Proj. ADC EL-9021. 19 Apr 57, 26p. 4 refs. Rept. no. NADC-EL-5712; AD-139 012.
Order from LC mi$2.70, ph$4.80 PB 148 423

An investigation of a spray chamber cooling system and a packed chamber cooling system was made to determine their performance characteristics and to determine whether a theoretical mathematical analysis could be correlated with empirical data. A simulated model of an electronic package was used to gather the data. Air and water flowed countercurrently through a diffusion chamber within the simulated electronic package where the simultaneous heat and mass transfer occurred. A mathematical design technique is described and equations are derived relating the average electronic equipment case temperature to the variables in the simultaneous heat and mass transfer system. The results of the tests showed that a spray chamber cooling system is adequate to maintain case temperatures from 80° to 130° F under the following conditions: (1) airflow and water-flow rates varying from 40 to 100 lb/hr; (2) air temperatures varying from 90° to 260° F; (3) water temperatures varying from 35° to 160° F; (4) an average dewpoint temperature of 52° F for the incoming air; and (5) a 500-watt load at sea level. The packed chamber cooling system is adequate to maintain case temperatures from 116° to 154° F under the following conditions: (1) airflow rates from 40 to 160 lb/hr; (2) water-flow rates from 40 to 106 lb/hr; (3) average air temperature of 109° F; (4) average dewpoint temperature of 55° F; (5) average water temperature of 112° F; and (6) a 1000-watt load at sea level. (Author)

Airborne Instruments Lab., Inc., Mineola, N. Y.
RADIO NAVIGATION AIDS IN COMMON AIR-TRAFFIC CONTROL SYSTEMS, by L. A. Hartman, J. P. Hektner, and A. Tatz. Final engineering rept. on Contract AF 30(602)1444. May 57, 84p. 4 refs. Rept. no. 3580-1; RADC TR-57-132; AD-131 200.
Order from LC mi$4.80, ph$13.80 PB 149 255

Existing and proposed navigation systems were studied to determine their potential usefulness in the common system of air-traffic control (ATC). The system included Decca, Cytac, Tacan, VOR, the Radio-Web system of the French Society of Telecommunications, Doppler navigators, Navatec, and Egecon (electronic geographic coordinate navigation facility). The following conclusions were reached. Increased navigation accuracy is needed for more efficient airspace use to provide safe, efficient, and expeditious aircraft movements in major multiple-airport complexes. For optimum airspace use, the navigation equipment must provide flight paths independent of the lines of position determined by the radio navigation aid. The ATC system should be based on the economic use of facilities commensurate with the requirement in the particular airspace covered. LF hyperbolic systems can provide greater accuracy at a much lower cost for ground installations than the presently planned navigation aids if (1) means can be found to integrate Cytac or Decca into the ATC system, (2) noise interference will not be a serious limitation, and (3) sufficiently lightweight and economic airborne receivers can be built. The ability of an aircraft to fly a prescribed ground-referenced flight path depends on the accuracy of the navigation aid, the aircraft's control characteristics, and knowledge of the rate of displacement from the path. If the latter is supplied by airborne sensors, the information rate from the ground aid can be greatly reduced.

Airborne Instruments Lab., Inc., Mineola, N. Y.
SITE REFLECTIONS ON ILS GLIDE-SLOPE FACILITIES, by A. Tatz. Final engineering rept. on Contract Cca-28688. Oct 53, 94p. 2 refs. Rept. no. 830-2.
Order from LC mi$5.40, ph$15.30 PB 147 954

The ILS glide-slope facilities are considered with respect to the effects of reflecting surfaces in the propagation path. Reflection from terrain is the main feature that determines the quality of system performance. Ground-reflected energy is shown to have variable phase and amplitude, and this variation causes deterioration from ideal performance. Charts are presented to allow calculation of the variable phase and amplitude and of the deterioration of performance. Flight data are submitted to corroborate the extent of deterioration in performance factors. Site criteria are provided to determine the expected performance under various conditions of sites and flight paths. (Author)

Aircom, Inc., Winthrop, Mass.
INVESTIGATION OF HIGHLY DISPERSIVE LOW LOSS TRANSMISSION LINE DEVICES, by R. A. Rivers. Final rept. for 1 Feb 57-30 June 58, on Contract AF 19(604)2136. [1958] 46p. 4 refs. AFCRC-TR-58-155; AD-152 433.
Order from LC mi$3.30, ph$7.80 PB 146 675

A figure of merit is given for comparing dispersive structures for the ratio of dispersion to losses. This figure of merit is employed in comparing several dispersive structures. The figure of merit is related to group velocity and Q. Design data is given for dispersive structures employing periodic loading in ridge guide and in a newly developed ridge trough guide. One structure matched to a 50 ohm input and output has a phase shift of 2.27π between input and output for a 10% frequency shift. This unit has an input VSWR of 1.6 or less over a 10% frequency band and has an insertion loss of 1.8 db or less. (Author)

Applied Physics Lab., U. of Washington, Seattle.
ASTOR RELIABILITY PROGRAM. Rept. on Subcontract NOrd-12937 to Contracts NOrd-17542 and 17647. 1 Aug 58, rev. 1 Feb 60. [1960] 43p. 5 refs. APL/UW/TE/58-25; AD-213 398.
Order from LC mi$3.30, ph$7.80 PB 148 456

Various methods of obtaining circuit reliability are discussed and some methods of computing circuit reliability are shown. A detailed description is given of the Reliability Program. The group organization, and methods of applying reliability concepts to the complete ASTOR program, are discussed. (Author)

Armour Research Foundation, Chicago, Ill.
HIGH POWER TRANSDUCERS, by H. B. Karplus and R. R. Whymark. Quarterly rept. no. 1 on Contract [Nonr]-2900(00). 14 Oct 59, 4p. ARF 1149-1.
Order from LC mi$1.80, ph$1.80 PB 149 877

Several aspects of high power magneto-striction transducer design have not been dealt with adequately in the past. Two of these are the primary concern of this project. One is the loading of the transducer and the other is the utilization of nonlinear parameters.

Army Ballistic Missile Agency, Redstone Arsenal, Ala.
DEVELOPMENT OF PRINTED CABLES AND CONNECTORS, by Wilhelm Angele. 30 June 59, 25p. DG-TR-14-59.
Order from OTS $0.75 PB 161 927

Presented at the 3rd National Convention on Military Electronics in Washington, D. C. Sponsored by the I. R. E., June 30, 1959.

Army Ballistic Missile Agency, Redstone Arsenal, Ala.
PRINTED CABLES AND CONNECTORS. Development rept. no. 3. 18 Feb 60, 95p. Rept. no. DG-TR-4-60.
Order from LC mi$5.40, ph$15.30 PB 149 095

The materials and their features are reviewed and compared with other applicable products. From this comparison conclusions may be drawn as to the advantages of these materials. The product details discussed provide useful information for manufacturers and customers. Mechanical and electrical characteristics of printed cables are outlined and test results are discussed and graphically presented. A complete section of the report establishes requirements for connectors and the necessary application and functional data. Installation, routing, cable end preparation, and fastening techniques are suggested which demonstrate the application and service capabilities of printed cables. Proposals are submitted for printed cable standardization.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
DESIGN AND DEVELOPMENT OF A PRECISION 400-CYCLE GENERATOR, by Stanley S. Schodowski. 28 Feb 58, 28p. 4 refs. Engineering rept. no. E-1225; AD-160 088.
Order from LC mi$2.70, ph$4.80 PB 149 417

This report describes in detail the design of a 400-cps generator having a high degree of frequency stability and reliability. Considerations given to the choice of resonator, frequency divider and power amplifier are thoroughly treated in connection with meeting all technical requirements. A proven crystal oscillator design procedure is employed in arriving at an optimum design of a highly stable crystal oscillator. Frequency dividers and power amplifiers are designed for maximum performance reliability. Test results are given which indicate the satisfactory performance of the ABMA Precision 400 cps Generator. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PROGRESS IN THE U. S. DURING THE LAST THREE YEARS ON FREQUENCY AND TIME INTERVAL STANDARDS AND MEASUREMENTS, by E. A. Gerber. 20 May 60, 10p. 60 refs. USASRDL Technical rept. 2119.
Order from LC mi$1.80, ph$1.80 PB 149 416

The progress in U. S. during the last three years in the fields of quartz crystal standards, atomic frequency and time standards, and frequency and time measurement and comparison is reviewed. An attempt has been made to describe briefly the most important results of research and development in the above fields, based on the pertinent papers which have been published since May 1957. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
STATIC CAPACITANCE FORMULA FOR A QUARTZ BAR EXCITED IN THE Y'X MODEL OF FLEXURE, by Arthur D. Ballato. 15 Dec 58, 17p. 4 refs. USASRDL Technical rept. 2009; AD-220 105.
Order from LC mi$2.40, ph$3.30 PB 149 414

Quartz oscillators for operating in the Y'X mode of flexure have 2 pairs of electrodes arranged on the major surfaces of the plate, in contrast to most other modes where all the electrodes are parallel. Thus the simple formula for the static capacitance of parallel plates cannot be used. By considering the basic relations between capacitance and energy stored in an electric field, a formula is obtained for the static capacitance, C_o, for the Y'X mode. (Author)

[Army] Signal [Research and Development Lab.] Fort Monmouth, N. J.
TECHNICAL MINUTES OF THE HYDROGEN THYRATRON SYMPOSIUM [NO. 3] HELD AT THE PENTAGON, WASHINGTON, D. C., ON 27-2o MAY 1953, by H. J. Sullivan and M. H. Zinn. 1 Aug 55, 201p.
Order from LC mi$9.30, ph$31.80 PB 149 386

Contents:
Purpose of symposium and general discussion of the results of second symposium
Use of the JAN hydrogen thyratron specification by equipment manufacturers
Design and measurement of hydrogen thyratron modulator characteristics
Thyratron drive requirements and trigger circuits
Miniature tube drivers for high power hydrogen thyratrons
Universal hard tube driver
Use of hydrogen thyratrons as clippers
Effects of driver voltage and source impedance and peak anode charging voltage on pulse time jitter in the 5948 hydrogen thyratron
Arcing behavior in pulsed magnetrons
Magnetron softening circuits
Operation of hydrogen thyratrons at conditions other than JAN Test
Multiple operation of hydrogen thyratrons
System jitter requirements and jitter measuring equipment
Measurement of time jitter of thyratron pulses
Hydrogen reservoirs in hydrogen thyratrons
The multiple line modulator

Army Signal [Research and Development] Lab., Fort Monmouth, N. J.
TEMPERATURE RISE STUDY, by Abraham Rand. 1 Aug 57, 37p. 1 ref. Engineering rept. no. E-1207.
Order from LC mi$3.00, ph$6.30 PB 147 819

A practical approach is presented for measuring temperature rise rapidly and accurately. It is shown that it is possible to measure temperature rise on an open bench in a varying ambient with better accuracy than present methods in a carefully controlled chamber. The feasibility of eliminating the constant temperature test chamber for most tests is demonstrated. Correlation is of the order of $1^{o}C$ per $40^{o}C$ rise, and repeatability is of the order of a few tenths of a degree centigrade.

Arnold Engineering Development Center, Tullahoma, Tenn.
THE DESIGN AND EVALUATION OF A SIX CHANNEL, D-C COUPLED, TRANSISTORIZED GALVANOMETER DRIVER AMPLIFIER WITH CURRENT LIMITERS, by W. M. Crouch. Rept. on ARO, Inc., Contract AF 40(600)800. June 60, 28p. 3 refs. AEDC-TN-60-96; AD-237 627.
Order from LC mi$2.70, ph$4.80 PB 148 099

A d-c amplifier to drive recording galvanometers and to work in conjunction with analog magnetic tape systems has been designed and fabricated at AEDC. This amplifier has an input impedance compatible with the tape systems, unity or greater voltage gain, very low output impedance, and a frequency response which allow its use with all existing recording galvanometers The unit has built-in current limiters which allow its use with low frequency, low current galvanometers without subjecting the galvanometer to the possibility of being overdriven from random signals or noise. The amplifier was tested for gain, frequency response. drift, phase shift, distortion, common mode rejection, input and output impedance, linearity, output noise level, line voltage interaction, and cross talk. (Author)

Avco-Everett Research Lab., Mass.
AN EXPERIMENTAL MAGNETOHYDRODYNAMIC POWER GENERATOR, by Richard J. Rosa. Rept. on Contract AF 04(647)278. Jan 60, 9p. 3 refs. AMP 42; AFBMD-TN-60-1; AD-233 684.
Order from LC mi$1.80, ph$1.80 PB 147 217

A description is presented of an experimental magnetohydrodynamic generator that was constructed at the Avco-Everett Research Laboratory. Some basic aspects of its performance are summarized. Included is a discussion of the term efficiency as applied to magnetohydrodynamic generators. (Author)

Avco-Everett Research Lab., Mass.
MAGNETOHYDRODYNAMIC ENERGY CONVERSION TECHNIQUES, by Richard J. Rosa and Arthur R. Kantrowitz. Apr 59, 20p. 5 refs. Research rept. 86, formerly Research note 120; AD-233 689.
Order from LC mi$2.40, ph$3.30 PB 147 216

An introductory account is presented of the basic theory of magnetohydrodynamic (MHD) generators, the characteristics of such devices, and the electrical properties of gases. Shock tube experiments which demonstrate some of the fundamentals of MHD flow are described. (Author)

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATIONS OF RHENIUM FOR ELECTRON-TUBE APPLICATIONS, by D. J. Maykuth, G. B. Gaines and others. Final rept. for 1 July 56-31 Mar 60 on Contract AF 19(604)1741. Mar 60, 94p. 40 refs. AFCRC-TR-60-153.
Order from LC mi$5.40, ph$15.30 PB 149 169

The reactions of unalloyed and thoriated rhenium with carbonaceous and boron-containing atmospheres and with Al_2O_3 were investigated. Rhenium is relatively inert to Al_2O_3, is hardened by carbon, and reacts readily with boron trichloride to form brittle borides. Rhenium and rhenium-coated tungsten show excellent resistance to water-cycle attack. While rhenium does not show unusual properties in alkaline-earth cathodes, rhenium matrices containing tungsten and molybdenum show promise for application in pressed-dispenser-type cathodes. The workability to fine wire and properties of molybdenum-, tungsten-, and tantalum-base alloys containing rhenium were studied. Increasing additions of rhenium to molybdenum and tungsten greatly improve the hot workability, hot strength, low-temperature ductility, recrystallization characteristics, and weldability of these metals. Alloys based on Mo-28Re or W-25Re show optimum properties which should make them of interest for use as high-temperature structural and electrode components in electron-tube devices. (Author) (See also PB PB 151 523)

Bell Telephone Labs., Inc. [New York]
IMPROVED ELECTROLYTIC CAPACITORS, by D. A. McLean, N. Schwartz and others. Final rept. for 1 Feb 58-15 Jan 60 on Contract DA 36-039-sc-74996. 15 Jan 60, 48p. 5 refs. Rept. no. 25309-E; AD-232 690.
Order from LC mi$3.30, ph$7.80 PB 149 024

Al, Ti, W, Zr, and Cb were investigated as anodes for solid electrolytic capacitors. Clear interference-colored anodic oxide films can be formed on titanium and tungsten, but both oxides are unstable in either wet or solid capacitors. A rating of 35V at 150°C appears possible for aluminum wire anode capacitors. Thermal treatment and selective etching of the dielectric film yielded improved capacitance, dissipation factor, and leakage for porous anode aluminum capacitors. The initial leakage remains undesirably high but decreases markedly during life test. Zirconium wire anode capacitors were prepared with a tentative rating of 60V at 85°C; similar results with porous anodes were not achieved because purification of the metal does not occur at a sintering temperature 200°C below the melting point. Porous anode niobium capacitors with 6V and 20V ratings have electrical properties comparable to tantalum units, but have the advantage of yielding a higher capacitance-per-anode weight. Although resintered niobium foil can be anodized to 225V, porous pellets start to develop a crystalline film at about 100V. The crystallization is believed responsible for the poor life test stability of 35V rated capacitors. A selective etching process of the oxide film was used to improve the leakages of niobium capacitors. Models were prepared of 6V and 20V rated niobium capacitors. (Author)

Bell Telephone Labs., Inc. [New York]
MICROWAVE SOLID-STATE DEVICES. Interim rept. no. 11, 1 July-30 Sep 59, on Contract DA 36-039-sc-73224. 15 Nov 59, 36p. 11 refs. AD-232 689.
Order from LC mi$3.00, ph$6.30 PB 149 016

Slow-wave structures to be used in traveling wave masers have been studied for a frequency of 2390 mc. Resonance isolators have been operated using yttrium iron garnet at liquid helium temperature and at the magnetic field called for by the ruby maser operation. On the basis of these results, the development of a ruby traveling wave maser for this frequency has been initiated. A theory of high power performance of traveling wave masers has been developed. It suggests a novel utilization of traveling-wave masers as energy storage and conversion elements. Low-temperature noise measurements on a diffused germanium varactor diode have been obtained for amplification in the degenerate mode at a frequency of 6 kmc/sec. Excess noise temperature is determined as a function of the diode operating temperature in the range from near liquid nitrogen temperature to room temperature. Harmonic generation at relatively high-power levels has been achieved using diffused-silicon-junction diodes. The diodes used are "gradual grade" units, in the sense that their impurity gradients are substantially less than those of the silicon varactor diodes, although they are designed to minimize series resistance to ensure maximum cut-off frequency. (Author) (See also PB 144 934)

Bell Telephone Labs, Inc. [New York].
MICROWAVE SOLID-STATE DEVICES. Interim rept. no. 12, 1 Oct-31 Dec 59, on Contract DA 36-039-sc-73224. 15 Jan 60, 29p. AD-235 853.
Order from LC mi$2.70, ph$4.80 PB 149 017

Starting with a four terminal network representation, the impedance transformation from the semiconductor region of a mesa diode to a transmission line is discussed. It is shown that, under certain assumptions, the transformation between measured reflection coefficient and device impedance can be formulated in a simple way, and may be arrived at through a series of operations on a Smith chart. Proper use of impedance standards can determine the transformation. Experiments (conducted at a single frequency only) indicate validity of the assumptions, one of which is the appropriateness of the impedance concept itself. Using these measurement techniques, the impedance of a considerable number of diffused silicon mesa varactor diodes has been evaluated. The experimental results, obtained using diffused silicon from a single run with a fixed impurity gradient, indicate a dependence of Q (measured at 1 kmc per sec.) on the area of the diffused junction. This is attributed to the presence of an equivalent series resistance, some of which must be attributed to losses near the active region of the device. The magnitude of this series component is enough to begin limiting the cut-off frequency obtainable with diffused wafers when the junction capacity sizeably exceeds two or three pf. Possible reasons for these losses are discussed. (Author) (See also PB 149 016)

Bell Telephone Labs., Inc. [New York].
NIKE B. TRACKING RADAR SERVOS. CASE 27675-2, by J. E. Tarr. Memo. for file. 2 Dec 55, 6p.
Order from LC mi$1.80, ph$1.80 PB 150 145

This report released for sale to the public 13 Sep 60.

Bell Telephone Labs., Inc., [Whippany, N. J.]
STUDY OF SOLDERLESS WRAPPED CONNECTIONS FOR MILITARY COMMUNICATION EQUIPMENTS, by S. J. Elliott. Final rept. on Task BN; Technical rept. no. 15 on Engineering Services on Task Studies of Military Communication Systems, Contract DA 36-039-sc-52593. 21 June 56, 50p. AD-133 953.
Order from LC mi$3.30, ph$7.80 PB 147 920

Pertinent information, accumulated during the development of solderless wrapped connections for Bell System use, is reviewed in this report. The solderless wrapped connection is described, its advantages and disadvantages are enumerated, and parameters that influence its reliability are discussed. Solderless wrapped connections have a reasonable prospect of performing reliably in military communication equipments. Additional tests should be made, however, to evaluate their reliability under the environmental conditions of military service. Solderless wrapping would be advantageous in the manufacture of military communication equipments, provided the equipments are designed for solderless wrapping. Guidance for design is included. The problem of changing connections (where insufficient slack is available in an existing lead) would limit the usefulness of solderless wrapping for maintenance. This limitation, however, would not preclude the use of solderless wrapping in manufacture. (Author)

Bendix Aviation Corp., Eatontown, N. J.
Ge PNP DRIFT BASE POWER TRANSISTOR, by Charles Z. Leinkram, H. Newman, and W. C. Waldron. Final rept. no. 4, 15 July 58-15 Dec 59, on Transistors, Power, Drift Base, Germanium PNP, Contract DA 36-039-sc-78149. [1959] 113p. AD-235 673.
Order from LC mi$6.00, ph$18.30 PB 149 117

The production refinement program is presented for the 2N1430 drift base power transistor. This device is characterized by very fast switching times at high collector currents, high-frequency response, low saturation resistance, and excellent high temperature stability. The refinement of development techniques so that production of the drift base power transistor could be readily achieved required the optimum employment of conventional transistor technology and the use of new and imaginative fabrication methods. The resulting processes not only yielded production techniques capable of low cost manufacture of the unit but also gave a greater understanding of the technology of the devices. The introduction of new concepts in diffusion and slice preparation, and the use of special emitter alloys resulted in better yields, greater reliability and better performance of the transistor. Testing and evaluation of the product has continued beyond completion of the contract requirements. The results of this further evaluation indicates a greater device capability than called for in the contract specifications. Some parameter measurements of a higher current transistor, B1037B, are included. (Author)

Case Inst. of Tech., Cleveland, Ohio.
SHUNT SUSCEPTANCE OF PLANAR ARRAYS OF CONDUCTING DISCS, by Ronald A. Gardner. Master's thesis. Scientific rept. no. 13 on Contract AF 19(604)3887. 25 Apr 60, 71p. 8 refs. AFCRC-TN-60-533 (or 553).
Order from LC mi$4.50, ph$12.30 PB 148 745

The value of shunt susceptance is computed for a planar array of conducting discs using small aperture theory. Static and dynamic interaction effects are considered. Computed values of shunt susceptance are compared with experimental values. Using experimental values of shunt susceptance, a propagation constant is determined for disc type artificial dielectric. (Author)

Case Inst. of Tech., Cleveland Ohio.
A TRANSISTOR REGULATED POWER SUPPLY FOR A HIGH CURRENT MAGNET, by Kenneth C. Brog. Master's thesis. Technical rept. no. 2 on Contract Nonr-1141(07). Aug 59, 42p. 9 refs. AD-229 365.
Order from LC mi$3.00, ph$6.30 PB 148 179

Current regulation of a high current electromagnet utilizing power transistors in series was achieved. A sampling voltage, obtained from a sensing resistor in series with the magnet, is compared with a reference voltage; the error signal is sufficiently amplified and fed back to the series transistors thru a 2 stage transistor driver. Magnetic fields from 845 gauss to 8550 gauss with field regulation of a few parts per million over this range were obtained. (Author)

[Centre de Physique, Eléctronique et Corpusculaire (France)]
DESIGN AND DEVELOPMENT OF UHF PROTOTYPE CARCINOTRON TUBES WITH MAGNETS. Final rept. on Contract AF 61(514)917. Dec 57, 113p. 1 ref. WR.204; RADC TR-58-62; AD-148 714.
Order from LC mi$6.00, ph$18.30 PB 147 808

Development was conducted on 2 UHF prototype carcinotron tubes with magnets to cover the 200- to 400-mc band. Design requirements called for a minimum HF output power of 5 kw. The 2 tubes are the CM 32 covering the 200- to 300-mc band the the CM 34 covering the 300- to 400-mc band. A convenient interdigital line was chosen to deliver the wanted RF power in the given tuning range. Main disadvantages of the tubes are the large dimensions. These dimensions can be reduced with a short finger line and the CM 34 will be designed with a finger length of 140 mm and the CM 32 with a finger length of 200 mm. The RF properties, especially the dispersion characteristics and matching problem of the line and output device, were examined. The main difficulty experienced was the rather close-by cutoff of the line. The design of the sole and collector is given, and only a very closely shielded collector suppressed parasitic plate current. Means were tried for improving the heat transfer between the absorbing layer and the cooling medium. The most satisfactory device for heat transfer is a glass tube with Kovar contacts covered by an inner aquadag layer protected by Araldite. To avoid heat transfer between 2 faces of an insulator, the cooling liquid is made a conductory (salt water with a concentration of 30 to 40 g/liter is satisfactory).

Centre de Physique Electronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE T. C. M. 16, by G. Wendt. Quarterly rept. no. 1 on Contract N-62558-2275. 1 Sep 59, 22p. W. R. 434
Order from LC mi$2.70, ph$4.80 PB 148 868

Several tubes were mounted with guns which were described previously: their characteristic curves showed up a beam current to collector plus aperture current ratio which was satisfactorily constant. The target behavior inside the tube with the new gun was studied. Various abnormal effects appear on that tube and this new coplanar effect has not been explained. (See also PB 146 261)

Centre de Physique Electronique et Corpusculaire (France).
WIDE DYNAMIC RANGE BARRIER GRID STORAGE TUBE T. C. M. 14, by G. Wendt. Final rept. for May 57-Jan 59 on Contracts N62558-(14)-1667 and N62558-(14)-1932. 31 Oct 59, 178p. 2 refs. W. R. 457; AD-228 840.
Order from LC mi$8.10, ph$27.30 PB 149 876

Contents:
How to improve the output signal amplitude and the charge and discharge factors
- Conventional theory of charge deposition and withdrawing on the dielectric surface of a tube T. C. M. 14
- Main parameters (I_W, I_R, τ, σ_A, C, Δt) influence on the reading signal amplitude according to the way the tube is used
- Measurement of the target main electronic properties
- Tentative explanations of the anomalies observed during the tube measurements

Improvement of the resolution
- Methods for measuring the resolution
- Improvement of resolution at the target center shielded collector given up
- Improvement of the resolution at the target edges
- Some disturbing effects

Output signal irregularities
- Definition of the various signal irregularities
- Low frequency irregularities
- High frequency irregularities

Target technology
- Conventional targets
- Targets having embedded barrier grids
- Thick dielectric targets

Characteristics of the final tube T. C. M. 14
- Static operating data
- Dynamic data

(See also PB 146 261)

Chatham Electronics, Livingston, N. J.
IMPROVED BALLAST TUBE FILAMENT MATERIALS, by R. Spencer and W. Buchanan. Final rept. for 15 July 58-14 Oct 59 on Contract DA 36-039-sc-78158. [1959] 75p. 4 refs. AD-234 904.
Order from LC mi$4.50, ph$12.30 PB 149 025

Comparison information is presented in the data and in the graphs for various types of iron filaments operated in hydrogen, helium, neon, argon, and xenon. The tube life test data was obtained by running the filaments on various continuous and intermittent operation. The results indicate that most promising filament type is the gold-platinum plated iron filaments operating in 100% helium. No burnouts or changes in current out of prescribed limits have been observed for this filament type in over 5000 hours of life test operation. (Author)

Clevite Corp., Cleveland, Ohio.
RESEARCH ON NEW HIGH TEMPERATURE SEMICONDUCTING MATERIALS, by Shaun S. Devlin, Jacob M. Jost, and Lebo R. Shiozawa. Rept. on Contract AF 33(616)3923. June 60, 167p. 87 refs. WADD Technical rept. 60-11.
Order from OTS $3.00 PB 161 938

Three years of research on the preparation, purification, crystal growth, and measurement of the fundamental properties of CdS, CdSe, ZnTe, and mixed crystals of CdS·CdSe are summarized. The basic requirements of high-temperature semiconductor devices for operations to 500°C were closely examined and led to the choice of the above materials for further investigation. A detailed account, with liberal references to previous quarterly reports, is presented on the following topics; (1) purification of elemental zinc, cadmium and tellurium by zone refining and vacuum distillation using spectrographic and radioisotopic techniques for evaluation; (2) mechanism of crystal growth in the Reynolds-Czyzak process, including analog studies of soap-bubble and iodine-crystal models; (3) measurement of basic properties. Measurements taken of a variety of doped and undoped crystals include; (1) X-ray crystallographic data; (2) thermal expansion data from 25 to 200°C; (3) optical absorption (energy gap) data, including the variation of ΔE with composition of mixed CdS-CdSe crystals; and (4) data on the temperature dependence of Hall effect and conductivity from 77°K to 800°K. The room-temperature energy gaps are typical values of interest and for CdS, CdSe, ZnTe and ZnSe are 2.38, 1.70, 2.21 and 2.43 ev, respectively. ΔE of mixed crystals are nonlinear with composition (ΔE of $Cd(S_{.5}Se_{.5})$ - 1.91 ev). Room temperature carrier mobilities in doped crystals ($P \simeq 10^{-2}$ to 1 ohm cm) are 350, 550, and 100 cm^2/volt sec., respectively, for CdS(n-type), CdSe(n-type), and ZnTe (p-type). At high temperatures $\mu_n \propto T^{-3/2}$ for In-doped CdS, $\mu_n \propto T^{-1}$ for Ga-doped CdSe, and $\mu_p \propto T^{-3/2}$ for Cu-doped ZnTe. Low temperature electron mobility in Ga-doped CdSe ≥ 1000 cm^2/volt sec. with $n \leq 10^{17}$ cm^{-3}. Thermoelectric power of Ga-doped CdSe ≥ 250 μV/°K. (Author)

Compagnie Générale de Télégraphie Sans Fil (France)
INFLUENCE OF THE MANUFACTURING PRECISION OF AN ANTENNA ON ITS PERFORMANCE, by J. Robieux. Technical note no. 1 on Contract AF 61(514)737. C. 27 May 55, 80p. (p. 65-66 omitted). AD-83 556.
Order from LC mi$4.50, ph$12.30 PB 150 090

The purpose of the present study is to investigate the influence of manufacturing lack of precision on the performance of an antenna. The problem is stated in the introduction. The field radiated by an antenna results from the addition of the fields radiated by each one of its elements. A lack of precision in manufacturing does not modify in any substantial manner the amplitudes of these elemental fields. It is necessary, however, to add to their theoretical phases, calculated by utilizing the surface, assumed perfect, an aleatory angle which corresponds to the aleatory deviation between the actual surface the the theoretical surface. The problem is thus an aleatory problem and it is necessary to use the methods of the calculus of probabilities.

Computation Lab., Harvard U., Cambridge, Mass.
SOME APPLICATIONS OF LOGICAL SYNTAX TO DIGITAL COMPUTER PROGRAMMING, by Richard Manning Carp. Doctoral thesis. Rept. on Theory of Switching to Bell Telephone Labs. Jan 59, 200p. 54 refs. Rept. no. BL-22.
Order from LC mi$8.70, ph$30.30 PB 147 350

In this thesis the methods of logical syntax are applied to the analysis of programming languages. The programming languages considered include not only computer languages, but also flowcharting languages and the source languages of automatic programming systems. Syntactic models are defined and used for the development of analytic check-out procedures and techniques for improving the efficiency of programs. (See also PB 147 351)

Computation Lab., Harvard U., Cambridge, Mass.
THEORY OF SWITCHING, by Howard Aiken. Rept. for 1 May 56-Dec 56 to Bell Telephone Labs. [1956] 193p. 64 refs. Rept. no. BL-16
Order from LC mi$8.70, ph$30.30 PB 147 348

Contents:
The synthesis of a special class of switching functions
Silicon carbide crystal switches
The decomposition of switching functions
A theorem concerning two-terminal switching networks
On the functional separability of Boolean functions
Recording on thin magnetic films with a single wire polepiece, preliminary report
A mathematical model for single wire recording
Circuit synthesis for network switching functions (II)
(See also PB 122 821)

Computation Lab., Harvard U., Cambridge, Mass.
THEORY OF SWITCHING, by Howard Aiken. Rept. to Bell Telephone Labs. 15 Dec 58, 173p. 19 refs. Rept. no. BL-21.
Order from LC mi$8.10, ph$27.30 PB 147 351

Contents:
The use of adding transformations in the synthesis of switching functions
Notes on the subfunctions of switching functions
Identification and optimal realization of a class of switching functions
Transportation problems with joint capacity constraints
Refined methods of solving the traveling-salesman problem
Magnetic core parallel adder
(See also PB 140 104)

Computation Lab., Harvard U., Cambridge, Mass.
THEORY OF SWITCHING, by Howard Aiken. Rept. to Bell Telephone Labs. 1 June 59, 138p. 14 refs. Rept. no. BL-23
Order from LC mi$6.90, ph$21.30 PB 147 349

Contents:
Modular functions
Transportation problems with equality constraints
The description of finite sequential processes
A Harvard Univac method for the selection of the prime implicants of a switching function
The derivation of minimal forms for incompletely defined switching functions
(See also PB 147 350)

Control Systems Lab., U. of Illinois, Urbana.
BARRIER GRID STORAGE TUBE DISTURBANCE, by John K. Robe. Rept. on Contract DA 36-039-sc-56695. Aug 58, 37p. 3 refs. Rept. no. R-103; AD-202 487.
Order from LC mi$3.00, ph$6.30 PB 149 400

Storage tube disturbance is defined as the positional fluctuations of the input-output characteristic. An attempt to characterize this single concept by a single number or "Figure of Merit" is complicated by the fact that disturbance has been found to be a function of several variables. The periodic and aperiodic structure of the barrier grid of a barrier grid storage tube is used to illustrate disturbance. It is found that a portion of the disturbance is independent of the signal level, whereas another portion is directly dependent on it. In considering the frequency distribution of the disturbance it is found that the aperiodic variations cause a disturbance which is spread throughout the tube's pass band, while the periodic variations produce a disturbance at particular frequencies. The amplitude of the periodic disturbance which appears in the output is shown to be a function of the ratio of beam diameter to barrier grid mesh size. (Author)

Cruft Lab., Harvard U., Cambridge, Mass.
A LOOP ANTENNA COUPLED ELECTROMAGNETICALLY TO A FOUR-WIRE TRANSMISSION LINE TO ACHIEVE THE CIRCULARLY POLARIZED RADIATION, by Kun-Mu Chen. Scientific rept. no. 5, series 2, on Contract AF 19(604)4118. 25 Jan 60, 67p. 3 refs. AFCRC-TN-60-365; AD-237 668.
Order from LC mi$3.90, ph$10.80 PB 148 321

A loop antenna coupled electromagnetically to a four-wire transmission line is studied theoretically and experimentally when the line is driven as two mutually perpendicular two-wire lines that are 90° out of phase in time. The size of the loop at which resonance occurs is determined. The zeroth-order and first-order solutions of the current distribution are evaluated and it is found that at resonance the antenna currents due to each two-wire line oscillate in a dipole mode of the loop. The currents induced by the four-wire line circulate as a traveling wave. The radiation fields pattern is also evaluated. The square loop is first studied; later, it is shown that the circular loop resembles the square loop closely. An array that consists of many loop antennas coupled electromagnetically to a four-wire transmission line has a very high gain with circularly polarized radiation. (Author)

Cruft Lab., Harvard U., Cambridge, Mass.
THE RADIATION PATTERNS PRODUCED BY A LINEAR ARRAY OF HALF-WAVE DIPOLES COUPLED ELECTROMAGNETICALLY TO A TWO-WIRE TRANSMISSION LINE, by Dipak L. Sengupta. Scientific rept. no. 4, series 2, on Contract AF 19(604)4118. 20 Jan 60, 21p. 6 refs. AFCRC-TN-60-371; AD-237 669.
Order from LC mi$2.70, ph$4.80 PB 148 322

The effects of the different physical parameters on the radiation pattern are studied both from physical and theoretical considerations. The theoretical conclusions are verified by actual measurements. The electromagnetic coupling principle used in this antenna provides more flexibility for controlling the radiation pattern than in the case of the usual method of coupling the dipole arrays to a two-wire transmission line. A step-by-step design procedure is given; this can be used in order to obtain the best radiation pattern from the antenna. (Author)

David Sarnoff Research Center, Princeton, N. J.
STORAGE LIGHT INTENSIFIER DISPLAY PANEL, by E. E. Loebner, H. O. Hook, and D. C. Darling. Quarterly rept. no. 6, 1 July-30 Sep 57, on Contract DA 36-039-sc-71194. 15 Oct 57, 30p. 3 refs. AD-151 525.
Order from LC mi$2.70, ph$4.80 PB 149 366

Progress is reported for work accomplished on following: (1) complex circuit optical feedback light intensifiers for feedback control and multitone storage, (2) design, fabrication and test of perforated and pedestal photoduct and lateral flow structure light intensifier panels, (3) fabrication techniques of interlayer conductor patterns and master patterns for test structures, (4) device analysis of light intensifiers including photoconductivity, electroluminescence and photoduct transmission, (5) simulated device tests, and (6) the adaptation of a logarithmic preamplifier for use with photomultiplier. (Author)

Diamond Antenna and Microwave Corp., Wakefield, Mass.
RADIO FREQUENCY ROTARY COUPLER CU-64[MSQ-16(XW-1) by Robert W. Silberberg. Rept. no. 2 on Contract AF 30(602)1931. 20 Dec 59, 21p. 5 refs. RADC TN-59-42; AD-210 394.
Order from LC mi$2.70, ph$4.80 PB 147 361

This report describes the efforts and work accomplished during the second quarter period of the subject contract for the development of a Four Channel Rotary joint. Two channels will transmit signals in the frequency range of 1-4 Kmc, and the other two channels cover the range of 4-15 Kmc. The VSWR will be limited to less than 1.8 to 1, and its variation as a function of rotation shall be less than 1.1 to 1. The portion of the task reported here includes the test results of the prototype 1-4 Kmc channel, #3, and the 4-15 Kmc channel, #1. Some results of a theoretical investigation are presented together with the suggested modifications. It is shown that the channel #1 unit is satisfactory in its present form, however some improvement is expected following subsequent changes. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A NOTE ON ZERO-CROSSINGS AND AVERAGE FREQUENCY, by P. R. Karr. 25 Oct 54, 10p. 3 refs. Technical rept. TR-133.
Order from LC mi$1.80, ph$1.80 PB 149 329

An expression is derived for the expected rate n of zero crossings of the function $\sin[N(t) + \gamma)$, where N(t) is a stationary, Gaussianly distributed, random or "noise" function with zero mean.

Diamond Ordnance Fuze Labs., Washington, D. C.
TRANSISTOR D-C REGULATORS, by F. Allen and H. J. Reed. 18 July 60, 19p. 8 refs. Technical rept. TR-852.
Order from LC mi$2.40, ph$3.30 PB 148 224

Modifications and extensions of a basic series-type regulator circuit are utilized in the design of three d-c regulators for electrochemical power supplies. Expressions are given for the regulated output voltage and the output resistance in terms of the supply voltage and circuit parameters. The performance of the experimental circuits is in reasonable agreement with the calculated values obtained from the stability equations. (Author)

Eastman Kodak Co., Rochester, N. Y.
BASIC RESEARCH INVESTIGATIONS FOR AMMONIA VAPOR ACTIVATED BATTERIES, by J. M. Freund, V. M. Bryant, Jr. and J. B. Schliff. Final rept. for 15 Sep 57-14 Sep 59 on Contract DA 36-039-sc-74902. [1959] 63p. 10 refs. AD-235 814.
Order from LC mi$3.90, ph$10.80 PB 149 109

The densities of several ammonium salts, KSCN, and $Pb(NO_3)_2$ together with mixtures of the last with NH_4NO_3 have been measured, mostly at -34°C. With the exception of KSCN, these solutions are non-ideal. Conductance of the same substances has also been measured. The KSCN solutions have the highest specific conductance at the optimum concentration. At the maximum, NH_4SCN is a better conductor than is NH_4NO_3. In highly concentrated solutions, however, NH_4NO_3 is the better conductor. KSCN at its peak is a 30% better conductor at -60°C. and a 20% better conductor at -40°C. than NH_4SCN. Studies of liquid $Zn/NH_4SCN/PbO_2$ cells at -40°C. show that essentially 100% of theoretical cathode capacity was obtained at current densities up to 31 ma/cm^2, although there were less than 4 moles NH_4SCN per mole PbO_2 available in the electrolyte. Liquid $Pb/NH_4SCN/PbO_2$ cells, discharged at current densities between 0.15 and 15 ma/cm^2, delivered the theoretical capacity of the PbO_2. Vapor activated $Pb/NH_4NO_3/PbO_2$ cells, discharged at room ambient temperature, show susceptibility to concentration polarization as the ammonium ion available is decreased. (Author) (See also PB 145 878)

Edison, Thomas A., Industries, West Orange, N. J.
HIGH CAPACITY VENTED NICKEL-CADMIUM CELLS, by Arthur Fleischer, Edward C. Kopper and others. Quarterly rept. no. 1, 30 Nov 59-29 Feb 60, on Contract DA 36-039-sc-84555. [1960] 59p. 20 refs.
Order from LC mi$3.60, ph$9.30 PB 149 118

The task of manufacturing six types of high capacity nickel-cadmium cells varying in capacity from 3.5 to 36 amp-hrs. was set up in three phases, experimental design, and manufacture. The experimental program for the Type 4 cell was set up after a preliminary estimate of elements for the six sizes of cells. A sufficient number of cells was planned to permit testing two concentrations of lithium hydroxide in the 30% potassium hydroxide electrolyte. In addition, cells were included to study the effect of a 5% cobalt addition to the fused nickel nitrate impregnating bath in the Edison process for preparing positive plates. The design of cells, cell parts and hardware, and tools and fixtures has proceeded up to the point at which further progress must be delayed till decisions can be reached on the basis of the experimental program.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
RATIONAL APPROXIMATION OF ARBITRARY REAL FUNCTIONS WITH SPECIFIED WEIGHTS, by Tao-Nan Tang. Doctoral thesis. Technical note. no. 14 on Contract AF 49(638)63. 1 May 60, 99p. 25 refs. AFOSR-TN-60-613.
Order from LC mi$5.40, ph$15.30 PB 148 766

The problem of obtaining the Tchebysheff approximation of a real continuous function in a closed interval by a polynomial or a rational function under a specified weighting function is treated. Solutions of such problems are obtained by numerical methods involving iterative procedures which may be carried out by modern computing machines. The effect of shifting a zero or several zeros of an error function on the weighted error function itself is obtained by multiplying the amount of shift by the sensitivity, defined as the partial derivative of the weighted error function with respect to the zero shifted. The successive equalization of the weighted error function at the points of extrema gives an iterative procedure with assured convergence of the process.

Electro-Optical Systems, Inc., Pasadena, Calif.
DESIGN AND DEVELOPMENT OF VERY HIGH SPEED SWITCHING TECHNIQUES, by R. M. Aron, M. P. Ernstene, and F. R. Marshall. Final technical rept. on Contract DA 04-495-501-ORD-1097. 15 May 59, 76p. 12 refs. Rept. no. 120-Final; AD-218 844.
Order from LC mi$4.50, ph$12.30 PB 147 609

The hydrogen thyratron and the atmospheric triggered spark gap were studied. With the hydrogen thyratron used in the normal circuit configuration, current commutation times as low as 4.5 millimicroseconds were achieved, and times as brief as two millimicroseconds are believed possible by making use of design improvements demonstrated to be advantageous. With the hydrogen thyratron in a special pulsed-anode circuit configuration, a current commutation time of two millimicroseconds was achieved, and fractional millimicrosecond times appear to be obtainable. With the triggered spark gaps at atmospheric pressure, current commutation times as brief as 7 millimicroseconds were achieved. The operation of the high pressure triggered spark gaps follows simple scaling laws which show that commutation times can be expected to vary inversely with pressure, up to pressures of 10 to 20 atmospheres; hence commutation times under a millimicrosecond are possible. (Author)

Electronic Defense Labs., Sylvania Electronic Systems, Mountain View, Calif.
OPTIMAL SPARES PROVISIONING FOR ELECTRONIC SYSTEMS, by Jorgen P. Jorgensen. Rept. on Contract DA 36-039-sc-78281. 30 Mar 60, 91p. 13 refs. Technical memo. no. EDL-M237; AD-235 936.
Order from LC mi$5.40, ph$15.30 PB 148 340

Spare parts kits were designed for the AN/MLQ-19 (XL-2), ESGM I, and EP-EDL-16 systems. The kits provide spares for a one-year operating period at an assurance level of 0.85 to 0.90.

Electronic Engineering Co., of California, Santa Ana.
MODIFICATION OF FIRE CONTROL SYSTEM, AA, M-33, by R. F. Akers. Final technical rept. for 1 May-5 Nov 59 on Contract DA 36-039-sc-78317. 15 Dec 59, 21p.
Order from LC mi$2.70, ph$4.80 PB 149 377

The primary modification involved the installation of a system to provide high accuracy digital data. This involved: installation of precision encoders on the azimuth, elevation, and range shafts of the radar; addition of slip rings to accommodate the encoder data: and design, fabrication, and installation of electronic equipment to provide the precision digital data output. Other modifications involved: the addition of a sighting telescope on the antenna; the design, fabrication, and installation of a remote control unit so that an operator at the antenna can position the antenna; and changes to the plotting board to provide for various map scales. The accuracy tests performed on the high-precision data system are included, and reveal that linearity errors in azimuth and elevation were less than 20 seconds of arc. Backlash and range data errors were too small to be detected. Approximately 95% of the circuitry of the precision data system is transistorized. The data output is presented in two forms: a binary-coded-decimal display of azimuth, elevation, and range, and a decimal display of time on a panel which is photographed; and a binary-coded-decimal output of azimuth, elevation, range, and time suitable for recording on magnetic tape. (Author)

Electronics Research Lab., U. of California, Berkeley.
STABILITY OF SYSTEMS WITH RANDOMLY TIME-VARYING PARAMETERS, by A. R. Bergen. Scientific rept. no. 1 on Contract AF 19(604)5466. 9 Feb 60, 20p. 10 refs. Series no. 60, issue no. 268; AFCRC-TN-60-174.
Order from LC mi$2.40, ph$3.30 PB 148 499

Consider a system which alternates between two known configurations at random times; one of these configurations is stable, the other is unstable. Since the unstable mode is intermittent it is entirely possible for the system to be stable despite the unstable mode. Since the system is random, stability must be defined in a probabilistic sense. In this report a system is defined to be stable if the return to equilibrium of the system after any finite disturbance is "almost sure," i.e., if the system returns to equilibrium with probability one. The randomness of the system resides entirely in the intervals between successive alterna-

tions of system configuration. Assuming these intervals to be independent, the expected values of the state variables after an arbitrary number of alternations of system configuration may be determined. By use of the Kronecker product the expected values of the squares of the state variables may also be determined; the expected values of the squares of these state variables tend exponentially to zero with the number of alternations if the eigenvalues of a specified matrix lie within the unit circle. Furthermore, because of this exponential convergence the stronger condition of convergence with probability one may be established. The problem of determining conditions for stability then reduces to the investigation of the eigenvalues of a matrix. If stability with variation of a parameter is to be investigated a root-locus plot of the eigenvalues with parameter adjustment is convenient. (Author)

Electronics Research Lab., U. of California, Berkeley.
STUDY OF CROSSED-FIELD AMPLIFIERS, by J. R. Whinnery, C. K. Birdsall and others. Interim final rept. for 15 Oct-30 Nov 59, on Contract DA 36-039-sc-74981. [1959] 22p. 3 refs. AD-236 172.
Order from LC mi$2.70, ph$4.80 PB 149 410

Fabrication of the second model of the crossed-field velocity analyzer has continued. This model includes means for reducing the effects of secondaries and for water cooling the anode. In the derivation of the crossed-field diode equations reported earlier, all transverse derivatives were neglected. This implies that the magnetic fields produced by the displacement and convection currents are unimportant. A study was made to determine the range of conditions under which this is true. This work incidentally answers similar questions for the Llewellyn-Peterson equations. (Author) (See also PB 148 108)

Farnsworth Electronics Co., Fort Wayne, Ind.
MODIFICATION OF VIDEO INTERCONNECTION EQUIPMENT ANDB TYPE 2. 3NS4a. Final development rept. on Contract NObsr-64276. [1959] 23p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 147 955

This report covers the modifications to the ANDB Type 2. 3NS4a Video Interconnection Equipment in accordance with Addendum No. 3 to ANDB Specification 2. 3NS4a. Complete technical information is contained in the instruction book for this equipment (Navships 92770). This report details the modifications necessary to increase the capabilities of the equipment to provide compatability with the latest ANDB radar safety beacon system. (Author)

Flight Research Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
NAVIGATIONAL SYSTEMS COMBINING INERTIAL AND GROUND VELOCITY VECTOR INFORMATION, by John E. Clemens, Wolfram Kerris, and Friedrich Wazelt. Apr 52, declassified 28 July 60. 40p. 4 refs. WADC Technical rept. 52-76; ATI-169 180.
Order from LC mi$3.00, ph$6.30 PB 150 148

This report released for sale to the public 13 Sep 60.

Gilfillan Bros., Inc., Los Angeles, Calif.
MULTICOLOR PLAN POSITION INDICATOR FOR USE IN THE AIR TRAFFIC CONTROL RADAR SAFETY BEACON SYSTEM. Final engineering rept. for 1 Jan-28 Feb 58 on Contract NObsr-72571. 7 Mar 58, 31p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 147 961

The objective of this contract is to provide a radar Plan Position Indicator on which pulse coded beacon returns can be displayed in seven color hues depending on the code-to-color assignment.

Horizons, Inc., Cleveland, Ohio.
FERROELECTRIC MEMORY CELLS, by Richard A. Fotland. Final rept. on Contract AF 19(604)5498. Apr 60, 4 refs. AFCRC-TR-60-140.
Order from LC mi$3.60, ph$9.30 PB 148 816

Techniques have been developed for obtaining 20 micron films of sodium niobate and barium-lead titanate ceramics. Inferences derived from the switching voltage-film thickness curves indicate that the sodium niobate crystallites are surrounded by a 10^{-6} cm parelectric skin. Switching voltages as low as 20 volts have been utilized with switching pulse lengths of 50 μsec. A 15 megacycle read-out voltage functions effectively. The second-harmonic phase of an output current provides a nondestructive read-out. Ten by ten matrices have been examined with a static address and found to possess good uniformity. Coincidence switching is effective due to the high loop squareness when operating in the second-harmonic output mode. Indications are presented which show the feasibility of large matrix sizes. (Author)

[ITT] Labs., Nutley, N. J.
TESTS OF TACAN SYSTEM WITH REDUCED BEACON SPECTRUM, by A. Biagi and J. Hobbs. Final rept. on Contract NOas-51-1227. 20 July 56, 136p. Technical memo. no. 576; includes Technical momo. no. 569.
Order from LC mi$6.90, ph$21.30 PB 147 960

A series of measurements was conducted of the effects of co-channel and adjacent-channel interference on the AN/ARN-21 in accord with procedures prepared by the Air Navigation Development Board. The first results of the work gave some performance figures concerning the effect of co-channel and adjacent-channel interference on range accuracy, bearing accuracy and identity fidelity, using ARN-21 equipments manufactured in the Summer of 1955. These figures showed that, under the conditions of the tests, the "hole-punching" effect of the airborne Ferris discriminator degraded the otherwise excellent bearing accuracy of the Tacan System. While such deterioration had never been observed in actual flight, there was reason to believe that the problem might become of some importance in the future when many more beacons would cover a given area. The present memorandum describes the greatly improved results obtained by removing the Ferris discriminator from the airborne equipment, while simultaneously reducing the beacon spectrum. This change not only reduces errors but increases the operating range and reduces vulnerability to jamming. Minor improvements have also been made to the airborne decoding circuitry in order to reduce co-channel interference.

Knights, James, Sandwich, Ill.
PHASE STABLE OVERTONE CRYSTAL STUDY, by Robert E. Christian. Quarterly rept. no. 1, 1 July-1 Oct 57, on Contract DA 36-039-sc-74884. [1957] 34p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 149 105

A literature survey disclosed that a lateral force applied along a diameter of a crystal would cause a frequency deviation. The magnitude of the frequency deviation varied with changes in diameters in which the force was applied and points of minimum frequency deviation was noted. Mathematical calculations show that nodal points of AT crystals are located $\pm 40^{\circ}$ from the Z axis. The static capacitance of the experimental crystals was lower than outlined in the specs. The temperature coefficients of the crystal were measured. Representation crystals were tested for phase shift and the data obtained showed no clear trend. A new crystal vibration holder has been designed which equals the JPL holder in performance but is superior in convenience to use. Two Teflon mounted crystals were tested for phase stability. They appeared promising in the Y and Z plane but were very unsatisfactory in the X plane.

Knights, James, Co., Sandwich, Ill.
PHASE STABLE OVERTONE CRYSTAL STUDY, by Robert E. Christian. Quarterly rept. no. 2, 1 Oct 57-1 Jan 58, on Contract DA 36-039-sc-74884. [1958] 45p. 2 refs.
Order from LC mi$3.30, ph$7.80 PB 149 106

Modification of the constant acceleration apparatus has minimized frequency shift due to the apparatus. Application of pressure along various diameters of an AT crystal showed that a point of minimum frequency shift occurs at 30° off the Z axis at room temperature (23°C). Six groups of crystals were mounted every five degrees from $15\text{-}40^{\circ}$ off the Z axis and phase stability measurements were made. An analytical proof is presented verifying the theory that the reorientation of the nodal points with respect to temperature is a function of the changes in the elastic coefficients with temperature. (See also PB 149 105)

Knights, James, Co., Sandwich, Ill.
PHASE STABLE OVERTONE CRYSTAL STUDY, by Robert E. Christian. Quarterly rept. no. 3, 1 Jan-1 Apr 58, on Contract DA 36-039-sc-74884. [1958] 25p. 1 ref. AD-200 892.
Order from LC mi$2.70, ph$4.80 PB 149 107

Analytical and experimental investigations are being made of crystallographic orientations and crystal plate mountings in order to minimize phase instability when the crystal unit is subjected to mechanical vibration. Distributed capacity changes in the leads between the crystal and the external oscillator were minimized by the use of a series mode oscillator. A series mode oscillator constructed with vacuum tubes for mounting on the shaker head proved unsatisfactory. A transistor grounded base oscillator also proved unsatisfactory because of inadequate output. Laboratory test results on 3 crystal units were in agreement with phase stability measurements made at Fort Monmouth. Solder mounting of crystals resulted in improved resistance characteristics but not of phase stability. The elastic properties of AT cut crystals differed from those of α quartz. (See also PB 149 106)

Knights, James, Co., Sandwich, Ill.
PHASE STABLE OVERTONE CRYSTAL STUDY, by Robert E. Christian. Quarterly rept. no. 4, 1 Apr-1 July 58 on Contract DA 36-039-sc-74884. [1958] 25p.
Order from LC mi$2.70, ph$4.80 PB 149 108

When compressional stress is applied to an "AT" crystal, the frequency of thickness-shear modes would vary due to the deformation of the crystal. The change of frequency Δf of the plate in the strained state as a function of the components of strain tensor has been derived. For an infinitesimal deformation, the strain is linearly related to the stress through a matrix $S' = a_c^{-1} S a^{-1}$. The matrix elements S'_{jk} were expressed in terms of elastic modulii of α quartz and the skew angle Ψ in "AT" plane. Consequently Δf as a function of Ψ and stress was obtained. Analysis showed that at a particular angle Ψ, compressional stress would cause a zero phase shift for an "AT" crystal of a definite strain distribution. An "AT" crystal subjected to a constant lateral force resulted in points of minimum frequency shift 30° on each side of the z axis. The points of minimum frequency shift are the same regardless of the magnitude of stress. Preliminary evidence indicates that there may be no point of zero frequency shift in the bending direction. (See also PB 149 107)

Lansdale Tube Co., Pa.
GERMANIUM PNP OR NPN JUNCTION TRANSISTOR, by James A. Sluss, Jr. Quarterly progress rept. no. 1, 26 May-26 Aug 58, on Contract DA 36-039-sc-75046. [1958] 38p. Philco no. R-218.
Order from LC mi$3.00, ph$6.30 PB 149 372

The necessary techniques for electrochemically etching and plating large area etch pits and electrodes on diffused germanium material have been developed, and large area, micro-alloyed, diffused-base transistors have been fabricated. The fabricative procedure of the device is being modified to meet the specification limits. The loss of the collector diode during the micro-alloying operation has considerably reduced the yield of units that have a satisfactory VCE of 60 volts. Micro-alloying of indium electrodes into diffused germanium blanks is being accomplished through the use of a focused light beam, which heats the electrode. A profile curve which will permit accurate placement of the emitter and collector in the diffused field and yield units which will closely approach the specification limits has been determined. An optical concentricity gauge for determining the concentricity and diameter of the emitter and collector electrodes has been devised. A new thermal stud mount which theoretically achieves a 400mw dissipation to free air has been designed. (Author)

Lansdale Tube Co., Pa.
GERMANIUM PNP OR NPN JUNCTION TRANSISTOR, by James A. Sluss, Jr. Quarterly progress rept. no. 2, 26 Aug-26 Nov 58, on Contract DA 36-039-sc-75046. [1958] 27p. Philco no. R-218.
Order from LC mi$2.70, ph$4.80 PB 149 373

An increased yield in the accurate placement of the emitter diode was the result of a modification of the gradient of diffusion in the base material. Emitter diode placements in the 10 to 20 volts V_{EB} range are easily accomplished. A reduction of the bulk resistivity of the base material has considerably improved the punchthrough condition of this device. Loss of collector voltage during the microalloying operation was studied through the use of specially constructed equipment that monitors the punchthrough condition as the collector or emitter breakdown voltage is measured. Modification of the testing requirements for the V_{CE} measurement might possibly provide a means of surmounting a seemingly incompatible relationship between V_{CE}, V_{EB}, and high current β. Test data indicates that some value of emitter-to-base resistance or an $\approx$0.1 volt reverse bias will produce a considerable improvement in the V_{CE} characteristic. (Author)

Lansdale Tube Co., Pa.
NUCLEAR RADIATION RESISTANT POWER TRANSISTORS, by A. Byer. Quarterly progress rept. no. 3, 15 Nov 59-15 Feb 60, on Contract DA 36-039-sc-78307. [1960] 28p.
Order from LC mi$2.70, ph$4.80 PB 149 376

The first group of power transistors was sent to MIT for the required irradiation. A higher temperature was experienced for those transistors receiving the 10^{14} NVT dosage. To combat this, the next group sent will call for successive smaller amounts of radiation, leading to the same total dosage. Collector-to-header soldering was causing BV_{CBO} degradation. Through extensive experimentation with heating techniques, solder composition, and type of electrode, this problem has been eliminated. The emitter pits were found to be concave in shape. This causes a higher resistivity at the center of the electrode than at the outer edges. Considerable improvement has been made in the pit geometry. The base tab connection, and its subsequent removal operation, have both been altered. The gold-arsenic whisker has been eliminated. The base index tab is now soldered to the base pin to serve as the electrical connection, and the excess tab is sheared off. Another collector degradation problem is that which occurs with the passage of time. This is separate and distinct from the collector degradation that was caused by header mounting. Attempts thus far have not eliminated this condition and are still being continued. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
PELTIER EFFECT AND THERMAL-CONDUCTIVITY MEASUREMENT TECHNIQUES FOR THERMOELECTRIC MATERIALS, comp. by Kenneth D. Carroll. June 59, 137p. 450 refs. LMSD-288 195. AD-237 470.
Order from LC mi$6.90, ph$21.30 PB 148 068

This selective bibliography covers the period 1950-1958. The literature of particular interest is that of the Peltier, Seebeck, and Joule-Thompson Effects as well as certain studies of thermal conductivity. The tellurides, in particular lead telluride, was the only thermoelectric material designated as being of primary interest. There was, therefore, no attempt to cover the rapidly expanding field of thermoelectric materials. Semiconductors were only of tangential interest; hence, reference is made only to those writings that were of interest to those who had originally requested compilation of the bibliography. The literature of both thermoelectric materials and semiconductors has been treated extensively in other publications. Sources for materials cited included: Chemical Abstracts, Nuclear Science Abstracts, Science Abstracts ASTIA, and Lockheed Missile and Space Division, Technical Information Center. (Author)

Mallory, P. R., and Co., Indianapolis, Ind.
RESEARCH AND DEVELOPMENT IN CONNECTION WITH MINIATURE VARIABLE RESISTORS, by Howard Reeve. Final rept. for 1 Mar 53-30 Sep 55 on Contract DA 36-039-sc-42655. [1955] 90p. 7 refs.
Order from LC mi$4.80, ph$13.80 PB 149 013

Efforts have been directed toward the research, development, and testing of materials and methods to establish designs for four specific types of miniature resistors and a single pole, single throw switch. Resistor designs developed include the 1/2 inch diameter bushing mount resistor with attached single pole, single throw switch, the 1/2 inch diameter flat mount resistor, the 3/8 inch diameter bushing mount resistor, and the 5/16 inch diameter multiturn resistor.

Mellon Inst., Pittsburgh, Pa.
HIGH TEMPERATURE PRINTED CIRCUITRY, by G. H. Young, C. H. T. Wilkins and others. Quarterly rept. no. 11, third series, 1 Apr-30 June 59, on Computer Components Fellowship no. 346, Contract AF 19(604)1959. 4 Apr 60, 31p. 29 refs. AFCRC-TN-60-361.
Order from LC mi$3.00, ph$6.30 PB 149 143

Continuation of investigations on printed circuitry has shown that non-glaze-containing, screen-printed conducting patterns comprised of silver-platinum alloys are feasible for use as two-dimensional electrodes. Tables of physical properties of refractory materials, including borides, nitrides, carbides, and silicides, considered pertinent to past and present investigations are given. Bulk alloy ultimate tensile values for the Ag-Pt alloy system at firing temperatures from 1000 to 1500°C on two substrates are given and acceptable combinations of variables are indicated. Bonding of silver-glaze enamels to alumina is discussed and illustrated photomicrographically. In addition, a number of effects encountered in firing screen-printed conducting films are shown and correlation of the Ag-Pt films with the binary phase diagram is discussed. The utilization of rhodium as a barrier layer between evaporated-film capacitor electrodes and dielectric has produced capacitors of acceptable electrical characteristics. (Author) (See also PB 144 545)

Mellon Inst., Pittsburgh, Pa.
HIGH TEMPERATURE PRINTED CIRCUITRY, by G. H. Young, C. J. Owen and others. Quarterly rept. no. 12, third series, 1 July-30 Sep 59, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 13 Apr 60, 33p. 12 refs. AFCRC-TN-60-577.
Order from LC mi$3.00, ph$6.30 PB 149 144

Screen-printed electrode films of alloyed silver and platinum powders and containing no glaze constituent are shown to have exceptionally good adhesion to refractory substrates and acceptable conductivity. These fired, electrically-conducting films should prove adaptable to high temperature circuitry. Extensive physical and electrical property data pertinent to these films are presented in tabular summaries. The physical variations in geometry of the Ag-Pt screen-printed electrodes of 5 to 60% Ag content are presented for illustrative purposes. The utilization of evaporation-annealing, or vacuum deposition on a hot substrate, as a substitute for cycle-annealing of Au-Pd thin film resistors is discussed. Resistance versus temperature sample curves for resistors annealed by both methods and monitored simultaneously are presented. The effect of electron bombardment on the electrical properties of high temperature resistors and capacitors fabricated in the laboratory is discussed. Radiation damage varied from none for the screen-printed enamel resistors to a permanent effect for film capacitors. (Author) (See also PB 149 143)

Mellon Inst., Pittsburgh, Pa.
HIGH TEMPERATURE PRINTED CIRCUITRY, by G. H. Young, C. J. Owen and others. Quraterly rept. no. 13, third series, 1 Oct-31 Dec 59, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 13 Apr 60, 40p. 10 refs. AFCRC-TN-60-578.
Order from LC mi$3.00, ph$6.30 PB 149 145

Continued investigations on essentially two-dimensional electronic components showed that laboratory-fabricated thin film capacitors were relatively temperature-insensitive up to about 300°C. A test circuit diagram for a more automated method for the elevated temperature testing of capacitors is described. As a preliminary step in the investigation of a newly-assigned research area, inorganic wire coatings and encapsulating compounds, a literature survey of the mechanism and rate of formation of oxides in general and of litanium and zirconium oxides is presented. Radiation tests on screen-printed and vacuum-evaporated resistors showed that, at the highest level of electron bombardment utilized, the resistors were unaffected during irradiation. Tensile and electrical resistance data are presented for screen-printed metallized alloy conducting films containing a glassy phase, with and without a molten silver phase, to show the degree of effect of silver on bond strength and electrical resistance. Photomicrographs of scraped capacitor dielectric films show that, in the absence of a barrier layer over the gold electrode, the gold diffuses or migrates laterally into and through the dielectric. (Author) (See also PB 149 144)

Mellon Inst., Pittsburgh, Pa.
HIGH TEMPERATURE PRINTED CIRCUITRY, by G. H. Young, C. J. Owen and others. Quarterly rept. no. 14, third series, 1 Jan-31 Mar 60, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 13 Apr 60, 53p. 16 refs. AFCRC-TN-60-579.
Order from LC mi$3.60, ph$9.30 PB 149 146

Continued investigations on high temperature, passive, 2 D components have included a literature survey of the mechanism and rate of formation of oxides, the second section being presented in this report. An apparatus for determining the gross effect at temperature of differential expansion between thin film (0.001" thick) enamels, screen-printed and fired on ceramic substrates, is described and illustrated. The useful operating temperature of the laboratory-developed, screen-printed $MoSi_2$ resistor has been raised from 500 to about 650°C. A systematic investigation of such related parameters as type and amount of glaze constituent, wetting agent, firing time and temperature, and type of substrate is presented in tabular form. The probable nature of the high-resistance film formed between a printed and fired Ag:Pt electrode and one end of an $MoSi_2$ resistor is discussed. The high temperature testing of miniature, single crystal dielectric capacitors by manual methods indicates tentatively that only a dielectric approaching single crystal properties will suffice in developing an adequate component. Initial studies on the effect of temperature on contact angle of compressed glaze pellets on silver, as a preliminary step in the development of dielectric coatings for silver wire, are discussed and illustrated. The temperature coefficient of resistance of evaporated Au:Pd alloy resistor films of controlled but widely varying thickness was found to remain essentially constant. (Author) (See also PB 149 145)

Michigan U. Research Inst., Ann Arbor.
TABLES OF d', by P. B. Elliott. Technical rept. no. 97 on Contract AF 19(604)2277. Oct 59. 44p. 3 refs. 2659-7-T; AFCRC-TR-59-55.
Order from LC mi$3.30, ph$7.80 PB 148 803

Tables of d' for yes-no and forced-choice experiments are presented along with explanations of the assumptions involved in the calculations. (Author)

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH. Scientific rept. no. 22, 1 Jan-31 Mar 60, on Contract AF 19(604)1930. May 60, 26p. 1 ref. M. L. Rept. no. 723; AFCRC-TN-60-587.
Order from LC mi$2.70, ph$4.80 PB 149 592

Contents:
Microwave tube studies
Plasma physics studies
Ferrite studies
(See also PB 148 028)

Microwave Lab., Stanford U., Calif.
A DISCUSSION OF PERIODICALLY LOADED WAVEGUIDES, BASED ON THEIR REPRESENTATION BY N PERIODICALLY COUPLED 'MODAL' TRANSMISSION LINES, by Emmanuel T. Feuchtwang. Scientific rept. no. 21 on Contract AF 19(604)1930. Apr 60, 245p. 22 refs. M. L. rept. no. 710; AFCRC-TN-60-390.
Order from LC mi$11.10, ph$37.80 PB 149 248

Contents:
The representation of a waveguide, periodically loaded by widely spaced obstacles, as a single, periodically loaded, 'modal' transmission line

The representation of a waveguide periodically loaded by closely spaced obstacles as n periodically coupled 'modal' transmission lines
The measurement of the approximate susceptance matrix of an obstacle in a uniform waveguide

Microwave Lab., Stanford U., Calif.
MODE-JUMPING CAVITY FOR FLOATING-DRIFT-TUBE KLYSTRONS, by J. J. Shaw and D. K. Winslow. Technical rept. on Contract DA 36-039-sc-73178. Oct 59, 37p. M. L. rept. no. 659; SEL Technical rept. no. 352-1; AD-232 383.
Order from LC mi$3.00, ph$6.30 PB 148 333

A new method is described for increasing the frequency-tuning band of high-power, CW microwave oscillators of the floating-drift-tube type. An important advantage of the system is that it would require a voltage tuning ratio on the tube of only 1.5, which is the same as required for $f_2/f_1 = 1.22$ in a single mode system. It is shown experimentally that a tube cavity can be designed so that both the parallel and series modes will have the proper RF voltage ratios between output and input gaps required for efficient operation. It is further shown to be experimentally possible to satisfy a simultaneous condition on the frequency separation between the series and parallel modes so that they will be mutually noninterfering. A cold test cavity was built, and measurements of voltage ratios and mode separation showed reasonable values over the entire 3/2 frequency turning range.

Microwave Lab., Stanford U., Calif.
SOLID-STATE, TWO-LEVEL, HIGH-POWER MASER, by H. John Shaw. Quarterly progress rept. no. 1, 1 Dec 59-29 Feb 60, on Contract DA 36-039-sc-85263, continuation of Contract DA 36-039-sc-72785. Apr 60, 14p. ML rept. no. 707; AD-236 801.
Order from LC mi$2.40, ph$3.30 PB 149 382

Several aspects of pulsed microwave generation using ferrites are currently being investigated. Cold test measurements have been made on the original S-Band generator. Full scale K-band components have been constructed for the K-band generator. Significant advances have been made in pulsed magnetic field production, which now make available pulsed fields suitable for a millimeter wave generation. Various millimeter wave generation schemes to utilize these pulsed fields have been considered, and components have been fabricated for one of these schemes. (Author)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
X-BAND BEACON FERRITE DUPLEXER, by G. J. Wheeler. Quarterly progress rept. no. 1, 1 Apr-30 June 59, on Contract DA 36-039-sc-78802. 8 July 59, 8p. AD-227 266.
Order from LC mi$1.80, ph$1.80 PB 149 412

Research concerns the development of an X-band beacon ferrite duplexer. The duplexer consists of a tee circulator and a limiter. Tee circulators meeting the requirements of phase 1, i.e., covering 9.3 to 9.5 kmc, had been constructed before the contract was received. A design for a phase 2 model, covering 8.5 to 9.6 kmc, was developed and preliminary tests indicate there will be no difficulty in meeting the specifications. A ferrimagnetic limiter is being developed experimentally. Insertion loss and threshold are too high, but were reduced substantially from earlier models. Several geometries and materials are being tested. Thus far, the results are satisfactory only over a narrow band. (Author)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
X-BAND BEACON FERRITE DUPLEXER, by G. J. Wheeler. Quarterly progress rept. no. 3, 1 Oct-31 Dec 59, on Contract DA 36-039-sc-78802. 12 Jan 60, 13p. AD-232 107.
Order from LC mi$2.40, ph$3.30 PB 149 413

A broad band Tee requiring less critical tolerances in fabrication was developed. A tunable ferrimagnetic limiter was also developed using a shunt cavity in a constant magnetic field. Low insertion loss and low threshold are still mutually exclusive. (Author) (See also PB 149 412)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ON STUDY OF MICROWAVE FERRITE DUPLEXER, by Laurence Levey. Quarterly rept. no. 1, 1 Apr-30 June 58, on Contract DA 36-039-sc-78000. 12 Sep 58, 32p. 4 refs. Rept. R-682.3-58; PIB-610.3.
Order from LC mi$3.00, ph$6.30 PB 149 111

Techniques employed to fabricate toroidal ferrite elements for rectangular waveguide have been detailed. The remanent magnetism of toroidal structures has been utilized to obtain a differential phase shift of 23 degrees per inch in rectangular waveguide. The feasibility of constructing switching devices using ferrite toroids has been demonstrated. Ferrite compositions in preparation to produce new square loop materials for switching applications have been described. The theoretical differential phase shifts obtained with a number of composite ferrite-dielectric geometries in coaxial lines and rectangular waveguide have been computed. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ON STUDY OF MICROWAVE FERRITE DUPLEXER, by L. Levey. Quarterly rept. no. 2, 1 July-30 Sep 58, on Contract DA 36-039-sc-78000. 28 Oct 58, 9p. 1 ref. Rept. R-682.6-58; PIB-610.6.
Order from LC mi$1.80, ph$1.80 PB 149 112

Ultrasonic techniques of fabricating ferrite toroids, for use in waveguide switches, have been explored. After some development, proper tools have been fabricated and the technique has been proven to be feasible. The differential phase shift, due to ferrite toroids in a rectangular waveguide, has been measured with the toroids centralized in the waveguide and with the toroids laterally displaced. Surprisingly enough, the laterally displaced toroids gave up to 50% more differential phase shift per unit length than the centralized ones. Ferrite materials are being sought which have a combination of good square loop and switching properties and also have good microwave properties. Exploration

of some Magnesium Manganese ferrite is promising in that some measurements showed various compositions had excellent microwave properties. (Author) (See also PB 149 112)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
STUDY OF MICROWAVE FERRITE DUPLEXER, by L. Levey. Quarterly rept. no. 3, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-78000. 25 Mar 59, 9p. Rept. R-682.9-59; PIB 610.9.
Order from LC mi$1.80, ph$1.80 PB 146 452

Ferrite toroids have been produced by both a compression molding process and an ultrasonic cutting technique in an amount sufficient to assemble several 90 degree differential phase shift sections for RG-52/U waveguide.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
STUDY OF MICROWAVE FERRITE DUPLEXER, by L. Levey. Quarterly rept. no. 4, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-78000. 29 May 59, 9p. Rept. R-682.12-59; PIB-610.12; AD-225 431.
Order from LC mi$1.80, ph$1.80 PB 146 453

The compression molding process has been employed to fabricate toroids which have a width of 0.170" as compared to 0.210" for units previously produced. Two 90 degree differential phase shift sections containing an axial wire have been matched to within a VSWR of 1.3 over a frequency range of 8.6 to 9.5kmc. (Author) (See also PB 146 452)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
STUDY OF MICROWAVE FERRITE DUPLEXER, by L. Levey. Quarterly rept. no. 5, 1 Apr-30 June 59, on Contract DA 36-039-sc-78000. 1 Sep 59, 12p. Rept. R-682-15-59; PIB-610.15.
Order from LC mi$2.40, ph$3.30 PB 146 451

The examination of methods of reducing the volume of ferrite material per degree of differential phase shift was continued. Computations of differential phase shift were made for a waveguide configuration consisting of permanently magnetized ferrite slabs separated by a dielectric material. (See also PB 146 453)

Mohawk Business Machines Corp., Brooklyn, N. Y.
DEVELOPMENT OF A DUAL SPEED, DUAL CHANNEL-DUAL TRACK MAGNETIC TAPE RECORDER-REPRODUCER AN/UNH-1 ( ), by W. F. Heine and S. Duckstein. Final engineering rept. on Contract DA 36-039-sc-52600. May 57, 85p. AD-148 233.
Order from LC mi$4.80, ph$13.80 PB 149 397

The results of this development indicate that the requirements of studio equipment quality and complexity field type ruggedness, and low weight in equipment of this kind cannot be realized simultaneously. It is entirely feasible to combine any two of these objectives and obtain a finished item at reasonable cost, but not all three. The primary instance of this conflict is the drive mechanism, wherein the requirements for studio type tape speed accuracy, and ruggedness could have been achieved with no particular difficulty, had it not been complicated by the weight factor. What is especially troublesome in this respect is that weight begets weight, not linearly, but with some higher order relationship.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
DATA TRANSMISSION IN THE PRESENCE OF INTERFERENCE, by R. M. Showers, R. S. Berkowitz and others. Final rept. for 1 May 58-30 June 59 on Project ADAR, Task C, Contract DA 36-039-sc-75047. 31 July 59, 135p. 4 refs. AD59URI, v. 3; AD-235 997.
Order from LC mi$6.90, ph$21.30 PB 149 393

Studies involve (1) the effects of interference in producing baud errors in a digital data transmission system and (2) the relative efficiency of various error detecting schemes in reducing the number of undetected errors in a transmitted message. The performance of AM and PM systems using standard teletype transmission in the presence of noise recorded from an actual transmission circuit was investigated. A baud error probability considerably less than one error in 10^5 can be expected with such circuits. From theoretical calculations of the performance of AM, FM, and PM systems in the presence of this type of interference it was concluded that the binary PM system is about 3 db better than AM or FM transmission. A procedure for predicting the performance of such systems is suggested. Of the five detection codes studied in the presence of random, grouped, and periodic errors, the transverse-longitudinal parity check proved to be quite superior to the others. (Author)

National Aviation Facilities Experimental Center, Atlantic City, N. J.
CHARACTERISTICS OF A VOR ON A 200-FOOT TOWER, by Sterling R. Anderson and Robert B. Flint. Final rept. Apr 60, 37p. 2 refs.
Order from OTS $1.00 PB 161 949

A mobile VOR station located in a cleared area 200 feet square at one corner of a heavily wooded site was flight tested. A maximum course scalloping of plus or minus 11.5^o was recorded at a radius of 20 miles and an altitude of 1,000 feet. Later, a VOR antenna was erected on a 200-foot tower with a 60-foot-diameter counterpoise. Similar flight tests indicated a scalloping maximum of plus or minus 0.5^o. A 20-mile-radius orbital flight in the first null (1.2^o) produced scalloping of plus or minus 6^o maximum. The distance range, for a receiver input signal of 5 microvolts, varied from 63 miles at 300 feet altitude to 175 miles at 9,000 feet altitude. It is shown that with an antenna 200 feet above ground, while there still are objectionable course bends in the nulls of the vertical plane radiation pattern, the detrimental effect of the site on VOR performance was reduced at low elevation angles, and the low-altitude coverage was extended. This type of installation should be useful in heavily wooded terrain where a suitable site cannot be obtained for the installation of a more conventional station.

National Bureau of Standards, Washington, D. C.
OXIDE COATED CATHODE SUBLIMATION STUDIES, by Glenn F. Rouse. Scientific rept. no. 3, 1 Feb 57-31 Dec 58. 4 Feb 59, 21p. 2 refs. NBS rept. 6286; AFCRC-TN-59-158; AD-211 448.
Order from LC mi$2.70, ph$4.80 PB 147 399

A sensitive vacuum microbalance has been used to study the sublimation characteristics of some samples of uncoated cathode nickel. The results of this study are presented. A study of the coated cathode has been started. As an initial step the changes in mass which occur during the thermal conversion of the carbonates have been determined. The data obtained are discussed. (Author)

Naval Ordnance Lab., White Oak, Md.
A BINARY COUNTER AND ACCUMULATOR USING TRANSISTORS AND MAGNETIC CORES, by H. R. Irons. 23 Oct 58, 30p. NAVORD rept. 6184; AD-210 060.
Order from LC mi$2.70, ph$4.80 PB 147 565

Binary devices are described which employ a transistor-magnetic core combination as a fundamental building block for digital circuits. These devices are capable of high operating speeds and yet require very little power at low operating speeds. For example, a five stage binary counter has a total power consumption of 40 micro watts when operated at a counting rate of 100 pulses per second. The same counter is capable of operation at rates as high as 2×10^6 pulses per second. Good reliability is indicated by the fact that a counter has been operated successfully over a temperature range of -65°F to 160°F with a supply voltage of -2.0 volts to -4.5 volts. (Author)

Naval Ordnance Lab., White Oak, Md.
A NARROW BAND LOCK-IN ANALYZER AND SLAVE ANALYZER, by A. Zed Robinson. Rept. for Dec 47-Sep 51 on Improved Noise Analyzers. 15 Jan 58, 15 Jan 58, 65p. 7 refs. NAVORD rept. 4420; AD-158 517.
Order from LC mi$3.90, ph$10.80 PB 147 570

This report describes a novel method for obtaining narrow band frequency analysis using RC circuits as the filtering elements. Normal ambiguities due to frequency and amplitude modulation of discrete components are eliminated by providing the analyzer with two quadrature phase channels. A lock-in circuit allows considerable more information to be obtained on discrete components. The use of this analyzer in conjunction with a slave analyzer is also described. This allows positive identification of discrete signals at different parts of a vibrating system. (Author)

Naval Research Lab., Washington, D. C.
AN IMPROVED DC CURRENT-INTERRUPTER UNIT, by C. H. Presbrey, Jr., and S. Schuldiner. 14 July 60, 22p. 2 refs. NRL rept. 5472.
Order from OTS $0.75 PB 161 437

An improved design for a dc current interrupter has been developed at this Laboratory. This improvement was made in an effort to remedy certain operational difficulties encountered in the use of an existing model and also to provide for further studies at higher cell-current levels. In its present application to electrochemical studies, the current interrupter is part of an overall system consisting of the interrupter, a cell-current dc meter, a cell (with probe), an external power supply for the cell and for gating-stage bias, a peak-to-peak ac voltmeter, and an oscilloscope for visual or photographic analysis of the interrupted waveform. The specifications of the improved interrupter include the following features: current range from 10 μamp to 400 ma, pulse repetition rate from 1 cycle to 10 kc, pulse length from 1 μsec to 0.1 sec, pulse rise-and-fall time of 0.25 μsec. This unit has been used in the study of the time vs potential characteristics of electrochemical solution IR drops and of the cleanliness of the associated electrode metals. (Author)

Naval Research Lab., Washington, D. C.
INSTRUMENTATION FOR THE CLASSIFICATION OF SPACE SIGNALS, by F. T. Powles. Interim rept. 21 July 60, 19p. 4 refs. NRL rept. 5488.
Order from OTS $0.50 PB 161 515

The detection and identification of nonradiating satellites require a system designed to provide a phase difference of two incoming signals from a common source which can be translated to an angular position for the source, and a record from which input intensities over the duration of the signal may be derived, both related to an accurate time scale. The Navy's Space Surveillance System, based on the interferometer principle, was designed to satisfy these needs. The classification of signals from this system requires a knowledge of as many as possible of the characteristics by which the identity can be established. In the measurement of the characteristics of the signals obtained from the SPASUR system, it has been found that equipment available for the processing and analysis of the data in general does not have the accuracy or high speed required for a precise determination of short-duration signal characteristics. Improvement of existing instruments and development of new equipment to meet these performance requirements is being investigated. (Author)

Naval Research Lab., Washington, D. C.
REGULATED LINEAR TRANSFORMER-RECTIFIER POWER SUPPLIES, by D. S. Toffolo. Interim rept. 27 July 60, 19p. NRL rept. no. 5494.
Order from LC mi$2.40, ph$3.30 PB 146 392

The NRL unit described in this report, without using any filtering components, has an essentially linear input impedance per phase, is lighter for the same rating than present operational units procured from commercial sources, utilizes the more economical standard grades of transformer steels, and has equal if not superior regulation characteristics, particularly under transient conditions. The regulation control scheme is relatively simple, rugged, and reliable. As a further reliability feature, the unit is capable of delivering power at the same regulation as the ac primary input power even when the control components fail. The NRL unit incorporates several new features in a conversion unit of this type. They are a multiwinding synthetic secondary, series compensation, flux switching to obtain regulation, and tertiary windings to suppress harmonics, particularly those due to the rectifiers. Additional control features can be added, depending upon the degree of regulation desired.

New York U. Coll. of Engineering, N. Y.
CONTROL SYSTEM WITH MINIMUM SPECTRAL BANDWIDTH PF PLANT INPUT, by James C. Hung. Rept. on Contract AF 49(638)586. May 60, 21p. 2 refs. Technical rept. 400-9; AFOSR-TN-60-493.
Order from LC mi$2.70, ph$4.80 PB 148 943

A design method for control systems that minimizes the spectral bandwidth of the plant input signal is discussed. The plant input signal is minimized subject to the constraint that the integral square error for deterministic inputs or the mean square error for random inputs be limited to a known desired value. The control system transfer function that satisfies these requirements is derived, and the functions used in bandwidth shaping are discussed. An example of a system design using this technique is given. (Author)

Ohio State U. Research Foundation, Columbus.
MICROWAVE TUBE RESEARCH ON BARKHAUSEN-KURZ CAVITY-TYPE OSCILLATORS AND A TRANSVERSE-FIELD TRAVELING-WAVE TUBE, by Dean T. Davis, Fang-Shang Chen, and E. M. Boone. Final rept. on Contract AF 18(600)982. Dec 59, 61p. 15 refs. AFOSR-TN-60-134.
Order from LC mi$3.90, ph$10.80 PB 149 261

An electron tube employing a magnetically focused electron stream moving in an electric field resulting from a parabolic potential distribution can be operated as a Barkhausen-Kurz oscillator. Electrons traveling in such a potential distribution execute simple harmonic motion, and insofar as an accurate parabolic potential distribution is achieved, the frequency of the electron oscillations will be independent of the amplitude of the motion. If the interaction gap of a cavity resonator is located at the center of such a potential distribution and the resonator is tuned to an odd integral multiple of the frequency of simple harmonic electron motion, the electrons can then remain in proper phase to deliver energy to the high-frequency field of the resonator on successive transits. Oscillators of this type have been investigated at wavelengths of 3 cm, 1 cm, and 6 mm. Two types of geometries have been utilized, one having symmetry about the plane of a flat electron beam, and the other being symmetrical about the axis of a cylindrical electron beam. These tubes have exhibited low starting currents, wide electronic tuning ranges, and efficiencies of 12 to 14 percent in the 3 cm and 1 cm wavelength range. A detailed theoretical analysis has been completed, and is well correlated by experiment.

Ohio State U. Research Foundation, Columbus.
PARAMETRIC AMPLIFICATION, by Marlin O. Thurston. Final rept. on Contract AF 19(604)4060. May 60, 53p. 21 refs. AFCRC-TR-60-145.
Order from LC mi$3.60, ph$9.30 PB 149 166

This research was concerned with the capabilities and limitations of parametric amplifiers of the non-linear capacitance type. The dependence of junction capacitance on bias voltage for various special impurity distributions near the junction was calculated theoretically It was found possible to obtain a moderately large rate of change of capacitance with voltage at a reverse bias voltage large enough to make the capacitance itself small. The implications of this design for high-frequency, high-sensitivity amplifiers were considered. Diodes embodying this idea were constructed and initial tests were made. In support of the work on diode characteristics it was necessary to extend the theory of parametric amplifiers. The results obtained permit the performance of a parametric amplifier to be related to the capacitance characteristic of the diode, even at moderately high-signal level. Experimental frequency multipliers and parametric amplifiers were constructed and tested at various frequencies from audio to 23 kMc. The main purpose of this part of the work was to provide systems for use in making comparative operating tests of experimental diodes. (Author) (See also PB 143 192)

Philco Corp., Philadelphia Pa.
INVESTIGATION OF PHYSICAL LIMITATIONS ON CURRENT GAIN (BETA) AND RESEARCH ON IMPROVED SILICON CONTACTS, by Leon L. Maissel and James P. Spratt. Final rept. for 1 Apr 58-31 Mar 59 on Contract AF 19(604)3894. 30 Apr 59, 22p. 10 refs. H-2162-F; AFCRC-TR-59-157; AD-216 765.
Order from LC mi$2.70, ph$4.80 PB 148 553

This report comprises two principal studies: an investigation of the factors limiting the grounded emitter current gain (β) of a transistor, and research on improved contacts for silicon. Theoretical analysis of β limitations suggested a technique for evaluating the relative importance of the factors known to affect current gain. Attempts to apply this technique experimentally yielded anomalous results. These discrepancies, as yet unexplained, indicate that it is not possible to produce high-gain and/or high-frequency devices by biasing transistors near punch-through voltage. The first step in the study of improved silicon contacts was to determine the possibility of developing a micro-alloy structure for silicon. When experiments showed that such a device, while possible, would not be adaptable to large-scale production, this work was discontinued. Attention was then turned toward a silver-antimony contact. A method of jet-plating silver onto silicon was developed. The effect of silver alloying on lifetime was investigated; no adverse effect was noted. A study was made of diffusion from a plated contact as a method of producing a good injecting contact of small area. It was concluded that this method does not yield usable contacts.

Radiation Research Corp., New York.
NUCLEAR BATTERIES, by John H. Coleman and Arthur P. Pinkerton. Final progress rept., 15 Aug-15 Nov 57, on Contract DA 36-039-sc-73115, continuation of Contract DA 36-039-sc-71132. [1957] 35p. 10 refs. AD-160 419.
Order from LC mi$3.00, ph$6.30 PB 149 104

The battery components (source, collector and enclosure) were tested separately to obtain general design data and batteries constructed to test these principles. In regard to components, first, tritium-

titanium sources were prepared and tested for helium 3 and tritium evolution. Tests using a mass spectrograph indicate no measurable evolution after 67 days. Tests using an ion chamber indicate model R life is 32,000 days at room temperature and 2,000 days at 75°C and R2 life is 930,000 days at room temperature and 5,200 days at 75°C. Secondly, a new electrophoresis process was developed to deposit the carbon collector with a minimum of impurities. Thirdly, enclosures for Models R and R2 types were designed and drawn from flat CRS with copper plating. In regard to battery models, two types (RS and R2S) were designed for 1000°C processing. Also electrical data was taken which indicated Model R and R2 output current as a function of internal gas pressure. (Author)

Radiation Research Corp., New York.
VACUUM TRITIUM NUCLEAR BATTERY, by Joseph Thomas-Hazel, Bernard Caras and others. Final rept., 15 June-14 Dec 58, on Contract DA 36-039-sc-78047. [1958] 64p. 9 refs. AD-218 856.
Order from LC mi$3.90, ph$10.80 PB 149 113

A new battery design was evolved which incorporates a ceramic terminal and a complete processing schedule was developed for constructing these batteries on a special large-bore double-pumping vacuum system. Batteries were fabricated and subjected to life tests. (Author)

Radio Corp. of America, Harrison, N. J.
RUGGEDIZATION OF TWO TYPES OF S-BAND PULSED PENCIL-TUBE-AND-CAVITY TRANSMITTER UNITS. VOLUME I. RESEARCH AND DEVELOPMENT PROGRAM, by R. K. Reusch, D. W. Power, and R. E. Brooks. Final rept. for 17 May 57-10 July 59 on Contract DA 36-039-sc-74808. [1959] 182p. 5 refs. AD-236 221.
Order from LC mi$8.40, ph$28.80 PB 149 607

The development and the ruggedization are described of two types of S-band, pulsed, pencil-tube-and-cavity transmitter units. Volume 1 contains a description of the work done, test procedures and results, conclusions, and recommendations concerning RCA Developmental Type Nos. A-15134 grid-pulsed and A-15135 plate-pulsed units. The work has produced transmitter units with increased reliability and the following major features: good stability in frequency and power output when subjected to linear acceleration forces of at least 10,000 g's, forces of shock, vibration, and rotation, changes in temperature, and mismatched loads. In addition, the units possess increased life, low rf power leakage, and uniform drive requirements. The report contains two studies by R. K. Reusch: "A Theoretical Analysis of Rieke Diagram Interpretation," and "A Theoretical Analysis of Starting-Time Delay." (Author)

Radio Corp. of America, Harrison, N. J.
RUGGEDIZATION OF TWO TYPES OF S-BAND PULSED PENCIL-TUBE-AND-CAVITY TRANSMITTER UNITS. VOLUME II. MANUFACTURING SPECIFICATIONS, by R. K. Reusch, D. W. Power, and R. E. Brooks. Final rept. for 17 May 57-10 July 59 on Contract DA 36-039-sc-74808. [1959] 105p. AD-236 222.
Order from LC mi$5.70, ph$16.80 PB 149 608
See also PB 149 607

Raytheon Co., Waltham, Mass.
INVESTIGATION OF THE CORRELATION OF STANDARD DIODE EMISSION STUDY CONTRACT FINDINGS WITH PRODUCTION TYPE TUBES USING STANDARD PRODUCTION EQUIPMENT, by F. Hill, C. Bardsley and others. Final Scientific rept., 15 Dec 58-15 Jan 60, on Contract AF 19(604)4095. 4 Apr 60, 50p. AFCRC-TR-60-133.
Order from LC mi$3.30, ph$7.80 PB 149 574

Controlled laboratory exhaust tests have shown that the three variables affecting the emissive qualities of a vacuum tube are: time (length of exhaust cycle), cathode temperature during the exhaust cycle, and vacuum pressure conditions during the exhaust cycle. A program was initiated to study two exhaust machines: one with poor pumping speed, and one with vastly improved pumping speed. It has been demonstrated that the main variable affecting the pumping speed of the two exhaust units is the conductance of the plumbing connections between the vacuum tube exhaust stem and the pump. The conductance of the plumbing connections was improved by increasing the diameter of the piping. The first series of tests was run to study the effect of machine speed variations, with the same exhaust lighting and induction heating schedule on both units, upon the emissive qualities of the 6AH6 vacuum tube. It was concluded from these tests that machine speed variations from 500 to 1200 tubes per hour do not affect the life burning characteristics of the 6AH6 vacuum tubes regardless of the exhaust unit. (See also PB 148 123)

RCA Defense Electronics Products, Camden, N. J.
MICRO-MODULE PRODUCTION PROGRAM. Quarterly rept. no. 7, 1 Oct 59-1 Jan 60, on Contract DA 36-039-sc-75968. [1960] 212p. AD-234 690.
Order from LC mi$9.60, ph$33.30 PB 149 375

Production and testing of nearly all final-grade elements was accomplished. The process of molybdenum-manganese metallizing combined with ultrasonically assisted soldering was adopted as a method for producing reliable hermetic seals of semiconductor and quartz crystal units. All required digital modules of prototype-grade were completed and are undergoing tests. Forty-eight prototype-grade modules of sixteen different types have accumulated 62,000 module-hours of 85°C operating life-tests. (Author) (See also PB 146 042)

RCA Labs., Princeton, N. J.
BRIGHTNESS INTENSIFIER STUDY, by G. A. Morton, J. E. Ruedy and others. Rept. for 15 Sep 54-30 Nov 56 on Light Amplification, Contract AF 33(616)2631. May 60, declassified. 54p. 6 refs. ARL Technical rept. 60-284.
Order from OTS $1.50 PB 161 945

The basic limits of vision and image detection are discussed. Experimental results with the direct view intensifier are reported. A general discussion of pickup tube limitations concludes that the image intensifier orthicon is a very suitable pickup tube for a brightness intensifier amplifying a low light scene. Other intensifications methods and storage operation of intensifier orthicons are also investigated and discussed. The use of the image intensifier orthicon for optical pulse ranging is suggested. (Author)

RCA Defense Electronics Products, Camden, N. J.
MICRO-MODULE PRODUCTION PROGRAM. Quarterly rept. no. 6, 1 July-1 Oct 59, on Contract DA 36-039-sc-75968. [1959] 157p. 3 refs.
Order from OTS $3.00 PB 161 911

Electrical testing of prototype micro-elements was substantially completed during this quarter and environmental and life tests were initiated. Fifty prototype modules were assembled and encapsulated, and given electrical tests. Further evaluation is underway. The final printed wiring layouts for the micro-modular AN/PRC-36 Receiver and for three required subassemblies were completed. The design is compatible with the Program packing density objective of a quarter million parts per cubic feet. (Author)

Remington Rand Univac Div., Sperry Rand Corp., Philadelphia, Pa.
MATHEMATICAL CIRCUIT ANALYSIS AND DESIGN. Scientific rept. no. 1 on Contract AF 19(604)5189. 29 Feb 60, 40p. AFCRC-TN-60-358.
Order from LC mi$3.00, ph$6.30 PB 148 222

This report describes the attempt to develop a mechanized routine for the design and fault diagnosis of electronic circuits, summarizes the progress to date, and suggests areas for future study. Fault diagnosis has been considered initially, since (1) it seems to be the more tractable of the two, and (2) circuit design is considered to be a direct extension of fault diagnosis, requiring the incorporation of the worst case criterion and a method of optimization. A unique method has been devised for translating any schematic diagram into computer language so that each component and its location is specifically described. A method has been established and programmed for the Univac computer to generate the complete set of irredundant nodal and branch equations which will handle both linear and nonlinear characteristics of the circuit parameters. Finally, the set of equations has been reduced by eliminating all variables not required for solution of the component parameters. A sample circuit is given and a copy computer printout accompanies the description of each stage of the analysis. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
MODEL EXPERIMENTS ON A CAP LOADED FOLDED ANTENNA, by Donald L. Fehr and William C. Smith, Jr. June 60, 21p. 2 refs. RADC-TR-60-31.
Order from LC mi$2.70, ph$4.80 PB 149 326

This report describes tests and test results of the cap loaded folded antenna. These tests were conducted to determine application of the concept for 34 to 105 kc antenna applications for Air Force communications. The antenna uses top loading and folding techniques which yield an input resistance of 50 ohms at 0.04 wavelength. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
RADC RELIABILITY NOTEBOOK, by Joseph J. Naresky. Rept. prepared by McGraw-Hill Book Co. on Contract AF 30(602)1752. 30 Oct 59, 281p. 114 refs. RADC TR-58-111; AD-148 868.
Order from OTS $4.00 PB 161 894

Contents:
Reliability information services
The role of management: reliability programs
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Testing for reliability
Environmental factors affecting reliability
Reliability factors in mechanical design
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Reliability factors in electrical and electronic design
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Smyth Research Associates, San Diego, Calif.
REFRACTION ERRORS IN THE SPACE-POSITIONING OF HIGH FLYING OBJECTS, by L. J. Anderson, L. G. Trolese, and L. R. Hughes. Final rept. on Contract AF 30(602)1867. Nov 58, 50p. 10 refs. RADC [TR] 58-170; SRA-74; AD-148 887.
Order from LC mi$3.30, ph$7.80 PB 149 256

Sonotone Corp., Elmsford, N. Y.
STUDY OF SEALED NICKEL-CADMIUM BATTERIES, by Paul Ritterman. Final rept. for 1 Dec 58-31 Jan 60 on Research Investigations to Develop and Evaluate a Nickel-Cadmium Battery Having a Hermetically Sealed Construction, and to Study Its Reaction Mechanisms, Contract DA 36-039-sc-78249. [1960] 76p. 13 refs.
Order from LC mi$4.50, ph$12.30 PB 149 026

The life cycling program, using size "D" hermetically sealed cells filled with varying concentrations and amounts of electrolyte, was concluded after 608 cycles. Results of periodic capacity tests made during the entire cycling program are shown. Sealed cells were constructed for the experiment to test the effects of cobalt addition to the positive plates, lithia addition to the electrolyte and variation of negative/positive capacity ratios. The rate of reaction with oxygen of cadmium plates was investigated, within a sealed chamber, under varying conditions of oxygen pressure, mole fraction of oxygen and electrolyte concentration. Hermetically sealed cells were constructed with a special side opening so that it was possible to measure pressure build-up on charge and discharge by connection to a gauge. An experiment was designed to test the effect of temperature and initial cell atmosphere on the charge and discharge characteristics of the sealed cell. The effects on pressure build-up during charge and discharge were also studied. A relatively low recombination pressure (average = 12.4 psig) was found for the three cells tested when they were charged at the 3 hour rate (1.8 amperes).

Sperry Gyroscope Co., Great Neck, N. Y.
INVESTIGATION OF MICROWAVE WINDOW FAILURE MECHANISMS AND THEIR ELIMINATION, by D. Churchill and E. Cheatham. Quarterly progress rept. no. 2, 1 Sep-1 Dec 59, on Contract DA 36-039-sc-78314. Jan 60, 45p. 12 refs. Sperry rept. no. NA-8240-8182-2; AD-235 611.
Order from LC mi$3.30, ph$7.80 PB 149 027

The trajectories of electrons in an evacuated cylindrical waveguide under the fields of propagating rf energy were calculated. The results indicate an axial drift in the direction of propagation; this may be contributory mechanism in the charging of dielectric windows. The ghost-mode resonant frequencies of a thick, self-resonant structure were calculated using Forrer's equations. The solutions are presented as universal curves for various dielectric constants. These solutions were then compared with experimental values; the results were favorable. A survey of literature pertaining to radiation effects in inorganic solids was assessed. Radiation damage, such as color centers in the alkali halides, is primarily the result of ionization and excitation caused by electrons and X rays. A number of structures were selected for transmission measurements and bandwidth studies. The disc window with a short cylindrical section has produced the most promising results. A double-disc assembly was constructed for breakdown tests. Two material samples were subjected to 100-kv electron bombardment. The alumina sample was apparently undamaged; the Vycor sample showed indications of minor radiation damage. (Author) (See also PB 147 972)

Sperry Gyroscope Co., Great Neck, N. Y.
TRANSISTORIZED GYRO MAGNETIC COMPASS SET. Final engineering rept. for Aug 57-Feb 59 on Contract DA 36-039-sc-74871. Aug 59, 47p. 2 refs. Rept. no. LA-3254-0028; AD-227 162.
Order from LC mi$3.30, ph$7.80 PB 149 023

Design plans for four Gyro Magnetic Compass Sets were completed and submitted. Sperry was requested to redesign and convert the two sets with rotating pointer indicators to rotating dial indicators. This design incorporates integral lighting in both the rotating dial indicators and the rotating dial repeaters. Redesign of the two compass sets was accomplished and accepted. Fabrication of all four sets was completed. Testing of the compass sets to establish compliance with Procurement Specification SCL-1802 was completed. Evaluation of test data indicated that over-all performance of the compass sets is satisfactory.

Stanford Electronics Labs., Stanford U., Calif.
CORRUGATED WAVEGUIDE FILTERS WITH SPECIFIED STOP-BAND CHARACTERISTICS, by M. Crane and D. J. Grace. Rept. on Contract DA 36-039-sc-73151. 31 Jan 58, 62p. 8 refs. Technical rept. no. no. 152-4; AD-160 471.
Order from LC mi$3.90, ph$10.80 PB 149 407

This report treats the design of corrugated filters for which both pass-band and stop-band characteristics have been specified. Following a review of the general corrugated-waveguide matrix and a summary of image-parameter techniques, it is shown that considerable simplification results when the guide wavelengths in both the transmission waveguide and the slots are the same. A procedure is described for designing a filter in sections, with each section composed of a cascade of identical filter elements which accomplishes one of the design objectives. This technique is illustrated by the design of a filter with a pass band from 8.0 to 15.0 kMc and a stop band from 15.0 to 21.0 kMc. The attenuation was required to rise at least 10 db per 100 Mc above the 15.0 kMc lower cutoff and remain 40 db or more throughout the stop band. The sequence of construction and measurement for this filter is discussed, and the experimental results are presented. Of the many important filter constructions for which the general corrugated-waveguide matrix must be used, ridge waveguide and dielectric or paramagnetic loading are perhaps the most common. The results of some preliminary work using changes in the permeability of ferrite to shift the cutoff frequencies of a corrugated filter are discussed briefly. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A CROSSED-FIELD MULTI-SEGMENT DEPRESSED COLLECTOR FOR BEAM-TYPE TUBES, by D. A. Dunn, R. P. Borghi, and G. Wada. Rept. on Contract AF 33(616)6207. 21 Sep 59, 22p. 8 refs. Technical rept. no. 102-1; AD-227 051.
Order from LC mi$2.70, ph$4.80 PB 147 615

The velocity-dependent action of crossed electric and magnetic fields can be used to sort the electrons of the spent beam of a klystron or traveling-wave tube into two or more velocity classes and to collect each class of electrons at a potential appropriate to its velocity. Secondary electrons produced at the collection surfaces do not return to the interaction space of the tube because of the nonreciprocal action of the crossed fields. An experimental tube permitted two-segment operation with 20 per cent of the beam power dissipated in the collector at small signals. Velocity sorting was observed that permitted operation near this percentage of beam power over a considerable range of r-f signal levels. (Author)

Stanford Electronics Labs., Stanford U., Calif.
ELECTRON DEVICES RESEARCH. Consolidated Quarterly status rept. no. 10, 1 Apr 30 June 59, on Contracts DA 36-039-sc-73178, AF 33(616)6207, AF 33(600)27784, AF 19(604)1847, Nonr-225(40), and Nonr-225(24); [1959] 89p. 54 refs. AD-225 862.
Order from LC mi$4.80, ph$13.80 PB 149 408

See also PB 147 014

Stanford Electronics Labs., Stanford U., Calif.
A HELICAL MICROWAVE ANTENNA FEED, by W. H. Huntley, Jr. Rept. on Contract DA 36-039-sc-73151. 30 Sep 57, 17p. 10 refs. Technical rept. no. 461-3; AD-144 454.
Order from LC mi$2.40, ph$3.30 PB 149 406

Design and construction of an S band beam mode helix for feeding an offset section of a paraboloid are described. Some measurement data taken with a test helix are given and evaluated for this application. The characteristics described include: beam shape and width; axial ratio; impedance; and location of the phase center. (Author)

Stanford Electronics Labs., Stanford U., Calif.
AN INVESTIGATION OF THE SENSITIVITY OF SOME RECEIVERS HAVING LARGE R-F BANDWIDTH, by J. L. Grigsby. Rept. on Contract DA 36-039-sc-73151. 4 Nov 58, 172p. 18 refs. Technical rept. no. 553-1.
Order from LC mi$8.10, ph$27.30 PB 149 402

An investigation is made of the sensitivity of two types of receivers that have large r-f bandwidth. The receiver types considered are the superheterodyne with distributed-frequency local oscillator, and the crystal-video receiver employing r-f preamplification. The intent of the work is to determine the limiting values of the sensitivity of the receivers when the r-f bandwidth is at least several per cent of the band-center frequency.

Stanford Electronics Labs., Stanford U., Calif.
SOLID-STATE ELECTRONICS RESEARCH. Consolidated Quarterly status rept. no. 1, 1 Oct-31 Dec 58, on Contracts Nonr-225(24), Nonr-225(31), Nonr-225(44), and DA 36-039-sc-73151. [1958] 31p. 55 refs.
Order from LC mi$3.00, ph$6.30 PB 147 345

Abstracts of progress on 20 projects in electronic circuits and materials.

Stanford Electronics Labs., Stanford U., Calif.
TRANSMITTING AND RECEIVING EQUIPMENT FOR S-BAND PROPAGATION STUDIES. PART A. RECEIVER, by R. E. Miller, D. B. Coates, and C. S. Liston. Rept. on Contract DA 36-039-sc-73151. 3 Feb 59, 15p. 2 refs. Technical rept. no. 461-6A.
Order from LC mi$2.40, ph$3.30 PB 149 403

A high-sensitivity S-band receiver is described. Principal design factors of the system leading to a suitable receiver design for beyond-the-horizon propagation experiments are included as well as special circuit features of the receiver.

Stanford Research Inst., Menlo Park, Calif.
APPLIED RESEARCH IN MICROMINIATURE FIELD EMISSION TUBES, by W. W. Hansen. Quarterly progress rept. no. 2, 1 Oct 59-1 Jan 60, on Contract DA 36-039-sc-84526. [1960] 23p. 2 refs. AD-235 643.
Order from LC mi$2.70, ph$4.80 PB 149 380

Characteristics of simulated, microminiature, field emission tubes were studied in apparatus now nearing completion. Important parts of the apparatus are a demountable, ultra-vacuum chamber and a micromanipulator for adjustment of the spacing of tube elements without breaking the vacuum seal. Theoretical studies of a particular triode configuration indicate that power gains of 10 to 20 are realizable if plate loads of several megohms are used. The possibility of significant power gain at frequencies as high as 100 megacycles is implied by inter-electrode capacitances of the order of 10^{-15} farads. Tube dimensions determine whether tube operation is plate-power or emission limited. Maximum plate power becomes the dominant limiting factor as the dimensions of the tube studied are increased. (Author) (See also PB 146 797)

Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF METHODS OF SCANNING THE BEAM OF LARGE ANTENNAS, by M. Gilden and J. S. Honda. Scientific rept. 10, 1 Sep-30 Nov 59, on Contract AF 19(604)2240. Feb 60, 58p. 23 refs. AFCRC-TN-60-394.
Order from LC mi$3.60, ph$9.30 PB 148 758

Gas discharge phase shifters are discussed with a view to determining their applicability to electronic scanning antenna arrays. A description of a gas-discharge plasma is given, and several modes of wave propagation are analyzed. Criteria for evaluation of phase shifters are then specified and applied to the various types of gas-discharge phase shifters described in the literature. It is concluded that a low-power, electronically controlled, gas-discharge phase shifter of small size is feasible at UHF. The second half of the report discusses a 360-degree-azimuth, line-source scanner employing a toroidal bend. (See also PB 144 310)

Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF METHODS OF SCANNING THE BEAM OF LARGE ANTENNAS, by L. A. Robinson and E. M. T. Jones. Scientific rept. no. 11, 1 Dec 59-29 Feb 60, on Contract AF 19(604)2240. Apr 60, 29p. 16 refs. SRI Proj. 2184; AFCRC-TN-60-560.
Order from LC mi$2.70, ph$4.80 PB 149 543

The discussion is devoted to line-source feeds for the mechanical scanning of large spherical reflectors. With present-day large reflectors required for radars and for radio astronomy, the line source which is needed is many wavelengths long, so that leaky-wave type radiators become feasible. Radiation from leaky-wave atennnas can be very accurately controlled in amplitude and phase along the length of the antenna, and it should therefore be possible to approximate very closely the theoretical line source feed requirements. A particular leaky-wave feed design, consisting of a circular waveguide section perforated by narrow, transverse slots, is discussed. The slots are operated below resonance so that the amount of power coupled through each slot can be controlled by means of the slot length, and the phase velocity along the line source can be controlled by means of the waveguide diameter. (Author) (See also PB 144 310)

Sylvania Electronic Systems, Inc., Waltham, Mass.
MULTIWAVE TRANSMISSION LINE, by James D. Kellett. Rept. on Contract AF 19(604)5474. 1 Apr 60, 81p. 11 refs. Scientific rept. no. SR424-1; ERD-TN-60-599.
Order from LC mi$4.80, ph$13.80 PB 149 813

This paper describes an investigation of the electrical properties of a multiwave transmission line. The structure consists of two unbalanced TEM transmission lines whose outer conductors are modified to form either a rectangular or a ridged waveguide. The attenuation, mode cross-coupling, TEM characteristic impedance, and cut-off wavelength properties of this multiwave structure are analyzed both theoretically and experimentally. TEM attenuation of less than 1.5 times the attenuation of a coaxial structure of the same physical dimensions, decoupling between the TEM modes of greater than 50 decibels, and changes in cut-off frequency of less than 8 percent can be realized in the multiwave structure. (Author)

Syracuse U. Research Inst., N. Y.
DIAGNOSIS OF EQUIPMENT FAILURES, by Richard A. Johnson, Earl Kletsky, and John Brule. Technical rept. no. 1 on Contract AF 30(602)1833. Apr 59, 75p. 6 refs. SURI rept. no. EE577-594T1; RADC-TR-59-47; AD-213 876.
Order from LC mi$4.50, ph$12.30 PB 147 540

Recent advances in the design of electronic systems have results in an ever-increasing complexity in such systems. While such complexity is necessary to permit the systems to perform tasks of ever-increasing scope, the problem of keeping the systems in "working" order tends to increase at least as fast as the basic complexity. The present report is concerned with one particular phase of the problem of maintenance - namely the problem of determining which part of an equipment is in need of repair when the equipment as a whole does not function properly. While this is only one aspect of the whole problem of maintaining equipment in working order, any improvement in general diagnostic procedures would result in significant economies. Some of the other factors which contribute to maintainability are the reliability of the basic component parts, proper preventive maintenance procedures, and proper mechanical and electrical design so as to make component parts easily accessible for replacement.

Technical Operations Inc., [Burlington] Mass.
DEVELOPMENT OF POWER TRANSISTOR CIRCUITRY, by R. R. Smyth. Final rept. on Contract DA 36-039-sc-63072. 14 May 56, 77p. 2 refs. Rept. no. TOI 56-13; AD-104 650.
Order from LC mi$4.50, ph$12.30 PB 149 014

The use of a simple transistor push-pull oscillator circuit as a d-c to d-c power converter has been investigated. The transistors act essentially as switches alternately connecting the supply battery across each half of a transformer primary. As a result the transistor dissipation is very low and the circuit efficiency high. Because of the importance of transistor dissipation in determining the maximum power output, considerable attention is given to the problem of determining optimum conditions. The problem of regulating the output voltages has received considerable attention. Three practical circuits have been developed. Satisfactory regulation of a single output for both supply voltage and load current changes has been obtained with a circuit employing saturable reactors in the output circuit. (See also PB 140 106)

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer and H. E. Weaver. Quarterly rept. no. 7, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-73266. [1959] 41p. 5 refs. Engineering rept. no. 218-7Q.
Order from LC mi$3.30, ph$7.80 PB 146 462

The EPR spectrum of $SrTiO_3$ has been examined over a wide temperature range and the results correlated with earlier measurements on the dielectric properties of this crystal. In thin plate crystals the EPR spectrum reveals an anomalous frozen-in-tetragonal splitting which is independent of temperature. This effect is large enough that it masks the temperature dependent splitting predicted on the basis of dielectric measurements. The frozen-in splitting is probably due to strain-release brought about by cutting the thin plates. This hypothesis is supported by measurements at room temperature on a cubic-shaped sample. Additional measurements of the EPR spectrum at low magnetic fields reveal the presence of two unexplained lines of twofold symmetry. (See also PB 145 234)

Westinghouse Electric Corp., Baltimore, Md.
PULSE TRANSMISSION STUDY, by Heinz Fiege-Kollmann. Quarterly Technical note no. 2 on Contract AF 30(602)1866. 24 Feb 59, 135p. 10 refs. RADC-TN-59-82; AD-211 434.
Order from LC mi$6.90, ph$21.30 PB 147 130

Contents:
Telephone facilities
Test message
Test runs
Double differentiation detector
Test runs
Double differentiation detector
Further AM-FM waveform investigation
Synchronization
Matched filters
Appendicies
Tests
Determination of maximum level of input to a leased line
Digital subset
Investigation of transmission signals and tabulation of their WT products
A matched filter design approach
Matched filters in the carrier band
Diagrams of matched filters
Integrated data systems

Westinghouse Electric Corp., Baltimore, Md.
R-THETA TRANSPONDER. Westinghouse Instruction Book. Rept. on Contract NOa(s)-12186. 18 Oct 51, 65p.
Order from LC mi$3.90, ph$10.80 PB 147 949

The R-Theta Transponder is an airborne radio transmitting-receiving equipment used as a radar beacon and as an aid in the identification of aircraft. It is designed primarily to be used in conjunction with ground radars, ASR and PAR. The R-Theta Transponder will permit extending the reliable range of the S-Band Surveillance radars to 100 miles, and the X-Band Precision Approach radars to 15 miles. In addition, the use of the Transponder codes provides positive aircraft identification without maneuvering the aircraft.

Westinghouse Electric Corp., Baltimore, Md.
RHO THETA TRANSPONDER MOD II. Westinghouse Instruction Book. Rept. on Contract NOa(s)-12186. 15 Aug 52, 81p.
Order from LC mi$4.80, ph$13.80 PB 147 950

The Rho Theta Transponder Mod II is an airborne radio transmitting-receiving equipment used as a radar beacon and as an aid in the identification of aircraft. It is designed primarily to be used in conjunction with ground control approach radars, ASR and PAR. The Rho Theta Transponder Mod II will permit the reliable range of the S-Band Surveillance radars to be extended to 100 miles, and the X-Band Precision Approach radars to 15 miles. In addition, the use of the Transponder codes provides positive aircraft identification without maneuvering the aircraft. (See also PB 147 949)

Westinghouse Electric Corp., Elmira, N. Y.
RESEARCH AND REPORTS ON AN OPTICAL AMPLIFIER, by Joseph Lempert. Rept. on Light Amplification, Contract AF 33(616)2611. May 60, declassified, 82p. ARL Technical rept. 60-283.
Order from OTS $2.25 PB 161 944

The purpose of this contract has been twofold. During Phase A, the object was to find through research new solutions which lead to new and improved types of pickup transducers which are potentially suitable for future development in the military field, especially under low light level conditions. Definite improvement has been accomplished in the threshold by extra dynode multiplication and by image preamplification. Phase B called for investigating the feasibility of producing an imaging pickup tube which would be capable of operating under the vibration encountered in an aircraft in flight. The feasibility of constructing image orthicons with considerably reduced microphonics, and suitable for use in aircraft, was established. (Author)

Ordnance, Missiles, and Satellite Vehicles

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
THE DEVELOPMENT OF IRDOMES, by J. R. Jenness, jr. Progress rept. for 1 June 51-1 June 53 on TED Proj. ADC EL-889. 21 Aug 53, declassified 28 July 60, 21p. 13 refs. Rept. no. NADC EL-53112.
Order from LC mi$2.70, ph$4.80 PB 149 776

This report released for sale to the public 25 Aug 60.

Experimental work was conducted on reflection-reducing coatings, transmittance measurements, and Kel-F molding. The problem of measuring the transmittance of a sample at large angles of incidence was analyzed and an optical system for these measurements was designed. This report also summarizes the over-all problem of designing irdomes for supersonic guided missiles.

Air Force Cambridge Research Center, Bedford, Mass.
A CATALOGUE OF POSITIONAL DATA OF THE RUSSIAN ARTIFICIAL EARTH SATELLITE DELTA I (SPUTNIK III ROCKET BODY). VOLUME I: TABULATION OF INDIVIDUAL OBSERVATIONS, AND AIR FORCE SIGHTINGS, 16 MAY TO 20 MAY 1958, by W. S. Ripley. Rept. on Project Space Track. 1 Jan 60, 261p. 3 refs. GRDST-11; AFCRC-TN-60-232(I).
Order from LC mi$11.10, ph$41.10 PB 149 179

This catalogue (published in three volumes) contains approximately 100,000 positional data observed during the life of the Russian earth satellite 1958 Delta I (Sputnik III Rocket Body). These data, collected by Space Track, are from two types of sources; those sent in by individuals and various organizations from all over the world and those produced by United States Air Force facilities. The positional data are arranged chronologically with observation station names and coordinates. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
A CATALOGUE OF POSITIONAL DATA OF THE RUSSIAN ARTIFICIAL EARTH SATELLITE DELTA I (SPUTNIK III ROCKET BODY). VOLUME II: AIR FORCE SIGHTINGS, 23 MAY TO 29 AUGUST 1958, by W. S. Ripley. Rept. on Project Space Track. 1 Jan 60, 258p. GRDST-11; AFCRC-TN-60-232(II).
Order from LC mi$11.10, ph$39.60 PB 149 180

See also PB 149 179.

Air Force Cambridge Research Center, Bedford, Mass.
A CATALOGUE OF POSITIONAL DATA OF THE RUSSIAN ARTIFICIAL EARTH SATELLITE DELTA I (SPUTNIK III ROCKET BODY). VOLUME III: AIR FORCE SIGHTINGS, 30 AUGUST TO 30 NOVEMBER 1958, by W. S. Ripley. Rept. on Project Space Track. 1 Jan 60, 265p. GRDST-11; AFCRC-TN-60-232(III).
Order from LC mi$11.10, ph$41.10 PB 149 181

See also PB 149 180

Air Force Cambridge Research Center, Bedford, Mass.
A CATALOGUE OF POSITIONAL DATA OF THE U. S. EARTH SATELLITE 1958 ZETA (PROJECT SCORE), by W. S. Ripley. Rept. on Project Space Track. 1 Jan 60, 140p. 3 refs. GRDST-12; AFCRC-TN-60-233.
Order from LC mi$6.90, ph$21.30 PV 149 178

This catalogue contains approximately 16,000 positional data observed during the life of the U. S. earth satellite 1958 Zeta (Project Score). These data, collected by Space Track, are from two types of sources; those sent in by individuals and various organizations from all over the world and those produced by United States Air Force facilities. The positional data are arranged chronologically with observation station names and coordinates. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
SOLUTIONS OF THE PROBLEM OF ARTIFICIAL SATELLITE THEORY WITHOUT DRAG, by Dirk Brouwer (Yale U. Observatory). Rept. on Project Space Track. Oct 59, 48p. 3 refs. GRDST-10; AFCRC-TN-59-638.
Order from LC mi$3.30, ph$7.80 PB 149 177

Sections 1 - 6 give the solution of the main problem for a spheroidal earth with the potential limited to the principal term and the second harmonic which contains the small factor k_2. The solution is developed in powers of k_2 in canonical variables by a method which is basically the same as that used in a different problem by von Zeipel (1916). The periodic terms are divided in two classes: The short-period terms contain the mean anomaly in their arguments: the arguments of the long-period terms are multiples of the mean argument of the perigee. The periodic terms, both of short and long period, are developed to $O(k_2)$; the secular motions are obtained to $O(k_2^2)$. The results are obtained in closed form; no series developments in eccentricity or inclination arise. The solution does not apply to orbits near the critical inclination, 63.4^o, but is otherwise valid for any eccentricity < 1 and any inclination. Section 7 gives the long-period terms and the additions to the secular motions caused by the fourth harmonic in the potential; section 8 gives the contributions by the third and fifth harmonics; section 9 contains formulas for computation. (Author)

Air U., Maxwell AFB, Ala.
AEROSPACE GLOSSARY, by Woodford Agee Heflin. Sep 59, 118p. Documentary Research Study AU-282-58-RSL
Order from LC mi$6.00, ph$18.30 PB 149 447

The work list has been arrived at by noting words and phrases spoken by people engaged in aerospace research, development, and operations, also by noting terms found in the current periodical and book literature of missiles, astronautics and related fields. A large number of quotations have been extracted from aerospace literature, each quotation illustrating a manner in which a particular term is used. As a result, the definitions are based upon an analysis of both spoken and written usage, fortified by consultations with knowledgeable persons in residence at Air University, in missile industry, and at AF research and development and test centers. This glossary attempts only to describe and explain usage not to prescribe it.

Allied Research Associates, Inc., Boston, Mass.
LAUNCHING OF AIRBORNE MISSILES UNDERWATER. PART IV. OPTIMUM LAUNCHER HEADING IN A CONFUSED SEA, by Theodore R. Gordon and Irving Frank. Rept. on Contract Nonr-2343(00). 30 Oct 59, 49p. 5 refs. Document no. ARA-701; AD-229 080.
Order from LC mi$3.30, ph$7.80 PB 149 510

When a missile is launched underwater in a confused sea, mean-square trajectory responses (e. g. angle of attack, pitch angle, etc.) can be calculated. These variances, in turn, define a bivariate Gaussian probability density function. It is assumed here that a particular launch is successful if, at a certain time, a particular response falls within the confines of a square region whose sides are fixed with respect to the launcher. By changing the launcher heading the square is rotated with respect to the directional properties of the sea, and the probability of successful launch is thereby altered. It is the objective of this report to discover that particular launcher heading which gives maximum probability of success. The results are applied both to sea-type and swell-type disturbances, and some numerical illustrations are included. It is concluded that significant improvement in the probability of successful launch is obtained by optimizing launcher heading under virtually all sea conditions likely to be encountered. (Author)
(See also PB 147 711)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SUITABILITY OF INSULATED CONTAINERS FOR TRANSPORT OF MATERIAL WITH CRITICAL THERMAL TOLERANCES TO COLD, by John R. Cavanaugh. July 57, 6p. Technical note AAL-TN-57-43.
Order from LC mi$1.80, ph$1.80 PB 146 630

The container, Blood Shipping, Stock No. Med. 6515 NSL (figure 1), was evaluated to determine whether a packing method could be sufficient to protect thermocritical fluids from freezing during air shipment in cargo type aircraft which do not employ supplemental heating systems for the cargo compartment. The container and its test contents were subjected to repeated exposure to ambient temperature conditions ranging from $+62^oF$ to -34^o F and the container was found to amply protect its contents from freezing for periods in excess of 9 hours. (Author)

Army Transportation Environmental Operations Group, Fort Eustis, Va.
PRELIMINARY INVESTIGATION OF DESERT TRANSPORTATION, by Daniel F. Richards. June 60, 35p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 149 222

The report contains discussions of desert environment, operation and maintenance of wheeled vehicles, methods of navigation utilized by USATREOG, reconnaissance, and night operations. (Author)

Avco-Everett Research Lab., Mass.
HIGH POWER PULSE STEEPENING BY MEANS OF EXPLODING WIRES, by G. S. Janes and H. Koritz. Apr 59, 20p. 3 refs. Research rept. 50.
Order from LC mi$2.40, ph$3.30 PB 147 201

A circuit technique is described which reduces the rise times of high power pulses by means of exploding wires. Using this technique, a mangetic field of 10,000 gauss is built up in .15 microseconds throughout a volume 4 cm in length and 10 cm in diameter. The best results are obtained with high conductivity fuse materials such as copper or aluminum.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ELECTRONIC MISSILE ACQUISITION SYSTEM BY MEANS OF FM/FM TELEMETRY INSTRUMENTATION, by K. H. Patterson. Aug 53, declassified [15 Dec 53]. 14p. Technical note no. 817; AD-91 098.
Order from LC mi$2.40, ph$3.30 PB 148 646

A method of obtaining trajectory data from the FM-FM telemetry carrier by means of highly specialized receivers is proposed. These receivers would provide

a means of comparing the phase of the signal received by two antennas spaced a known distance apart. Problems involved and inherent limitations are discussed. While accurate predictions are impossible present considerations indicate that such a system should prove to be a valuable asset in the field of electronic instrumentation. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
MACRO-PELLET PROJECTION WITH AN AIR CAVITY HIGH EXPLOSIVE CHARGE FOR IMPACT STUDIES, by John H. Kineke, Jr., and Lee S. Holloway. Apr 60, 12p. 5 refs. Memo. rept. no. 1264; AD-237 944.
Order from LC mi$2.40, ph$3.30 PB 148 905

A series of high explosive charges has been developed for projecting steel pellets at velocities sufficiently high for terminal ballistic investigations of hypervelocity crater formation. The air cavity charge suggested by Deas and Zimmerman has been the basis for designing a number of charges projecting pellets whose masses and velocities are statistically reproducible within 3%. Pellet masses range from 0.15 to 8.86 grams and velocities from 1.99 to 5.43 km/sec. Mass determination and velocity measurement techniques are described. These charges are currently being used for extensive, and economical hypervelocity crater studies. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ORBIT OF A SATELLITE OF AN OBLATE PLANET, by Boris Garfinkel. Dec 59, 39p. 7 refs. Rept. no. 1089.
Order from LC mi$3.00, ph$6.30 PB 149 237

The report gives a solution of the problem of motion of a particle in the potential field

$$V = -1/r + J_2P_2(\sin\theta)/r^3 + J_4P_4(\sin\theta)/r^5,$$

where J_2 and J_4 are small parameters. The first approximation is furnished by a V_o that incorporates the major effect of the second spherical harmonic and leads to a closed solution with no secular variations of order J_2. The perturbations of this non-Keplerian intermediary orbit are derived here by the von-Zeipel modification of the method of Delaunay. The secular variations are carried up to orders J_2^2 and J_4, and the periodic variations to orders J_2 and J_4/J_2. A computational summary is included, and the effect of the third spherical harmonic is appended. (Author)

Ballistic Research Lab., Aberdeen Proving Ground, Md.
RESEARCH AND DEVELOPMENT OF OPTICAL TRACKING METHODS AND INSTRUMENTATION AT THE BALLISTIC RESEARCH LABORATORIES, by Dirk Reuyl and Walter Carrion. May 60, 60p. 23 refs. Rept. no. 1103.
Order from LC mi$3.60, ph$9.30 PB 148 903

Problem areas discussed include determination of missile trajectories, measurement of missile attitude and recording of special events in flight, determination of target intercept by guided missiles, observation of small missiles at great distances, evaluation of missile performance in the terminal phase of flight, especially that pertaining to the functioning of the warhead, as well as atmospheric optics research and studies of detection, acquisition and tracking. Instrumentation systems described include cinetheodolites, tracking telescopes T-1 to T-5 of various types, the IGOR intercept system, the large aperture SMT instrument for small missiles, the TET, WAF and IMP telescopes for terminal trajectory, warhead functioning and impact proximity problems, respectively, and the RT-1 and RT-2 research telescopes. (Author)

Boeing Airplane Co., Seattle, Wash.
PITCH AXIS CONTROL SYSTEM, FC-110, by L. Rupel. Rept. on Contract AF 33(038)19589. 10 Feb 56, 67p. Document no. D-16954 A; AD-88 517.
Order from LC mi$3.90, ph$10.80 PB 150 296

This report released for sale to the public 19 Sep 60.

The purpose of the pitch control system is to control the model 624-7 missile in the pitch plane during all phases of flight. It is composed of the pitch rocket control system and the elevator control system. The circuitry involved in the pitch control system electronics is explained. Packaging considerations are enumerated. Unit requirements and hydraulic and mechanical component requirements are tabulated. Appendixes describe the ring-type instrument amplifier-demodulators, the series demodulator, and the operational magnetic amplifiers.

Centro di Studio per la Fisica Delle Microonde (Italy).
ON THE DETERMINATION OF THE PATH OF THE ARTIFICIAL SATELLITES, by N. Carrara, P. F. Checcacci and L. Ronchi. Technical note no. 1 on Contract AF 61(052)182. Oct 59, 19p. 8 refs. AFCRC-TN-60-151.
Order from LC mi$2.40, ph$3.30 PB 148 779

A method based on the Doppler effect is described for determining some parameters of the path of an artificial satellite and the available approximation discussed. Another system is described which does not require any special hypothesis on the path to be determined. A possible arrangement of the ground equipment is described in detail. This system is very similar to the SPHERODOP system. However, the SPHERODOP system is in general used for tracking the missiles from the starting point. Four stations are required, because the frequency emitted from the missile cannot be considered known. This system is substantially the application of the SPHERODOP to the determination of the orbit of the satellites, in the general case, when the stations do not receive the signals from the starting point.

Centro di Studio per la Fisica delle Microonde (Italy).
TECHNIQUES AND EQUIPMENTS FOR DOPPLER OBSERVATIONS, by P. F. Checcacci. Technical note no. 2 on Contract AF 61(052)182. Oct 59, 43p. 2 refs. AFCRC-TN-60-370.
Order from LC mi$3.30, ph$7.80 PB 148 780

This report describes the apparatuses used for carrying out the measurements on the satellites planning

according to the Space Track Program. The measurements concern the determination of the Doppler effect curves and of the plots of the intensity of the received signal versus the time. The complete apparatus is basically composed of an antenna, a receiver, a recorder, a frequency meter and other auxiliary equipments. Everyone of these elements might be chosen between some different types, with slightly different performances. The apparatus used has been chosen after a number of tests of several types, which are described and discussed.

Department of the Air Force, Washington, D. C.
INTERIM AEROSPACE TERMINOLOGY REFERENCE. 30 Oct 59, 79p. Administrative Practices Pamphlet AFP 11-1-4.
Order from OTS $2.00 PB 161 913

This pamphlet is an interim consolidation of the numerous aerospace terms and definitions that have appeared in various Air Force publications. It is intended to offset the confusion resulting from the inconsistencies of many of those definitions. Here, to the most practical extent, a singular definition has been ascribed to each term, to replace previous multi-definitions. Thus, mutual understanding is promoted. Additionally, this pamphlet provides a meaningful reference-guide, and focuses the attention of Air Force members on the terminology of the aerospace age.

Diamond Ordnance Fuze Labs., Washington, D. C.
FUZE, ROCKET, PDSQ, T2058, by Peter B. Ferrara. Final rept. 29 July 60, 12p. Technical rept. TR-850.
Order from LC mi$2.40, ph$3.30 PB 150 012

The fuze, now in the Engineering and User Test Phases, is a point detonating, superquick, mechanical design for use with the T238, 115-mm Area Toxic Rocket—a high velocity, fin-stabilized, ground-to-ground projectile. The rocket is designed for use with the T145 Multiple Rocket Launcher System. The T2058 fuze employs a modified Mk 181 S&A mechanism. The final laboratory and R&D field test results, drawings, and pertinent photographs are included. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
SPECIFICATION OF ZIRCONIUM FOR USE IN GASLESS MIXTURES, by R. E. McIntyre and M. L. Couch. 9 Mar 60, 36p. 13 refs. TR-821; AD-234 317.
Order from LC mi$3.00, ph$6.30 PB 147 795

Relationship between the properties of zirconium powder and the properties of heat powders or delay compositions, to arrive at a suitable specification. The data show the important points to be specified are the total zirconium content, the ignition gain, the hydrogen content, the particle-size distribution and the surface area. The data show that the burning rate of barium chromate-zirconium delay compositions depends primarily upon the calorific value and secondarily upon the composition.

Frankford Arsenal, Philadelphia, Pa.
THE DETECTION OF FLAWS IN 20mm HEI SHELL, by A. J. Wysoczanski. Dec 58, 39p. 1 ref. Technical rept. no. R-1484.
Order from LC mi$3.00, ph$6.30 PB 150 304

This report released for sale to the public 19 Sep 60.

A detailed description is given of the various electromagnetic techniques that were developed and evaluated in an attempt to detect the presence of surface and sub-surface defects in 20mm HEI shell. Details are given concerning a reluctance technique and two eddy current techniques, and the instrumentaion developed during these studies.

General Electric Co., Schenectady, N. Y.
BIBLIOGRAPHY AND INDEX OF PROJECT HERMES REPORTS, 1945-1950, by W. D. Robusto. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23]. May 51, declassified 13 May 58. 82p. 804 refs. Technical Information Series rept. no. R51A0515.
Order from LC mi$4.80, ph$13.80 PB 149 208

The material is listed according to a subject, number, and author index. German documents translated by Project Hermes are also included. A listing of the Hermes Bimonthly Surveys is not included in this report. (Author)

General Electric Co., Schenectady, N. Y.
AN EXPERIMENTAL INVESTIGATION OF SUBSONIC DIFFUSER CONFIGURATIONS FOR THE HERMES B-1 RAMJET, by R. E. Geiger. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. Dec 50, declassified 17 Mar 58, 28p. 6 refs. Technical Information Series TR-55274.
Order from LC mi$2.70, ph$4.80 PB 149 468

This report presents the results of an experimental investigation of some of the important parameters affecting the design and performance of subsonic diffusers. The subsonic diffusers tested were of the annular divergent area type common to the after-part of ramjet diffusers. Each configuration was tested with two types of flows: supersonic flow with an internal shock and, completely subsonic flow. (Author)

General Electric Co., Schenectady, N. Y.
MATHEMATICAL DESIGN OF GERIPAC, by E. G. Keller. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23]. 25 Mar 51, declassified 17 Mar 58. 38p. 1 ref. Technical Information Series rept. no. [R]51A0501.
Order from LC mi$3.00, ph$6.30 PB 149 206

The Geripac (General Electric Radar in Put Automatic Computer) is a binary device which receives signals from a high altitude rocket by means of the General Electric high precision Doppler radar and after smoothing and differentiating azimuth and elevation signals makes a transformation of coordinates from radar to inertial space and computes corrections in the latter space applicable to the rocket for its terminal guidance. (Author)

General Electric Co., Schenectady, N. Y.
PRELIMINARY DESIGN STUDIES FOR A LOW-COST SURFACE-TO-SURFACE MISSILE, by H. M. Mitchell and R. L. Morey. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23]. Sep 50, declassified 17 Mar 58. 61p. 1 ref. Technical Information Series rept. no. R50A0511.
Order from LC mi$3.90, ph$10.80 PB 149 204

This report covers design studies made for a missile capable of carrying a 500-pound warhead to a maximum range of approximately 75 nautical miles with an accuracy in the order of 300 yards. Comparative designs are made for a liquid and solid propellant missile. (Author)

General Electric Co., Schenectady, N. Y.
VACUUM PATH EQUATIONS OF VARIATIONS IN BOTH RADAR AND INTERNAL COORDINATES, by E. G. Keller and J. E. Crawford. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23]. July 51, declassified 17 Mar 58. 19p. 4 refs. Technical Information Series rept. no. R51A0504.
Order from LC mi$2.40, ph$3.30 PB 149 207

It is not possible for a simple of complicated digital computer to solve the equations of variation in either radar or inertial coordinates in 10 seconds. Consequently, the equations are set-up and solved in a form containing the initial conditions such that the Hermes A-3 Digital Computer handles the solution instead of the differential equations in 10 seconds. (Author)

General Electric Research Lab., Schenectady, N. Y.
MEASUREMENT OF ROCKET EXHAUST GAS VELOCITY BY SPECTROSCOPIC DOPPLER SHIFT METHOD, by F. P. Bundy and H. M. Strong. Rept. on Project Hermes. 6 Oct 48, declassified 17 Mar 58, 42p. 6 refs. Rept. no. 55269.
Order from LC mi$3.30, ph$7.80 PB 149 467

Considerable effort has been directed toward developing ways of measuring the velocity, temperature and pressure directly from the flame by optical means which do not produce any mechanical disturbance of the flame. This paper presents the method which has been developed for measuring the flame gas velocity.

General Electric Co., Schenectady, N. Y.
A PROPOSED GUIDANCE SYSTEM FOR THE HERMES A3 MISSILE, by A. P. Adamson and R. F. Drenick. Rept. on Project Hermes. [Contract DA 30-115-ORD-23]. 23 Sep 48, declassified 17 Nov 58, 22p. 1 ref. Rept. 55200.
Order from LC mi$2.70, ph$4.80 PB 149 465

A class of guidance systems is desired which eliminates all random first order range errors from short range surface-to-surface trajectories. It is shown that guidance systems of this type can be realized by one properly mounted integrating accelerometer matching its output against that of computer which generates an arbitrary function of the time of flight. Two special systems are discussed in some detail and a combination of the two is recommended for the range control of the Hermes A-3 missile. It is shown that considerable accuracy of hitting can be achieved with existing control equipment. (Author)

Naval Ordnance Lab., White Oak, Md.
THE ACTUATOR, EXPLOSIVE WOX-23A, AN ACTUATOR TO REPLACE ACTUATOR MK 3 MOD 0 IN THE EXPLOSIVE SWITCH MK 46 MOD 0, by E. Eugene Kilmer. 4 May 60, 33p. 1 ref. NAVORD rept. 6761.
Order from OTS $1.00 PB 161 933

In view of Explosive Switch Mk 46 Mod 0 failures, a program was initiated to find a suitable replacement for the Actuator Mk 3 Mod 0. An investigation indicated that the inability of the Olin-Mathieson Ball Powder (W2920.3 Type II class 4) to sustain burning under the leakage condition existing in the Mk 46 Mod 0 Switch to be the cause of the explosive switch failures. Various propellants were investigated both in a variable volume pressure bomb and in the Explosive Switch Mk 46 Mod 0. Of the powders tested, SR4990, a Dupont smokeless powder, gave the desired boundary condition of a fast rise pressure front unaffected by the change of volume in the switch. Consequently, a direct substitution replacing the Olin Mathieson Ball Powder (W2920.3 Type II class 4) by SR4990 (DuPont) will be made in the actuator for the switch Mk 46 Mod 0. The new actuator has been designated Actuator, Explosive, WOX-23A. (Author)

Naval Ordnance Lab., White Oak, Md.
CHARACTERIZATION OF THE MK 1 MOD 0 SQUIB: IMPEDANCE MEASUREMENTS IN THE FREQUENCY RANGE 50-1500 MEGACYCLES, by R. M. H. Wyatt. 31 May 60, 35p. 2 refs. NAVORD rept. 6826.
Order from OTS $1.00 PB 161 934

The impedance characteristics of the Mk 1 Mod 0 Squib were determined by the use of an admittance meter for the frequency range of 50 to 1500 megacycles. In general the reactance values obtained were very close to what could be expected if the squib were considered to be a symmetrical two-conductor parallel transmission line terminated with a 1-ohm resistor (the bridge wire). Under limited conditions of frequency and lead length the investigation showed that the squib could be considered to consist of lumped parameters: pure inductances for the leads within and without the bakelite portion of the plug and a pure resistance for the bridge wire. (Author)

Naval Ordnance Lab., White Oak, Md.
A DESIGN FOR SPHERICALLY DETONATING EXPLOSIVE CHARGES, by C. Randall and R. Clairmont. 5 Apr 60, 30p. 1 ref. NAVORD rept. 6292.
Order from LC mi$2.70, ph$4.80 PB 149 227

A design and technique of fabrication for spherical detonators or detonator-booster combinations are discussed. The detonators are either 0.312 or 0.495 inch in diameter with the outer, secondary explosive initiated from a central sphere of silver azide 0.150 inch in diameter. The primary charge in turn is initiated from a hot spot located on a bridge extending through the detonator. The detonator-booster combinations consist of 0.312-inch diameter detonators imbedded in the initiating 0.750-inch diameter spheres. Examples of the early expansions to be expected from these charges are presented which show that variation in simultaneity of detonation breakout on the charge surface = ±0.15 to 0.20 microseconds, deviation of gas

cloud and early shock contour from the true sphere ± 2 to 5 per cent of contour radius, and deviation of contour center from charge center 1/8 to 1/4 charge radius. (Author)

Naval Ordnance Lab., White Oak, Md.
DEVELOPMENT OF WOX-73A AND WOX-74A PRIMERS, by E. Eugene Kilmer. 30 June 60, 18p. 8 refs. NAVORD rept. 6883.
Order from OTS $0.50 PB 161 935

An instantaneous primer, the WOX-73A, and a delay primer, the WOX-74A, have been developed for use in a picket-boat depth-charge pistol. The delay primer has a mean delay time of 18 seconds and operates reliably over the temperature range -65° to 160°F. This primer contains a double cup and a water tight seal which enables it to pass MIL-STD-304 (temperature and humidity cycling). The design of the delay primer is such that at the time of firing the inner cup is ruptured, allowing the gases evolved by the ignition element and the delay powder to be vented. Both primers have identical bridge wire circuits. The energy for 0.50 probability of firing (mean energy), determined by a Bruceton Sensitivity Test, is 4200 ergs. The energy for 0.999 probability of firing was calculated to be 5650 ergs. The WOX-73A and WOX-74A primers have been subjected to the standard environmental tests and have functioned properly following these tests. (Author)

Naval Ordnance Lab., White Oak, Md.
DISCRIMINATING COPPER-BALL ACCELEROMETERS, by V. F, DeVost and G. Stathopoulos. 10 Apr 59, 38p. 5 refs. NAVORD rept. 6204; AD-219 368.
Order from LC mi$3.00, ph$6.30 PB 147 604

Several inertia-actuated discriminator mechanisms were incorporated into the NOL copper-ball accelerometer design. The discriminators are used where several shock pulses occur in close time sequence and where it is desired to measure the maximum acceleration of one pulse or a portion of a pulse while discriminating against shocks incidentally present. This report describes briefly the NOL copper-ball accelerometers and presents information and drawings on the discriminator modifications. (Author)

Naval Ordnance Lab., White Oak, Md.
THE EFFECT OF DIFFERENT AMINES ON THE MECHANISMS OF CURE OF EPOXY RESINS AND EXPLOSIVE COMPATIBILITY, by Hugh C. Anderson. 16 Dec 57, 22p. 9 refs. NAVORD rept. 6023; AD-158 532.
Order from LC mi$2.70, ph$4.80 PB 146 470

The causes of the generally adverse effects of amine cured epoxy resins on explosives were investigated. The effects of four structurally different amines on percentage epoxy conversion, degree of crosslinking and compatibility of the cured products with HBX-1 were studied.

Naval Ordnance Lab., White Oak, Md.
GRAVITY-SENSITIVE COMPONENT SHOCK TESTER, by V. F. DeVost and G. Stathopoulos. 27 Aug 58, 23p. 5 refs. NAVORD rept. 5779; AD-206 792.
Order from LC mi$3.00, ph$6.30 PB 147 568

This report describes a shock tester developed at the NOL for evaluating gravity-sensitive, inertia-operated devices. The machine is designed to accelerate light test components at any desired angle while mounted in their normal orientation with respect to the earth's gravitational field. The tester essentially consists of a seismically suspended carriage to which the test component is mounted and an air driven hammer which strikes the carriage. Accelerations of 2 to 50 g and velocity changes of 0.25 to 15 fps can be obtained by varying the air pressure. Shock durations of 2 to 50 milliseconds can be obtained by varying the material and shape of the hammer impacting surface. The report also discusses the machine's advantages, limitations, and applications, includes machine drawings, and presents information on inertia sensitivity concepts. (Author)

Naval Ordnance Lab., White Oak, Md.
NOL COPPER-BALL ACCELEROMETERS, by G. Stathopoulos and V. F. DeVost. 6 May 59, 13p. 4 refs. NAVORD rept. 6638; AD-216 096.
Order from LC mi$2.40, ph$3.30 PB 147 605

This report describes the copper-ball accelerometers currently in use at the Naval Ordnance Laboratory. The principle of operation of this instrument as a peak reading accelerometer is discussed as well as its use as a velocity pickup. Discriminator modifications that permit programing the recording period of the gage to preclude recording multiple impacts are presented. (Author) (See also PB 147 660)

Naval Ordnance Test Station, China Lake, Calif.
AN EVALUATION OF LEAK-DETECTION METHODS, by Robert H, Martin and Wm. C. Shaw. 15 Oct 58, 36p. 12 refs. NOTS 1993; NAVORD rept. 5868; AD-206 622.
Order from LC mi$3.00, ph$6.30 PB 149 821

This report released for sale to the public 25 Aug 60.

The following industrial techniques for finding and measuring small leaks are described: bubble methods, volume-sharing method, and halogen, radioactive, and helium tracers. The use of the helium leak detector is discussed in detail as it was found to be the most suitable for working with small, sealed items of ordnance. (Author)

Naval Ordnance Test Station, China Lake, Calif.
PROPOSAL FOR A SIMPLE SYSTEM FOR ACHIEVING SOFT LANDING OF A ROCKET VEHICLE, by Charles E. Hendrix. 8 June 60, 17p. 4 refs. NOTS TP-2495; NAVWEPS rept. 7084.
Order from LC mi$2.40, ph$3.30 PB 148 964

A simple optical system has been proposed for terminal guidance of a soft-landing rocket vehicle. Working on the apparent motion of objects on the ground through the field of view, the system requires no specific targets, but only natural surface contrast. The system can be used to provide information on both deceleration and attitude stabilization. Deceleration is to be achieved with a NOTS-developed variable-thrust rocket motor, the use of which greatly simplifies the control problem. The system is not limited to vacuum conditions, but can work on any planetary surface, whether or not there is an atmosphere. (Author)

Naval Postgraduate School [Monterey, Calif.]
THE EFFECT OF EXPLOSIVE MIXTURES UPON IMPACT SENSITIVITY, by James Edward Sinclair. Mar 57, 32p. 6 refs. Technical rept. no. 16.
Order from LC mi$3.00, ph$6.30 PB 150 151

This report released for sale to the public 12 Sep 60.

The measurement of the impact sensitivity of two explosive systems TNB-TNB and TNT-PETN has been studied along with relevant factors affecting this sensitivity. The effects of sample size, dilution with inert material, and active mixtures have been explored and a "rule-of-thumb" formula suggested as an index of the reliability of a particular explosive or explosive mixture. (Author)

Naval Research Lab., Washington, D. C.
SATELLITE LAUNCHING TRAJECTORY CALCULATIONS: A MULTISTAGE, TWO-DIMENSIONAL, ZERO-LIFT PROGRAM FOR NAREC, by J. L. Hammersmith. Interim rept. 20 June 60, 6p. NRL rept. 5512.
Order from LC mi$1.80, ph$1.80 PB 147 834

Because all programs were done in basic NAREC coding, which allows only fixed point arithmetic, the formulas for apogee calculations were rescaled to permit greater distances and higher velocities. The procedure used to select suitable trajectories in some of the programs frequently collapsed when they were used for vehicles radically different from Vanguard, resulting in considerable loss of time. The program described in this report was constructed with many features which render it more efficient in such cases.

Naval School of Aviation Medicine, Pensacola, Fla.
A NOTE ON THE GRAVITY-FREE STATE ON A SPACE PLATFORM, by Hermann J. Schaefer. 29 Jan 59, 31p. 1 ref. Proj. NM 17 01 11, R-48; AD-213 439.
Order from LC mi$3.00, ph$6.30 PB 146 680

Through the use of a concrete example of intersatellite transportation, the dynamics and kinetics of such motions are analyzed in a simplified way. If the satellite is assumed to maintain attitude in space and if the free motions are described in a coordinate system at rest to the satellite, it is found that these motions are rectilinear and of constant speed during an initial period which, for an earth circling vehicle at 500 kilometers altitude, equals five minutes. Thereafter, the apparent motion follows a complicated circular or spiral pattern depending on the direction of the initial speed. Two limiting cases, the "forward" and the "upward" throw of an object from the satellite, are analyzed in more detail. A consequence of more general interest of these relationships is the known fact that it is not possible to put a loose assembly of parts or objects in orbit so that they maintain their original array. As their respective centers of gravity will have slightly different distances from the center of the earth, they will start spreading as soon as they are set free. On the other side, only very small conservative forces are required to keep even very "heavy" objects aligned.

Naval Weapons Lab., Dahlgren, Va.
EXTERIOR BALLISTIC DATA FOR THE 56-LB PRACTICE BOMB MK 89 MOD O WITHOUT SUSPENSION LUGS EJECTED FROM THE AERO 8A PRACTICE BOMB CONTAINER IN THE A3D-1 AIRPLANE IN HORIZONTAL FLIGHT, by J. D. Kunlo. 17 June 60, 22p. 4 refs. NWL rept. no. 1708.
Order from LC mi$2.70, ph$4.80 PB 149 160

From an analysis of the test results it is concluded that (1) the observed dispersions of the Mk 89 Mod O without suspension lugs are acceptable, and (2) the ballistic table OP 2787 is applicable to the subject bomb when ejected from the Aero 8A practice bomb container in the bomb bay of A3D aircraft in horizontal release maneuvers up to 10,000 feet altitude and 510 knots true airspeed. Moreover, it is believed that, in view of the satisfactory flight characteristics, OP 2787 will be applicable to the Mk 89 bomb when released at altitudes up to 70,000 feet and at subsonic airspeeds. (Author)

Oklahoma State U. Research Foundation, Stillwater.
AEROBEE RANGE SAFETY EQUIPMENT, by Oscar L Cooper. Scientific rept. no. 1 on Contract AF 19(604)2029. 1 Mar 60, 44p. AFCRC TN-60-280; AD-234 050.
Order from LC mi$3.30, ph$7.80 PB 146 465

The equipment, usually called a Range Safety Package, is built to be contained in a standard 10-inch Aerobee extension. It will accommodate an AN/DRW-3, AN/DRW-11 or an AN/DRW-13 command receiver for rocket fuel-cut-off. It also carries an S-Band radar beacon transponder such as the AN/DPN-19 or the AN/DPN-41 with their power supplies. A pair of S-Band Quadraloop antennas is mounted diametrically on the surface of the 10-inch extension. A removable battery access door is mounted on the side of the extension to facilitate battery changes without rocket disassembly.

[Pacific] Missile [Range] Port Mugu, Calif.
KAN-2 (LITTLE JOE) by Ken Mattson. Rept. on TED Proj. PAU 1804. 25 Mar 47, declassified 12 June 56, 45p. Technical rept. no. 10.
Order from LC mi$3.30, ph$7.80 PB 148 623

The test program has succeeded in testing the telemetering system under development as well as providing training of personnel in the testing of pilotless aircraft of this type. LITTLE JOE has been used to advantage in testing internal components of pilotless aircraft and, with a modified aerodynamic design, this missile could be a cheap, simple solution to a test vehicle for development of Pilotness Aircraft components.

Picatinny Research Center, Picatinny Arsenal, Dover, N. J.
THE USE OF CARBON-14 AS A TRACER TO STUDY THE ORIGIN OF TETRANITROMETHANE IN TNT MANUFACTURE, by Frederick S. Holahan, Thomas C. Castorina and others. July 60, 25p. 28 refs. Technical rept. 2695.
Order from LC mi$2.70, ph$4.80 PB 148 304

During the production of TNT, a small amount of tetranitromethane (TNM) forms as a by-product. The purpose of this study was to determine the origin of TNM in this reaction, using carbon-14 as a tracer. TNM is known to form during the trinitration step. It was found that most of the TNM originates from the aromatic ring carbons, with over 50% being contributed by the ring carbon attached to the methyl group of DNT. It was also found that over 80% of all the TNM can be traced to the DNT isomers derived from m-nitrotoluene. From the extent to which each of these compounds contributed to TNM formation, their relative rates of nitration were postulated. The ultimate formation of TNM is attributed to the DNT oxidation reaction in competition with that of nitration. (Author)

Rock Island Arsenal Lab., Ill.
FINGERPRINT NEUTRALIZING COMPOUNDS. V. PREPARATION OF A FORMULATION WITH MAXIMUM SPEED OF FINGERPRINT REMOVAL, by F. Blessin. 4 May 50, 41p. Rept. no. 50-750.
Order from LC mi$3.30, ph$7.80 PB 149 770

This report released for sale to the public 25 Aug 60.

Results of tests previously conducted are presented to illustrate the effect of increased water content in improving the removal efficiency of certain fingerprint removers. Two different methods of systematically determining the optimum composition as regards water content of triethanolamine oleate solubilized fingerprint remover formulations are presented and the results obtained by the two methods are compared. The various base formulations and the optimum solutions derived therefrom were prepared with amounts of water near the maximum tolerance and used for testing the speed of removal of fingerprint residues. (Engineering--Ordnance, 18 Nov 60)

Rome Air Development Center, Griffiss AFB, N. Y.
ON THE POSSIBILITY OF SPACE SURVEILLANCE VIA A 24-HOUR SATELLITE, by Joel S. Greenberg. Mar 60, 21p. 10 refs. RADC TN-60-9; AD-234 381.
Order from LC mi$2.70, ph$4.80 PB 147 805

A brief discussion is given of the possibility of utilizing a 24-hour satellite in a space surveillance system. The power requirements of a typical system configuration are investigated and discussed in terms of integration time (coherent versus noncoherent integration), transmitter beamwidth, frequency, and echo area. (Author)

Systems Development Labs., Hughes Aircraft Co., Culver City, Calif.
CREEP BUCKLING OF CYLINDRICAL SHELLS IN AXIAL COMPRESSION, by J. M. Bozajian and C. H. Tsao. Rept. on Contracts AF 33(038)28634 and AF 33(600)28438. 24 Jan 58, 35p. 5 refs. SRSM7-196; AD-158 651.
Order from LC mi$3.00, ph$6.30 PB 150 287

This report released for sale to the public 19 Sep 60.

Tests have been made of 56 QQ-M-44H magnesium alloy circular cylinders in axial compression. The test temperatures ranged from 75° F to 600° F and the loading program included stresses increasing linearly with time in addition to constant stresses. A semiempirical formula was obtained which correlates, through the use of basic elastic and creep properties, the buckling stress and time as influenced by temperature and the stress history in the ranges tested. The statistical variation of the data as correlated has been used to establish allowable buckling stresses of the material used in GAR-3/GAR-4 Falcon missile fuselages as a function of desired probability of failure. The buckling correlation equation has been expressed in terms of the elastic and generalized scant moduli of the cylinder material and has been used to predict creep buckling stresses for other materials. Methods of applying these results to creep buckling under transient stress and temperature conditions have been analyzed. (Author)

Watertown Arsenal Labs., Mass.
INFLUENCE OF CRACK WIDTH AND DEPTH ON MAGNETIC FLUX LEAKAGE FIELDS, by Patrick C. McEleney. Aug 60, 17p. 3 refs. Technical rept. no. WAL TR 148.1/2.
Order from LC mi$2.40, ph$3.30 PB 148 920

The depth of a crack is shown to be the major factor contributing to the amplitude of an induced signal in a pickup coil scanning a magnetized specimen. However, the magnitude of the contribution due to width variations is large enough to cause spread in data in voltage versus crack depth graphs. More refined techniques of signal analysis and a more accurate determination of the distribution of magnetic flux about discontinuities are required to improve the precision of measurement of crack depth by the magneto-inductive method. (Author)

Sanitation and Safety Engineering

Naval Civil Engineering Lab., Port Heuneme, Calif.
FOG FOR MOBILE FIRE APPARATUS, by John J. Bayles and Robert E. Jochums. 9 Mar 60, 53p. Technical Compilation C-002; AD-234 877.
Order from LC mi$3.60, ph$9.30 PB 147 811

A literature survey was conducted by the Laboratory to determine the optimum desired characteristics of water fog in fire fighting and to establish requirements for fog nozzles and fog guns. This study revealed that: (1) fog is now considered a basic tool in fire fighting, essential in efficiently fighting structural and brushgrass fires with mobile fire apparatus; (2) there is also a definite need for the availability of solid streams of water for specific situations encountered in fire fighting; (3) there is a need for both high-pressure and low-pressure pumping systems; and (4) there is a need for a variety of fog patterns for fire fighting.

Naval Civil Engineering Lab., Port Hueneme, Calif.
A PACKAGED FIRE SPRINKLER SYSTEM FOR ADVANCED BASE BUILDINGS, by R. J. Zablodil, C. R. Hoffman, and R. S. Chapler. Interim rept. 18 Feb 60, 38p. 2 refs. Technical rept. 067; AD-234 878.
Order from LC mi$3.00, ph$6.30 PB 146 970

The fire sprinkler system was developed to protect the standard 20 ft x 48 ft advanced base building. It has a 370 gal storage tank, a rectangular, 12-headed sprinkler loop, and associated valves and fittings. The system is dry and starts automatically when supervisory pressure maintained in the loop is lost. Pressure loss opens the pilot operated main nitrogen valve to pressurize the storage tank from two high pressure nitrogen cylinders. Five tests, one each with 1, 3, 6, 9, and 12 heads open, were made at 70 F, using water as the extinguishant, and all five were satisfactory. Flow rates varied from 12 gpm with one head open to 70 gpm with all 12 heads open, and operating time varied from a minimum of 5 min to a maximum of 30 minutes. Three tests were made at -65F on the nitrogen pressurization portion alone. Satisfactory performance was obtained with regulated pressure approximately twice that of the 70 F tests. The nitrogen pressurization components should be improved for low temperature application, and a prototype sprinkler system should be fabricated and field tested in the arctic. (Author)

Technical Development Labs., Dept. of Health, Education, and Welfare, Savannah, Ga.
COMPOSTING OF ORGANIC WASTES: AN ANNOTATED BIBLIOGRAPHY, by John S. Wiley. Feb 58, 126p. 145 refs.
Order from LC mi$6.30, ph$19.80 PB 147 219

This bibliography, with abstracts and occasional editorial remarks, may serve as a source of information for those interested in the subject. The subject matter is limited to composting which may be defined as a process in which microorganisms break down organic matter to a relatively stable humus-like material. Most of the references deal with actual or attempted aerobic thermophilic decomposition. They also deal largely with the composting of municipal refuse or garbage, sometimes with additional materials such as sewage sludge, night soil, or manure. Studies at Michigan State University and the CDC Technical Development Laboratories indicate that de-watered garbage or refuse can be composted through one cycle of decomposition in mechanical units in an appreciably shorter time, perhaps a week or less. A few cities, notably San Diego and Tacoma, have studied composting in pilot plants. The pilot plant at Chandler, Arizona, operated by the CDC Phoenix Field Station is now supplying "know-how" and cost data on the preliminary materials handling of refuse and on outdoor composting. Engineers and municipal officials should know reasonably soon if that type of composting is an approved, competitive method for the treatment of community solid wastes in that area. The composting studies conducted at the CDC Technical Development Laboratories should lead to design and operational improvements in high-rate mechanical composters for treating community solid wastes in the United States.

Technical Development Labs., Dept. of Health, Education, and Welfare, Savannah, Ga.
COMPOSTING OF ORGANIC WASTES: AN ANNOTATED BIBLIOGRAPHY, SUPPLEMENT 1, by John S. Wiley. June 59, 66p. 141 refs.
Order from LC mi$3.90, ph$10.80 PB 147 220

See also PB 147 219

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Aerojet-[General] Corp., Azusa, Calif.
RESULTS OF CERTAIN EXPERIMENTS ON CONVENTIONAL PULSE-JETS AND RELATED DEVICES, by W. P. Berggren, Winthrop K. Coxe and G. McRoberts. Final rept. as of 30 June 46 on Contract NOa(s) 7968, Task 9. 25 July 46, declassified 26 Oct 56. 29p. 1 ref. Rept. no. R-67; ATI-9819.
Order from LC mi$2.70, ep$6.30 PB 150 158

This report released for sale to the public 13 Sep 60.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
ANALYSIS, PERFORMANCE TESTS AND COMPUTER SIMULATION OF A 100 KW ENGINE-GENERATOR SET. Rept. on Contract DA 44-009-ENG-3214. July 58, 121p. 22 refs. AD-215 473.
Order from LC mi$6.30, ph$19.80 PB 149 254

Dynamic equations for a 100 KW engine-generator set supplying an isolated, balanced load are derived. The performance of the set composed of diesel engine, load-sensing governor, synchronous generator, and magnetic amplifier exciter was studied in the laboratory and test results are presented. Analog computer simulations for the speed governor loop and voltage regulation loop are given together with a computer representation of the complete engine-generator system. Performance tests and computer results are compared and discussed. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
A SURVEY OF THE BASIC SCIENTIFIC PROBLEMS ASSOCIATED WITH THE BEHAVIOR OF MATERIALS AT HIGH TEMPERATURES, by A. A. Westenberg. Rept. on Contract NOrd-7386. June 59, 183p. 245 refs. TG-333-1; AD-219 986.
Order from LC mi$8.40, ep$30.30 PB 150 155

This report released for sale to the public 12 Sep 60.

Contents:
High-temperature physical chemistry
Reacting gas dynamics: Chemical changes during nozzle flow in advanced rocket engines
Fluid dynamics of boundary layers
Radiation
Condensation
Gas film cooling
Internal cooling by means of liquid films
Ablation
Insulation
External cooling
Erosion and deposition of solids
Instrumentation
Propellant chemistry, thermodynamics, and high-temperature material properties

Borg-Warner Corp., Chicago, Ill.
PULSED PLASMA PROPULSION. AN ADVANCED REACTION SPACE PROPULSION SYSTEM. SUMMARY OF LITERATURE SURVEY, by Thomas L. Thourson. Rept. on Contract AF 33(616)6036. Apr 59, 132p. 276 refs. WADC Technical rept. 59-194; AD-213 838.
Order from LC mi$6.90, ph$21.30 PB 150 150

This report released for sale to the public 12 Sep 60.

A summary is presented of a literature survey on pulsed plasma propulsion, an advanced space propulsion system. Included is a discussion of experimental and analytical investigations of various pulsed plasma propulsion schemes. Other topics included are: (a) competitive propulsion systems, (b) studies in plasma physics, (c) studies in electric breakdown phenomena, and (d) experimental and diagnostic techniques applicable to the study of plasma physics. A bibliography is appended. (Author)

Convair, Fort Worth, Tex.
A NUCLEAR GROUND SUPPORT EXPERIMENT WITH QUICK DISCONNECT DEVICES, by P. L. Marjon. Rept. on Contract AF 33(600)32054. 29 June 59, 25p. 3 refs. NARF-59-24T; MR-N-247; AD-219 379.
Order from LC mi$2.70, ph$4.80 PB 149 992

This report released for sale to the public 31 Aug 60.

An experiment in remote handling was conducted to provide information on equipment needs for ground support of nuclear aircraft. Representative, commercially available components with quick-operation features were used in remote handling tests. An evaluation was made of the caused of difficulties encountered in remote operations. Recommendations are made to guide the design of handling equipment for nuclear airplane maintenance applications. (Author)

Cross-Malaker Labs., Inc., Mountainside, N. J.
KINETIC STUDY OF ROCKET EXHAUST GASES, by Richard A. Rossi and John Feduchak. Progress rept. no. 1 on Contract DA 30-069-ORD-2918. June 60, 69p. 233 refs. Rept. no. CM-103-1.
Order from LC mi$3.90, ph$10.80 PB 149 568

Forschungsinstitut für Physik der Strahlantriebe e. v., Stuttgart (West Germany).
THE THERMODYNAMIC PROPERTIES OF HYDROGEN AND WATER AS POSSIBLE WORKING FLUIDS FOR NUCLEAR ROCKETS, by I. Sänger-Bredt. Rept. on Contract AF 61(514)910. May 58, 52p. 22 refs. AFOSR-TR-58-87; AD-162 108.
Order from LC mi$3.60, ph$9.30 PB 150 159

Th s report released for sale to the public 1 Sep 60.

Contents:
Notion and function of a working fluid in rocket power planes
The heating of hydrogen, respectively water, at constant pressure and under equilibrium conditions, as well as attainable flow velocities in the end of the expansion nozzle
First comparative analysis of other possible working fluids, particular of hydrogen compounds of light elements
Heat transfers of hydrogen, water, and helium, to the interior walls of the combustion chamber under equilibrium conditions
The influence of nonequilibrium processes on the values of exhaust velocities and heat transfer, as well as on the qualification of the different working fluids

Jet Propulsion Center, Purdue U., Lafayette, Ind.
ON THE IMPORTANCE OF COMBUSTION CHAMBER GEOMETRY IN HIGH FREQUENCY OSCILLATIONS IN ROCKET MOTORS, by J. R. Osborn and J. M. Bonnell. Rept. on Contract AF 49(638)756. May 60, 18p. 7 refs. AFOSR-TN-60-393. AD-237 692.
Order from LC mi$2.40, ph$3.30 PB 148 235

The experiments reported herein were concerned with the determination of some of the underlying factors which contribute to the occurrence of transverse modes of combustion pressure oscillation in rocket motors. Two rocket motors having different diameters and several different lengths were employed in the experiments using a gaseous hydrocarbon fuel and air as propellants. The investigation indicated that changes in the aspect ratio and volume of the rocket motor combustion chamber has a profound effect on the incidence and amplitude of the transverse modes. These effects were modified by interactions of the transverse modes with the longitudinal mode. The transverse modes present in the experiments were determined to be the "spinning" and the radial modes. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
FUNDAMENTALS OF SOLID ROCKET PROPULSION, by Henry Tao-Sze Hsi. Technical memo. Jan 60, 49p. 6 refs. LMSD-288134.
Order from OTS $1.25 PB 161 907

The subjects treated are the basic theories and equations in dynamics and thermodynamics of rocket propulsion; rocket missiles in flight, and velocity and trajectory problems; and background theory and operation of solid-propellant rocket units. A glossary of terms commonly used in solid-propellant rocketry can be found in the appendix. (Author)

Naval Ordnance Test Station, China Lake, Calif.
A METHOD FOR DETERMINING VELOCITY BY COMBINING POSITION AND ACCELERATION DATA TAKEN ON THE SNORT TRACK, by Prescott D. Crout. 28 Mar 60, 59p. 2 refs. NOTS TP 2474; NAVWEPS rept. 7069.
Order from LC mi$3.60, ph$9.30 PB 149 153

A method of combining accelerometer and track-coil data to obtain velocity data using Lagrange polynomials is described. An error analysis shows that under most conditions an RMS of less than 0.1 fps over a velocity range of 200 to 2,000 fps is possible. (Author)

Reaction Motors Div., Thiokol Chemical Corp., Denville, N. J.
HEAVY PARTICLE PROPULSION RESEARCH, by Douglas M. Jamba. Rept. for 1 Jan-30 Apr 60 on Contract AF 49(638)657 and ARPA Order 6-58, Task 8. [1960] 38p. 3 refs. Rept. RMD-1155-S3; AFOSR-TR-60-[79].
Order from LC mi$3.00, ph$6.30 PB 149 903

The work is concerned with the generation, charging and acceleration of multi-atom particles to determine the characteristics of particle beams as they may apply to advanced electric propulsion systems. Major efforts have been concerned with the handling of previously prepared fine powders. Many types of mechanisms were tested to charge, hold and feed these solid metal particles with the end purpose of obtaining a continuous beam of charged particles having an average specific charge in the range of 1 to 100 coulombs per kilogram. Several measurement systems and techniques were investigated to determine their advantages and limitations. No one system was found that could be used for general comparison and evaluation of charged particle beam properties. (See also PB 147 519)

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
PRESSURE RECOVERY OF A FREE JET SUPERSONIC WIND TUNNEL WITH SHROUD DIFFUSER FOR TESTING AIR BREATHING ENGINES, by W. L. Melnick and R. Hermann. Rept. on Contract AF 49(600)713. July 59, 47p. 17 refs. AEDC-TN-59-71; AD-218 184.
Order from LC mi$3.30, ph$7.80 PB 147 574

The flow process in a shroud diffuser is investigated by means of a one-dimensional analysis that treats the flow between nozzle exit and diffuser entrance as a free jet. The effects of cowl drag and control of the test chamber pressure by means of mass inbleed or suction are included in the analysis. An exact solution of the equations of conservation of mass, momentum and energy for steady, inviscid, one-dimensional flow indicates the existence of two possible states after recapture of the flow in the shroud. In general, the flow will be subsonic after recapture; for suitable operating conditions, the flow can be supersonic. A phenomonological model of the flow process is formulated for the supersonic state. The operating conditions for optimum pressure recovery are reviewed for both cases. (Author)

Wiancko Engineering Co., Pasadena, Calif.
ACOUSTIC IMPEDANCE MEASUREMENTS FOR PROPULSION SYSTEM COMPONENTS, by C. L. Dailey, A. C. Brown, and J. W. Headley. Rept. on Contract NOas-58-565-c. July 59, 88p. 4 refs. Rept. no. W2328-F; AD-225 648.
Order from LC mi$4.80, ep$15.30 PB 150 156

This report released for sale to the public 12 Sep 60.

The concept of acoustic impedance is reviewed which is employed by acousticians in describing the boundary conditions relating pressure and velocity disturbance at some station in a distributed acoustic region. The concept is applied in formulating an analytical discription of a complete propulsion system in which experimentally determined functions are used. The acoustic impedances of a diffuser and engine from a specific airplane were measured, and the response of the duct system to a rapid transient in flight was computed. The airplane was flown, and the predicted data were compared with the experimental results. The tests showed that direct measurement of acoustic impedance is practical and that the acoustic system is linear over the range of amplitudes required for the measurement, i. e. the determined impedances do not depend on amplitude of the disturbance signal.

Manufacturing Equipment and Processes

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.
STUDY OF THE WELDABILITY OF A MODIFIED HOT WORK DIE STEEL, by W. A. Sipes and E. J. Fogarty. Rept. on Proj. TED NAM AE 4426, Pt. 4. 9 Apr 59, 28p. Rept. no. NAMC-AML-AE-1083; AD-228 996.
Order from LC mi$2.70, ph$4.80 PB 149 316

A limited study of the weldability of a typical modified hot work die steel of the AISI H-11 type was made. Satisfactory joints were produced utilizing an experimental coated, low hydrogen electrode. The strength levels of the welded joints approached 300,000 psi after suitable heat treatment. Joint efficiencies approximating 100% were readily obtained. (Author)

Aeroprojects, Inc., West Chester, Pa.
FUNDAMENTALS OF ULTRASONIC WELDING. Bimonthly rept. no. 2, Dec 57-Jan 58, on Contract NOas-58-108-c. Feb 58, 35p. 9 refs. AD-161 344.
Order from LC mi$3.00, ep$7.80 PB 150 085

This report released for sale to the public 31 Aug 60.

Stress distribution in the weld zone: Three types of photoelastic models are discussed; (1) plank models,

(2) frozen-stress models, and (3) direct-observation triaxially restrained models. Energy delivered to the weld zone: A physics experiment was devised and instrumentation is being assembled to correlate oscillograph patterns with the standing-wave ratio associated with essentially zero power delivery by, and with about 100% power delivery through, an acoustical conductor. Energy transmitted through the weld zone: An experiment was devised to correlated weld strength with the signal produced during welding by a reflector anvil equipped with barium titanate microphonic elements. Temperature developed in the weld zone: Two techniques were used to determine temperatures: (1) by recording thermal emfs obtained from a junction consisting of the weldment and a single wire previously inserted or potted into the zone of the intended welds, and (2) by metallographic studies. Properties of materials being welded: A preliminary experiment is being statistically designed to investigate the relation of certain material properties to vibratory weldability. Initial consideration is being given to hardness, thermal properties, and recrystallization.

Aeroprojects, Inc., West Chester, Pa.
FUNDAMENTALS OF ULTRASONIC WELDING. Bimonthly rept. no. 3, Feb-Mar 58, on Contract NOas-58-108-c. Apr 58, 24p. 14 refs. AD-205 394.
Order from LC mi$2.70, ep$6.30 PB 150 080

This report released for sale to the public 31 Aug 60.

Stress distribution in the weld zone: the direct-observation triaxially restrained model (DOTRM), supplemented by the simple plank model, shows promise as a preliminary means of observing stress distributions. Energy delivered to the weld zone: Instrumentation is being developed for SWR measurement in a primary component of the elastic vibration coupling system which would provide means for determining the net power delivered to the weld zone. Energy transmitted through the weld zone: High response oscillography was used to obtain data from microphone elements attached to the reflector sonotrode during the formation of ultrasonic welds. The reflector-sonotrode system was intimately connected with the materials welded (2024-T3 Alclad, 1100-H4 Al, C. P. Cu, and Armco ingot iron), the operating variable of force and power, and the energy delivered to the weld zone. Temperature developed in the weld zone: The single-wire-thermocouple technique was utilized at 4 clamping force levels and 4 power levels to explore the temperature rise associated with ultrasonically welding (1) half-hard commercial purity Cu (0.032-in. thick) to itself, (2) 1100-H4 Al (0.032-in. thick) to itself, and (3) Armco ingot iron (0.028-in. thick) to itself. Properties of materials being welded: The effects of temperature rise, material thickness, and difficulties of energy measurement associated with ultrasonic welding are discussed. (See also PB 150 085)

Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC WELDING OF STRUCTURAL ALUMINUM ALLOYS. Bimonthly rept. no. 4, 21 July-20 Sep 57, on Contract NOas-57-480-c. Sep 57, 11p. AD-161 151.
Order from LC mi$2.50, ep$4.80 PB 150 083

This report released for sale to the public 31 Aug 60.

Control of weld quality: A more sensitive quality control test (AD-142 657) was initiated, but with 0.040-in. 2024-T3 bare Al alloy welded at 2400 effective w, 700-lb clamping force, and 1.5 sec welding time. Influence of vibratory direction on weld strength: Shear tests were devised for symmetric loading of single-lap specimen. Test results indicated that no preferential orientation exists. Validity of data for structural applications: No consistent trend for tab or panel weldments was developed. Extending capability of spot-type welding equipment: The use of an interleaf of 0.001-in. 1100-0 Al between 0.050-in. sheets of 2024-T3 bare Al alloy nearly doubled the strength of the welds in this material. Ultrasonic roller welding equipment: The brush-slip system design was revised and new parts are being fabricated and installed. (See also PB 150 080)

Aeroprojects, Inc., West Chester, Pa.
FUNDAMENTALS OF ULTRASONIC WELDING. Bimonthly rept. no. 6, Aug-Sep 58 on Contract NOas-58-108-c. Oct 58, 17p. 9 refs. AD-209 993.
Order from LC mi$2.40, ep$4.80 PB 150 078

This report released for sale to the public 31 Aug 60.

Temperature developed in the weld zone: Interface temperatures in 0.032-in. Armco iron were measured by means of the single-wire-thermocouple and meltable-wire-insert techniques. Properties of materials being welded: Acoustic power vs sheet thickness data were obtained for several foil gages of half-hard Cu and AISI 302 stainless steel to establish the minimum electric power required to accomplish a weld. Weld interface distrubance: Autoradiographs displayed high densities ad acent to the surface of radioactive foil insert in several areas of the weld. This darkening of the photographic emulsion was attributed to subsurface radiation. (See also PB 150 084)

Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC WELDING OF STRUCTURAL ALUMINUM. Bimonthly rept. no. 5, 21 Sep-20 Nov 57, on Contract NOas-57-480-c. Nov 57, 13p. 4 refs. AD-161 343.
Order from LC mi$2.40, ep$4.80 PB 150 084

This report released for sale to the public 31 Aug 60.

Control of weld quality: Weld strength test data are presented for 0.040-in. 2024-T3 bare Al alloy which indicate that ultrasonic welds are reproducible and that quality control is not difficult to obtain. Extending capability of spot-type welding equipment: A brief theoretical analysis was made to determine the stresses to which a transducer-coupler may be exposed. The results indicate the need for determining the standing-wave ratio in such systems if the power-handling capacity prediction is to be reasonable accurate. An experiment with foil interleaves of 1100-0 and 1100-H19 Al in various gages indicated that 0.001-in. foil generally produced stronger welds than the heavier gages. Preliminary fatigue studies: The results of studies on the preparation of fatigue test specimens indicate that at high loads ultrasonic welds are equal to and possibly better than resistance spotwelds in the same material. (See also PB 150 083)

California U., Los Angeles.
RESEARCH IN PRODUCTION SEQUENCING, by James R. Jackson. Rept. on Management Sciences Research Proj. [Contract Nonr-223(02)] 9 Oct 58, 14p. 17 refs. Research rept. no. 57.
Order from LC mi$2.40, ph$3.30 PB 148 834

An important class of industrial problems is concerned with the sequencing of production activities, as differentiated from the distribution of workloads among blocks of productive time. The relation of sequencing to workload distribution is parallel to that of job dispatching to master production scheduling. This paper provides a limited survey of analytic research in production sequencing, and a brief indication of the directions taken by some current computational studies. (Author)

Defense Metals Information Center, Battelle Memorial Center, Columbus, Ohio.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM, by H. R. Ogden. Status rept. no. 5, 1 Jan-31 Dec 59, on Contract AF 18(600)1375. 1 June 60, 80p. 1 ref. DMIC rept. 46H.
Order from OTS $2.00 PB 151 087

Production of the heat-treatable alloys has been completed by one producer and is nearing completion by the other two producers. Three new alloys have been added to the program, Ti-7Al-12Zr, Ti-8Al-1Mo-1V, and Ti-8Al-8Zr-1(Cb+Ta). These are designed to be weldable alpha alloys with high creep strength. Phase II, the development of design data, has been started, with testing well under way. This work is being done on production-aged material by Lockheed Aircraft Corporation, Marietta, Georgia. Two of the seven Phase III contractors have completed their programs, and evaluation is well along for the other five contractors. The two companies who conducted preliminary evaluations of three alloys chose Ti-4Al-3Mo-1V as the most promising alloy for fabrication of parts. All of the Phase III programs are scheduled for completion in 1960. (Author) (See also PB 151 065)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
NEW DEVELOPMENTS IN THE WELDING OF METALS, by P. J. Rieppel. Rept. on Contract AF 18(600)1375. 24 June 60, 50p. 73 refs. DMIC rept. 131.
Order from OTS $1.25 PB 151 089

Progress being made with new methods of welding metals is described. The applications and limitations of each process are discussed, along with brief descriptions of how the process works and what has been done with it. The developments included are: (1) Fusion welding: (a) electroslag, (b) short-arc and dip-arc, (c) electron beam, (d) arc spot; (2) Resistance welding: (a) high frequency, (b) foil seam, (c) magnetic force, (d) process controls; (3) Brazing; (4) Solid-state bonding: (a) ultrasonic, (b) friction, (c) diffusion, (d) explosive; (5) Cutting and coating (plasma jet). (Author)

Naval Engineering Experiment Station, Annapolis, Md.
EVALUATION OF WELDED JOINTS BETWEEN AISI 347 STAINLESS STEEL AND 70/30 COPPER-NICKEL ALLOY TUBES UNDER THERMAL SHOCK, MARK II, by W. E. Clautice. 27 Aug 54, 27p. 1 ref. E.E.S. rept. 060088A.
Order from LC mi$2.70, ph$4.80 PB 150 289

This report released for sale to the public 19 Aug 60.

As a sequel to test work reported in Engineering Experiment Station Report 060064, further thermal shock tests were performed for another mock-up representing welded bimetallic joints uniting components in emergency heat exchangers in newly developed submarine propulsion plants. In their present state of development, they are considered unsatisfactory for use in the naval service. (Author)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
AN IMPULSE TYPE RESISTANCE WELDER. 10 Apr 51, 7p. NEPA 1799.
Order from LC mi$1.80, ph$1.80 PB 149 996

This report released for sale to the public 31 Aug 60.

Titanium Metals Corp. of America, Toronto, Ohio.
TITANIUM SHEET ROLLING PROGRAM FOR Ti-6Al-4V AND Ti-4Al-3Mo-1V, by W. M. Parris and H. D. Kessler. Bimonthly rept. no. 11, 1 Jan-28 Feb 58, on Contract Noas-56-993-c. 28 Feb 58, 25p. AD-160 076.
Order from LC mi$2.70, ep$6.30 PB 150 082

This report released for sale to the public 31 Aug 60.

Solution treatment of the required twenty full-size Ti-6Al-4V sheets was completed. Uniformity tests on one 0.020" gage sheet showed yield strength variations from 118,000 to 132,000 psi as-solution treated and 149,000 to 160,000 psi after aging. Three additional sheets, one from each of the remaining gages, will be sectioned for uniformity studies later in the program. An additional 57 sheets of the Ti-4Al-3Mo-1V alloy were solution treated making a total of 115 sheets to data. A tentative classification system for solution treated sheets based upon transverse properties only is described. (Author)

Titanium Metals Corp. of America, Toronto, Ohio.
TITANIUM SHEET ROLLING PROGRAM FOR Ti-6Al-4V AND Ti-4Al-3Mo-1V, by W. M. Parris and H. D. Kessler. Bimonthly rept. no. 12, 1 Mar-30 Apr 58, on Contract NOas-56-993-c. 30 Apr 58, 22p. AD-201 485.
Order from LC mi$2.70, ep$6.30 PB 150 079

This report released for sale to the public 31 Aug 60.

Production of Ti-4Al-3Mo-1V sheets from the 3000-pound ingots is well along and should be virtually completed during the next report period. The transfer of the resistance heating - spray quench apparatus to the TMCA, Toronto mill facility was completed and one

sheet each of 0.125, 0.063, and 0.025" gage sheet was solution treated and sectioned for uniformity studies. Results indicated that good uniformity can be expected in 0.063" and heavier gages but that some problem may exist in lighter gages. Further studies on light gage material are in progress. An additional 32 heat treated sheets were shipped to various customers. Properties of these sheets taken from transverse and end strips are presented. (Author) (See also PB 150 082)

Machine Parts and Mechanisms

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
EXTENSION OF THE CONDUCTING SHEET ANALOGY TO EXTERNALLY PRESSURIZED GAS BEARINGS, by Lazar Licht. Rept. on Contract Nonr-2342(00). Oct 59, 15p. 3 refs. Interim rept. I-A2049-9; AD-228 300.
Order from LC mi$2.40, ph$3.30 PB 149 490

Incompressible, viscous flow in narrow passages bounded by parallel surfaces yields the 2-dimensional Laplace equation, $\nabla^2 P = 0$. The pressure field, load capacity and lubricant flow of hydrostatic oil bearings can be readily determined by means of the electric analogy of the conducting sheet. The equation $\frac{\partial}{\partial x}\left(P\frac{P}{x}\right) + \frac{\partial}{\partial y}\left(P\frac{\partial P}{\partial y}\right) = 0$ characterizes laminar, isothermal flow of gas lubricants in otherwise geometrically identical bearings. It is shown that by means of suitable change of the dependent variable the above equation can be reduced to the Laplacian form. The ensuing advantage is the extension of the conducing sheet analogy to externally pressurized thrust and journal guide bearings when the lubricant is a gas. (Author)

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
INVESTIGATION OF THE UNNOTCHED AND NOTCHED FATIGUE BEHAVIOR OF SEVERAL HEAT RESISTANT MATERIALS FOR ENGINE BOLTS, by Donald M. Forney, Jr. and Douglas Y. Wang. Rept. for Jan 58-Dec 59 on Materials Analysis and Evaluation Techniques. Feb 60, 59p. 4 refs. WADD Technical rept. 59-25; AD-236 684.
Order from OTS $1.50 PB 161 930

An investigation of the fatigue behavior of 3/8 inch engine bolts at various temperatures is described for the heat resistant alloys AMS 5735(A-286), Udimet 500, Inconel 700 and Incoloy 901. Tests were also performed under axial stress on unnotched fatigue specimens and fatigue specimens with a theoretical stress concentration factor of 3.4. The data are presented as S-N diagrams to show the effect on fatigue strength of temperature, stress concentration, stress magnitude and bolt thread rolling. The results of this investigation suggest the possibility of using fatigue test data obtained with single notched specimens to evaluate other heat resistant alloys for possible engine bolt applications thereby reducing the significant expense of fabrication of experimental lots of bolts for test. (Author)

Transport, Traction and Hoist Facilities

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DIGITAL COMPUTER PROGRAM FOR ACCELERATION PERFORMANCE, WHEELED VEHICLES, by Robert Arno. Rept. on Contract DA 20-089-ORD-39246. 9 Feb 60, 45p. Rept. no. RR-9.
Order from LC mi$3.30, ph$7.80 PB 148 391

A general computer program was written for the Electrodata 204 "Datatron" digital computer to calculate acceleration performance and related characteristics for wheeled vehicles. Vehicle performance is determined at prescribed time intervals during acceleration from standstill to maximum velocity. Other additional performance data supplied by this program are vehicle speed, distance traveled, time of travel, wheel torque, tractive effort, rolling resistance, drawbar pull, and acceleration. (Author)

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DIGITAL COMPUTER PROGRAM FOR CENTER OF GRAVITY, PRODUCT OF INERTIA, AND MOMENT OF INERTIA COMPUTATIONS, by M. Archambault. Rept. on Contract DA 20-089-ORD-39246. 7 Mar 60, 56p. Rept. no. RR-11.
Order from LC mi$3.60, ph$9.30 PB 148 392

A high speed computer program for determination of the center of gravity, product of inertia, and moment of inertia of a complete vehicle, or of individual components and major assemblies. Complete information is printed for the individual items considered. (Author)

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DIGITAL COMPUTER PROGRAM FOR TRACKED VEHICLE MOBILITY COMPUTATION, by Alexander Edwards. Rept. on Contract DA 20-089-ORD-39246. 15 Feb 60, 19p. Rept. no. RR-18.
Order from LC mi$2.40, ph$3.30 PB 148 393

A general computer program was written for the Electrodata 204 Digital Computer to provide rapid solution of tracked vehicle mobility performance as defined by the theory and procedure of Ordnance Tank-Automotive Command Land Locomotion Laboratory. (Author)

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
WHEELED VEHICLES (M135), LEAN AND FAT CLAY, 1957, by A. B. Thompson and Mary E. Smith. Rept. no. 2 on Stresses under Moving Vehicles. May 60, 71p. 2 refs. Technical rept. no. 3-545.
Order from LC mi$4.50, ph$12.30 PB 149 199

A study was conducted to determine the distribution of stresses imparted to soil by a moving, pneumatic-tired vehicle and to compare the suitability of three different types of pressure-sensing devices for measuring these stresses. The effects on stresses of such variables as soil strength, tire inflation pressure, vehicle speed, acceleration, deceleration, and towing of the vehicle were investigated with the cells installed at varying depths and offsets from the line of traffic. The large (6-in. diameter), earth pressure cell was found to be the most reliable measuring device of the three used in these tests. Inaccuracy of traffic alignment, variations in wheel load, variations in soil consistency, and cell movement were concluded to have been major causes of the discrepancies in stresses recorded by the cells. Recommendations for future tests, in which these detrimental conditions would be avoided, are included. (Author)

MATERIALS

Army Transportation Environmental Operations Group [Fort Eustis, Va.]
AFTER ACTION REPORT, ANTARCTICA 1959-60. [1960] 30p.
Order from LC mi$2.70, ph$4.80 PB 149 221

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
MEASURING FIELD HANDLING AND TRANSPORTATION CONDITIONS, by Kenneth W. Bull and Carl F. Kossack (Purdue U.). Rept. for July 56-July 59 on Finishes and Materials Preservation. Feb 60, 39p. 1 ref. WADD Technical rept. 60-4, suppl. to WADC TR-56-464.
Order from OTS $1.00 PB 161 918

This study involves concealing shock recording instruments inside ordinary shipping containers and shipping the instrumented packages through normal supply channels to determine the actual heights from which packages are dropped. Based on the data given in this report, a test drop height of 21 inches is considered adequate for specifications. Further clarification is given in the report. The recorders, calibration procedure, collected data, analysis, accuracy and associated problems are discussed. Recommendations for future studies of this sort are also given. (Author) (See also PB 121 866)

Naval Civil Engineering Lab., Port Hueneme, Calif.
CHARACTERISTICS OF CORAL MORTARS, by William R. Lorman. Final rept. 28 June 60, 310p. 20 refs. Technical rept. 041.
Order from LC mi$11.10, ph$47.10 PB 149 446

Results are presented of a comprehensive program of tests to establish the physical properties of portland cement mortars incorporating coral sands. Nearly 2,500 specimens were tested. Selected correlations led to general formulations that serve to indicate the interdependence of mortar strength, elasticity, bulk density, volume and weight change, air content, yield, and flow. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
STUDY OF CREEP IN CONCRETE, by John R. Keeton. 11 May 60, 65p. Technical rept. 082.
Order from LC mi$3.90, ph$10.80 PB 148 397

Various size cylindrical concrete specimens from controlled environments (20%, 50%, and 100% R. H., 73F) received sustained compressive stresses of 38% (2000 psi) and 57% (3000 psi) of ultimate compressive strength at loading time. In the size range investigated, after 175 days of loading and regardless of specimen size, creep is 5% to 10% greater in 20% R. H. than in 50% R. H. Creep in 100% R. H. is about two-thirds of that in 50% R. H. An extensive study will be undertaken to disclose mechanics of shrinkage (Author)

Naval Ordnance Lab., White Oak, Md.
RESIDUAL AND THERMAL STRESSES IN POTTING RESINS, AND THE DEVELOPMENT OF STRAIN GAGE INSTRUMENTATION FOR THEIR DETERMINATION, by R. E. Heise, Jr. 29 Aug 58, 30p. 2 refs. NAVORD rept. 5767; AD-206 317.
Order from LC mi$2.70, ph$4.80 PB 147 569

A transducer was designed to measure strains during and after potting in thermosetting casting resin. Post-cure axial strain indicated residual compressive stress 2800 psi. Bending strains indicated little radial stress. The potted transducer was heated to 160°F and stress was relieved but recovered on cooling; then cooled to 0°F resulting in axial compressive stress 8600 psi. Thermal shock -65°F produced axial compressive stress 12,600 psi. Production of stress was direct result of thermal gradient across resin in early stage and later of different expansion coefficients for resin and transducer. (Author)

Office of Defense Research and Engineering, Washington, D. C.
SUMMARY OF RECOMMENDATIONS FOR RESEARCH AND DEVELOPMENT IN MATERIALS. 1 July 60, 56p.
Order from OTS $1.50 PB 161 865

This document constitutes a review of the many recommendations in the following areas: Materials: iron and steel; heavy nonferrous metals (refractory metals); graphite; ceramic materials; rare earths; plastics, elastomers, and fabrics; semiconductors and thermoelectric materials; intermetallic compounds. Materials Systems: ultrapure materials; composite materials; particle-hardening systems; sandwich construction; coatings. Qualities of Materials: brittleness; heat-engineered structures; lightness; high-temperature physical properties of materials; plasma phenomena. Fabrication of Materials: general; forming of metals; casting of metals; metal stock removal; welding and brazing of metals or of metals with ceramics; adhesive bonding; heat treatment of metals; fasteners. General Recommendations: deterioration of materials and structures; engineering guidance and guidance studies; miscellaneous recommendations; materials research policies.

Adhesives and Sealants

Naval Civil Engineering Lab., Port Hueneme, Calif.
PARAFFIN AS A CONDUIT SEAL AGAINST BLAST PRESSURE, by H. G. Aggas. Final rept. 18 Feb 60, 12p. Technical rept. 074; AD-234 940.
Order from LC mi$2.40, ph$3.30 PB 147 813

The blast resistance of paraffin as a sealing compound in Crouse-Hinds explosion-proof sealoffs was investigated. These sealoffs, which had approximately one-half of their cross-sectional area filled with standard electrical wire, were sealed with paraffin and tested in the blast simulator. Paraffin is an effective seal for resisting dynamic and static pressures to at least 150 psi at an average temperature of 68°F. The sealoffs were subjected to dynamic pressures up to 170 psi with no damage to the wax seal. (Author)

Picatinny Research Center, Picatinny Arsenal, Dover, N. J.
SYNTHESIS OF RESORCINOL-EPOXY ADHESIVE AND EVALUATION OF ITS MECHANICAL PROPERTIES, by Hsueh T. Lee, Eileen R. Swick, and Michael J. Bodnar. July 60, 10p. 2 refs. Technical Notes no. 51.
Order from OTS $0.50 PB 161 785

A resorcinol-epoxy resin was synthesized which when used as an adhesive gave shear strengths of approximately 1570 psi at 73°F and 2110 psi at 160°F. An average impact strength of 16.8 ft-lb/0.75 sq in. of bonded area was obtained at both 73° and 160°F, and 16.4 ft-lb/0.75 sq in. at -65°F when bonding steel to steel. Although a room-temperature cure can be accomplished using 8.2 parts diethylene triamine curing agent per hundred parts resin, the rise in shear strength at 160°F indicates that an elevated-temperature cure would be more effective in achieving the maximum adhesive properties of this material. (Author)

Ceramics and Refractories

Bausch and Lomb Optical Co., Rochester, N. Y.
FABRICATION OF INFRARED TRANSMITTING MATERIALS BY HOT PRESSED TECHNIQUES, by Norbert J. Kriedl, Harold C. Hafner and others. Rept. for 1 Apr 57-31 Mar 58 on Ceramic and Cermet Materials, Contract AF 33(616)5123. Oct 58, 171p. 14 refs. WADC Technical rept. 58-275; Part 1; AD-202 844.
Order from LC mi$8.10, ph$27.30 PB 150 149

This report released for sale to the public 13 Sep 60.

The fabrication of infrared transmitting materials by hot pressing techniques has been studied. BaF_2 was used as a model material. The temperatures studied ranged from 600 to 1225°C and the pressures from 1500 to 8000 psi. The equipment used to obtain these conditions is described. The effects of various hot pressing atmospheres including nitrogen, helium, argon and carbon dioxide, were investigated. A study was carried out to identify the impurities present and to study their effects. (Author)

Bjorkstein Research Labs., Inc., Madison, Wisc.
RESEARCH AND DEVELOPMENT ON REFRACTORY MATERIALS FOR GUIDED MISSILES, by W. W. Drummond, J. B. Eisen and others. Quarterly rept. no. 7 (Final) 17 Nov 52-17 Aug 54, on Contract NOrd-13484. Aug 54, 64p. 315 refs. AD-101 406.
Order from LC mi$3.90, ep$12.30 PB 150 153

This report released for sale to the public 12 Sep 60.

Contents:
Glass fibers
Composition of the glass
Coating nascent glass fiber with metals

Marquardt Aircraft Co., Van Nuys, Calif.
DEVELOPMENT AND EVALUATION OF INSULATING TYPE CERAMIC COATINGS, by E. W. Blocker, C. A. Hauck and others. Rept. for 1 Mar 58-28 Feb 59 on Ceramic and Cermet Materials, Contract AF 33(616)5441. Nov 59, 74p. WADC Technical rept. 59-102; AD-231 732.
Order from LC mi$4.50, ph$12.30 PB 149 888

This report released for sale to the public 29 Aug 60.

A metal reinforced ceramic coating system has been developed that will successfully withstand temperatures of 3500°F while providing insulative values for the supporting structure. This ceramic coating system utilizes a corrugated strip of stainless steel as the reinforcement media and phosphate bonded alumina as the refractory medium. The great advantages of a coating system of this nature, aside from high temperature resistance and thermal insulation, is the wide variety of applications wherein it can be utilized. Attempts have been made to use zirconia as the refractory grain in phosphate bounded reinforced coatings. These attempts have not been wholly successful, due mainly to the poor thermal shock resistance of zirconia. It is anticipated that this drawback can be eliminated. Several items of research equipment have been designed and built to facilitate study of the various ceramic materials used in this program. These include a differential thermal analysis setup, a high temperature modulus of rupture furnace, and a modification of the existing thermal drop apparatus. (Author)

Fuels, Lubricants, and Hydraulic Fluids

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.
RESULTS OF A LABORATORY STUDY TO DETERMINE THE CORROSIVE PROPERTIES OF DRY FILM LUBRICANTS, by J. P. Cerini. 17 Aug 59, 12p. Rept. no. NAMC-AML-AE 42173, Pt. I.
Order from LC mi$2.40, ph$3.30 PB 149 320

The pH of MoS_2 powder used in the preparation of dry film lubricants can affect the corrosion characteristics of the film, when the film is in contact with a nonlubricated aluminum surface. Coating both mating surfaces with dry film lubricant provides maximum corrosion protection. The corrosion test method devised to simulate reported field conditions yielded results equivalent to those obtained in service for the one material for which service data was available. (Author)

Air Force Office of Scientific Research, Washington, D. C.
AFOSR CONTRACTORS' MEETING [NO. 2] ON COMBUSTION OF SOLID PROPELLANTS AT ATLANTIC RESEARCH CORP., ALEXANDRIA, VA., 7-8 JUNE 1960. [1960] 18p. 13 refs. AFOSR-TN-60-663; AD-239 150.
Order from LC mi$2.40, ph$3.30 PB 148 876

Contents:
Solid propellant ignition
Ignition of composite propellants
Theory of composite propellant burning
Combustion of laminar solid propellants
Solid propellant combustion mechanism
Decomposition, combustion and detonation of solids
Solid propellant combustion
Disturbances in burning solid propellants
Combustion instability

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
MEASUREMENT OF THE GAS VELOCITY OF SPHERICAL COMBUSTION WAVES BY THE BALLISTIC PARTICLE TRACK METHOD, by S. D. Raezer and H. L. Olsen. Rept. on Contract NOrd-7386. June 59, 25p. 6 refs. CM-952; AD AD-220 790.
Order from LC mi$2.70, ph$4.80 PB 149 190

When the temperature and density of the gas do not change and the velocity is in the Stoke's law regions, the gas velocity in a transient or wave disturbance can be calculated from its effect upon a heavy particle falling in its path. This method is used to obtain the cold gas velocity ahead of a spherical combustion wave in an effort to determine the flame speed. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
TEMPERATURE GRADIENT TESTS OF INERT PROPELLANT GRAINS; DATES TESTED: 2 THRU 23 APRIL 1958, by James F. Wiedman. 29 Aug 58, 35p. Rept. no. 3M78N10; AD-202 536.
Order from LC mi$3.00, ph$6.30 PB 149 182

Six inert propellant grains having the same configuration were temperature cycled to obtain data on the temperature gradients present. The grains were placed in a temperature conditioning chamber at 0°F and kept there until all thermocouples registered approximately that temperature. The grains were then transferred as quickly as possible to a chamber at 100°F where they remained for 10 hr. The readings of the thermocouples within a given group were not always alike, especially those located nearest the surface of the grain. This discrepancy is probably caused by the air flow and resulting temperature gradients set up in the test chamber itself. Another cause of error is the specimen; its consistency may not be homogeneous, causing the heat conductivity to vary.

Bureau of [Naval Weapons] Washington, D. C.
STANDARD METHODS AND PROCEDURES FOR THE STRAND BURNING-RATE EVALUATION OF ROCKET PROPELLANT POWDER, by M. F. Schoeffel. 29 May 53, 13p. 8 refs. NAVORD OD 9376.
Order from LC mi$2.40, ph$3.30 PB 149 995

This report released for sale to the public 31 Aug 60

This report describes standard methods and procedures as well as special equipment and materials needed for the strand burning-rate evaluation of rocket propellant powder. This publication specifically applies to the strand-burning rate determination of double-base sheet propellant, types N-4 and N-5. It will also apply to other rocket propellant powder when specifically designated in applicable specifications.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
STORAGE OF BRAKE WHEEL CYLINDERS WITH MINERAL OIL, by C. B. Jordan. 20 Apr 60, 14p. 6 refs. Rept. no. CCL-92.
Order from OTS $0.50 PB 161 662

The object of this study was to evaluate the storage properties of mineral oils with hydraulic brake system components. Synthetic rubber brake cups compatible with mineral oils and having improved operational characteristics were used in the study. Brake cylinders were packaged with two types of mineral oil and placed in warehouse storage and simulated vehicle storage. Cylinders were inspected at one year intervals. All aluminum, tin, steel, and brass parts were in excellent condition after 3 years storage. Cast iron cylinder walls were excessively pitted. Synthetic rubber brake cups were in satisfactory condition. Natural rubber boots were cracked and deteriorated. (Author)

Coordinating Research Council, Inc., New York.
SOLUTION AND EVOLUTION OF GASES AND VAPORS IN AIRCRAFT FUELS. Rept. for 22 Mar 57-1 Jan 59 on Atlantic Research Corp., Subcontract to AF 33(616)3735. Apr 59, 165p. 11 refs. WADC Technical rept. 59-193; AD-233 936.
Order from OTS $3.00 PB 161 900

A program was undertaken to study solution and evolution rates of gases and vapors in aircraft fuels. The purpose was to establish parameters and develop theories to predict the operation of the fuel tanks of high-powered, high-altitude aircraft. The work done, which is reported herein, was largely experimental. Laboratory tanks were tested under simulated dynamic aircraft conditions. Aircraft fuels were pressurized under various gases in shaking tanks for

various fuel levels, temperatures, pressures, contaminants, shaking frequency, and shaking direction. Shaking frequency proved to be the most important variable in controlling the rate constants of solution and evolution. Not only did the rates tend to increase with increased frequency, but when the shaking frequency was in phase with the natural oscillation of the fuel, the rates increased one hundred to a thousand times. Contaminants such as fine dust which held and disbursed minute air bubbles did not affect solution but markedly increased the evolution rate. However, this effect occurred during the first evolution cycle only, corresponding to the first initial climb to high altitude. Fuel level affected the rates by affecting wave action in the tank. The rates increased with increasing amplitude and generally decreased with increase in tank size. Vertical and horizontal shaking operated similarly to increase the rates of solution and evolution. (Author)

James Forrestal Research Center, Princeton, N. J.
BURNING MECHANISM OF AMMONIUM PERCHLORATE PROPELLANTS, by M. Summerfield, G. Sutherland and others. Rept. on Project Squid, Contract Nonr-1858(25). Dec 58, 31p. 13 refs. Technical rept. PR-87-P.
Order from LC mi$3.00, ph$6.30 PB 148 820

Contents:
Part I: Structure of the burning zone of an ammonium perchlorate propellant, by G. S. Sutherland, and M. Summerfield.
Part II: Theory of burning of a composite solid propellant, by M. Summerfield.
Part III: Comparison of burning rates with theory by M. J. Webb, H. J. Taback, G. S. Sutherland, K. P. Hall, and M. Summerfield.

Phillips Petroleum Co., Bartlesville, Okla.
RADIATION FROM LABORATORY SCALE JET COMBUSTOR FLAMES, by E. C. Miller, A. E. Blake and others. Special rept. on Contract NOas-52-132-c. Oct 56, 70p. 10 refs. Research Div. rept. 1526-56R; AD-138 244.
Order from LC mi$3.90, ph$10.80 PB 146 545

Characteristics of the energy radiated from aircraft gas turbine type combustion processes were investigated. Two paraffinic test fuels, normal heptane and isooctane, and two aromatic test fuels, benzene and toluene, were selected to obtain a wide range in hydrocarbon structure. Infrared flame emission and absorption spectra, from 1 to 15 microns in wavelength, were obtained at five different locations around the combustor. This was also done without combustion, and without fuel; to obtain fuel, and air, absorption spectra. Non-luminous flames were characterized by discontinuous radiation of molecular origin. Luminous flames were characterized by a predominance of continuous, black body type, radiation. At intermediate values of luminosity the discontinuous molecular radiation was evident, superimposed on the continuous radiation. The average transverse emissivity of the infrared spectral region for non-luminous flames was approximately 0.03; but it increased, with increasing flame luminosity, to nearly one. The transverse emissivity of the flames increased with increasing combustor pressure, but the rate varied with fuel type.

Rock Island Arsenal Lab., Ill.
A METHOD FOR ACCELERATING THE FEDERAL TEST METHOD PROCEDURE FOR DETERMINING THE MEAN HERTZ LOAD, by George P. Murphy. 8 July 60, 14p. 4 refs. Rept. no. 60-2156.
Order from LC mi$2.40, ph$3.30 PB 149 053

The test procedure is a combination of Girelli's "Compensation Line" and Nason's modification of the Mean Hertz Load procedure. The new test procedure gives Mean Hertz Load values that are on the average within 2% of the values obtained by Federal Test Method 6503. The advantage of the new procedure is that it reduces the number of runs necessary to determine the Mean Hertz Load from 20 to between 2 and 6 depending on the material tested. This is equivalent to a time savings of about 140 to 180 minutes in addition to the savings in cost of the test specimens. The procedure is applicable to both E.P. and non-E.P. oils and greases with the exception of those containing silicones. (Author)

Rock Island Arsenal Lab., Ill.
A STUDY OF THE SHELL FOUR BALL WEAR TEST VARIABLES, by G. P. Murphy. 8 July 60, 16p. 2 refs. Rept. no. 60-2154.
Order from LC mi$2.40, ph$3.30 PB 149 054

Four MIL-G-10924A "General Purpose" greases were tested under various conditions of load, time, and temperature. The results were mathematically treated and the relationship between the variables and the scar diameter determined. These relationships, which hold for tests on MIL-G-10924A greases over the following variable ranges, 2 to 50 kg. load, 27° to 150° C, 10 to 180 minutes and 600 RPM, are as follows: the scar diameter varies directly with the 0.25 power of the load, the 0.12 power of time and the 0.10 power of temperature. The exponential powers of load, time and temperature are also determined for mineral, diester, polyglycol, organic phosphate oils, and several different grease types. The general equation for conversion of data is given. This equation is applicable only to scar diameters in the nonseizure portion of the Shell Four Ball Wear Test wear curve. (Author)

Leather and Textiles

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DESIGN AND RELIABILITY OF SOIL BURIAL TESTS FOR TEXTILES, by J. M. Ashcroft. 28 Aug 58, 28p. 2 refs. Rept. 1541-TR; AD-204 278.
Order from LC mi$2.70, ph$4.80 PB 147 224

The investigation was to determine the extent to which the reliability of the soil burial method as a means of evaluating rot-inhibiting treatments of textiles might be increased by an experimental design more sophisticated than the random pattern frequently employed, and to ascertain whether varying the technique used in applying a given treatment would alter significantly its effectiveness as a rot inhibitor.

Fabric Research Labs., Inc. [Dedham, Mass.]
A SURVEY OF 18 OZ. BLENDED SERGE FABRICS: STABILITY OF FABRICS TO MOISTURE AND R. H. MOVEMENT, by Normal J. Abbott, Leo Barish, and Milton M. Platt. Rept. on USAF Uniform Clothing Assemblies, Contracts DA 19-129-qm-1312; AF 33(616)54-172; AF 33(616)55-82; and AF 33(616)57-20. Oct 59, 43p. WADC Technical rept. 59-242; AD-230 982.
Order from OTS $1.25 PB 161 901

The effect of blending a number of fiber types with wool on the behavior of 18-oz. serges under extremes of humidity was studied. The blended fibers included viscose, nylon, Dacron, Orlon Acrilan, and Dynel, in amounts up to 30%. The results have shown that some differences exist between the effects of changes in humidity on the nine fabrics examined. With one exception, however, the differences were small, and it would require some practical experience with the fabrics to assess their importance. The properties studied included dimensional change, fabric deformation, seam puckering, stiffness, moisture regain, and bagging tendency. The only relatively large change in any of these properties which was brought about by changes in humidity was the rather large increase in stiffness which took place in high humidity. This has been attributed to a jamming of the structure due to the swelling of the fibers, and was apparently not related to the type of fiber which was blended with the wool. In other characteristics the differences which existed between the fabrics are sufficient to differentiate between the fibers, but in general are not considered to be of major practical importance. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
AIR PERMEABILITY OF PARACHUTE CLOTHS, by H. W. S. LaVier and W. C. Boteler. Rept. on Contract AF 33(038)15624. Apr 55, 75p. 5 refs. WADC Technical rept. 52-283, Part V.
Order from LC mi$4.50, ph$12.30 PB 149 990

This report released for sale to the public 31 Aug 60.

The air permeability evaluations of various nylon cloths produced by different manufacturers to the same MIL specifications are presented here. The effect on air permeability due to various weaving defects was investigated and it was concluded that such normal defects had little or no effect on the cloth air permeability evaluations. Variation of the magnitude of the calendering load was studied regarding its effect on air permeability of a cloth. It was found that loads up to fifty tons per inch caused considerable change in the cloth permeability. However, loads above fifty tons per inch caused very little additional change in air permeability over that caused by a load of 50 tons per inch. Discharge coefficients for various kinds of parachute cloths are also included in this report. These values may prove useful in designing new parachute textiles. (Author)

Massachusetts Inst. of Tech., Cambridge.
AIR FLOW CHARACTERISTICS OF PARACHUTE FABRICS AT SIMULATED HIGH ALTITUDES, by C. V. Seshadri, G. A. Brown and others. Rept. for 1 July 58-30 June 59 on Contract AF 33(616)5864. Mar 60, 165p. 16 refs. WADC Technical rept. 59-374.
Order from OTS $3.00 PB 161 902

The air flow characteristics of parachute canopy cloth have been measured over an unusually wide range of test conditions. High altitude simulated tests (up to 150,000 feet) have shown the cloth to have markedly low flow rates, as may be predicted from a nozzle flow analogy. A method of predicting high altitude behavior has been proposed. Permeabilities of four cloths have been shown to be significantly dependent on their state of stress at the time of air flow measurement. The magnitude of this relationship is observed to be determined by the biaxial stress-strain behavior of each fabric. The air stream deflection tendency of thick canopy material has been verified and its cause investigated. The role of pore geometry in influencing cloth permeability has been explored. (Author)

Materials Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
RESULTS OF STUDY OF NYLON AND DACRON AT HIGH TEMPERATURES, by J. W. Muse, Jr. Apr 53, 13p. Technical note WCRT 53-44.
Order from LC mi$2.40, ph$3.30 PB 149 989

This report released for sale to the public 31 Aug 60.

Results of this study show that nylon is degradated primarily by oxygen at temperatures of 212°F to 284°F. The degree of degradation is influenced by the amount of oxygen present at a specific temperature, i.e., nylon loses 21.8% of its strength after exposure for 8 hours in pure oxygen at 212°F compared to a loss of 5.45% of its strength under the same conditions in compressed air. In comparison dacron is not appreciably affected by the presence of oxygen under identical conditions. From 375°F to 425°F, dacron is degradated primarily by heat. The degree of degradation in nylon by oxygen is very severe at the conditions for which the successful application of parachute material is critical. At maximum test conditions in oxygen, nylon lost 96% in strength in contrast to dacron's 9%. This is conclusive evidence that the principal cause of degradation in nylon is oxygen, which when subjected to higher temperature, increases the rate of oxidation.

Photographic Materials

[Aerial] Reconnaissance Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
COMPARISON OF SENSITIZED MATERIALS FOR AERIAL RECONNAISSANCE, by William Mallios. Rept. on Color Photography. Sep 52, declassified 28 Aug 59. 21p. WADC Technical rept. 52-500; ATI-173 049.
Order from LC mi$2.70, ph$4.80, PB 150 098

This report released for sale to the public 30 Aug 60.

With the exception of hydrographic, geological, and forestry studies, black-and-white film is the overwhelming choice of photo interpreters as a source of aerial photographic intelligence. For certain specific purposes, however, color film and camouflage detection film are superior sources of information. Unfamiliarity of the interpreters with color and camouflage detection films exerts more influence on the film choices than the actual values and qualities of the films themselves. Lack of proper viewing equipment, with special regard to stereo, was an equally strong influencing factor on these choices. Recommendations are made that more instruction be made available through the photo interpretation schools and that more and better equipment be made available for their use, all of which should be specifically aimed at special-purpose films. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
THE LIMITING TRACE SPACING ON FILM RELATED TO EXPOSURE AND CONTRAST RATIO, by E. Henry and M. Harrison. Memo. on Project Michigan, Contracts DA 36-039-sc-78801 and AF 33(600)38019. July 60, 19p. 5 refs. 2900-84-R.
Order from LC mi$2.40, ph$3.30 PB 149 455

Photographic film is one of the best materials known for storing maximum information in the smallest amount of medium. Data may be inserted in independent channels; it is therefore necessary to know the limiting channel spacing so that the uniqueness of each channel can be preserved. This memorandum describes a procedure to determine the limiting channel spacing. The method consists of contact-printing on a test film the image from a mirror-surfaced, optically flat glass block. In the mirror surface, lines 42 μ wide are engraved with a variable spacing from 8.5 lines/mm to 62.5 lines/mm. The image is then scanned with a specular densitometer and the light transmission recorded. The scanning aperture is 5 μ. From the recording, the contrast ratio at any resolution, i.e., the ratio of contrast at a given resolution to that at a low resolution (8.5 lines/mm) may be determined. This procedure is carried out with different amounts of exposure, all film being developed under constant conditions. A relationship is then expressed between light transmission through the image and the limiting resolution for a given contrast ratio (e.g., 0.707). Data for several commercially available films are given. (Author)

Plastics

Avco-Everett Research Lab., Mass.
HIGH TEMPERATURE BEHAVIOR OF TEFLON, by Tunis Wentink, Jr. Rept. on Contract AF 04(647)278. July 59, 15p. 18 refs. Research rept. 55; AFBMD-TN-59-15; AD-227 521.
Order from LC mi$2.40, ph$3.30 PB 146 650

The properties of tetrafluorpethylene polymer in the temperature range from 300 to 800°K are reviewed. The pyrolysis of the plastic is treated, with emphasis on behavior under ablating conditions. An effective heat of vaporization at 760°K is calculated. New data on thermal conductivity and emissivity in the infrared are presented. (Author)

Material Lab., New York Naval Shipyard, Brooklyn.
INVESTIGATION OF THE EFFECTS OF SEA WATER IMMERSION ON THE PROPERTIES OF GLASS REINFORCED POLYESTER LAMINATES, by P. M. Goldfarb. Final rept. on Lab. Project 4860-J-4. 21 Dec 59, 42p.
Order from OTS $1.25 PB 161 912

A five-year sea water immersion program on glass reinforced polyester laminates has been conducted. Five representative materials were fabricated with polyester resins and various types and constructions of glass reinforcement including glass cloth, glass mat, a combination of glass cloth and glass mat, and woven roving. The materials were immersed in the ocean at a Kure Beach, N. C., exposure station. Samples were removed from the test site yearly and sent, under water, to the Laboratory for mechanical property evaluations. It was found that a material fabricated with Garan finished Style 181 glass cloth had the best overall resistance to extended sea water immersion. A material fabricated with Volan finished Style 1000 glass cloth and a material made with Garan finished glass mat demonstrated fair resistance to sea water immersion. Two materials exhibited poor water resistance; these were a glass mat laminate with surface plies of 114 finished Style 1000 glass cloth and a Garan finished woven roving laminate. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
RADIATION-INDUCED CURRENTS IN SOLID ORGANIC INSULATORS, by J. W. Winslow and R. S. Alger. 21 May 59, 50p. 11 refs. Research and development technical rept. USNRDL-TR-325; AD-225 297.
Order from LC mi$3.30, ph$7.80 PB 150 302

This report released for sale to the public 19 Sep 60.

The general behavior of currents induced by high energy radiation in polyethylene is described. Certain considerations regarding design of circuits for operation in large radiation fluxes are discussed. The dose-rate dependence of x-ray induced photocurrents found by previous investigators at lower dose-rates appears to be extended to dose-rates as high as 15,000 r/min. The theoretical implications of this extension are discussed briefly. Calculations suggest that electrons freed from polyethylene molecules by ionizing radiation succeed in escaping permanently from their parent molecules. Attempts to measure ultraviolet-induced photocurrents in certain solidified organic solvents at near-liquid-nitrogen temperatures place an upper limit of 2×10^{-15} mho/cm on their photoconductivities at the ultraviolet intensities used. Some question is raised concerning the mechanism of color-center formation in Wurster's Blue under ultraviolet irradiation. A property of polyethylene which may be useful in detecting high-energy radiation in regions of low temperature, such as interplanetary space, is reported. (Author)

Wood and Paper

Clapp, William F., Labs., Inc., Duxbury, Mass.
MARINE BORER ACTIVITY IN TEST BOARDS OPERATED DURING 1958, by Dorothy Brown Wallour Progress rept. no. 12 on Contract NBy-17810. 15 Mar 59, 161p. Rept. no. 11044; AD-220 191.
Order from LC mi$7.80, ph$25.80 PB 149 766

This report released for sale to the public 25 Aug 60.

The compilation of the data obtained from the study of hundreds of test boards submerged in harbors, rivers, estuaries and on lightships throughout the world over a period of years show the extent and type of marine borer destruction taking place in the test boards at various locations. All marine boring organisms are commonly referred to as marine borers. There are three general categories of these organisms: Limnoria, Teredinidae and Pholadidae, all differing in their requirements and degree of destructiveness. Attention has been called to the presence of the different groups in the descriptive section of activity evaluations in this report. Photographs of the test boards showing the degree of attack are included in this report in order to give a more accurate presentation of the evaluation of the activity by Limnoria and Teredinidae. The activities of these two organisms are graphed separately. It is difficult to estimate the amount of damage caused by marine borers at any particular area due to the fact that its activity varies greatly from year to year. However, some general trends are discernible. The activity by both the marine borers Limnoria and Teredinidae continues to show a slight upward trend along the New England seacoast. A slight upward trend is also noted in marine borer activity in the New York area. (Author)

Material Labs., Puget Sound Naval Shipyard, Bremerton, Washington.
MARINE SERVICE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES: TEAK, MAPLE, ANGELIQUE, KOKRODUA, GREENHEART, EKKI, KHAYA, PHILIPPINE MAHOGANY, CENTRAL AMERICAN MAHOGANY, SOUTHERN PINE (TREATED AND UNTREATED), by R. F. England and E. Stahl. May 60, 68p. Final development rept. E-412A.
Order from LC mi$3.90, ph$10.80 PB 149 781

For extension of marine laminating to include species other than oak and Douglas fir, series of laminates were produced under closely duplicated conditions evaluated for glueline quality. With the exception of greenheart, ekki, and in some cases, maple, the following in the series were successfully laminated at center glueline cure of 150°F for six hours: teak, angelique, khaya, kokrodua, Philippine mahogany, Central American mahogany and southern pine (untreated and tanalith treated).

Naval Civil Engineering Lab., Port Hueneme, Calif.
TOXICITY OF CHEMICALS TO MARINE BORERS. I, by Harold P. Vind and Harry Hochman. Interim rept. 29 June 60, 141p. 24 refs. Technical rept. 048.
Order from OTS $2.75 PB 161 909

Methods for evaluating the toxicity of chemical agents to marine borers were developed and toxicity data covering the testing of several hundred compounds and mixtures were processed. The purpose of this report is to organize, condense, and interpret the results of these tests together with all available data on the toxicity of chemicals to marine wood-boring organisms. (Author)

Naval Research Lab., Washington, D. C.
MARINE BORER CONTROL. PART X. EVALUATION OF CREOSOTE-RESIN SOLUTIONS AND CREOSOTE DISTILLATION FRACTIONS, by T. R. Price and T. R. Sweeney. Interim rept. 27 July 60, 11p. 7 refs. NRL rept. 5505.
Order from OTS $0.50 PB 161 695

Three resins were combined with creosote, using several curing agents, in order to determine their ability to increase the resistance of creosoted wood to marine borer attack by reducing the leaching rate. Distillation fractions of creosote were studied to determine the relationship of boiling point to effectiveness as marine wood preservatives. Nitrated and hydrogenated creosotes were also studied for their preservative effect. It was determined that several of the resin-creosote solutions were significantly better than creosote alone in providing protection to wood against Limnoria attack when pre-leached. No improvement with respect to Teredinidae attack would be detected and some evidence of decreased effectiveness was determined. The effectiveness of the creosote distillation fractions was determined to be proportional to their boiling point. Hydrogenated creosote was found to be a very poor wood preservative, and nitrated creosote, though a very good wood preservative, was not very useful because of extremely high viscosity. (Author) (See also PB 151 807)

Royal Inst. of Tech. (Sweden).
STUDIES ON THE HEARTWOOD CONSTITUENTS OF CONIFERS, by T. Kubota, Y. Hirose and others. Final technical rept. for 1 Apr 59-31 Mar 60 on Contract DA 91-591-EUC-1113. 25 Apr 60, 59p. 36 refs.
Order from LC mi$3.60, ph$9.30 PB 149 451

Investigations were continued on the heartwood constituents of the Moroccan conifer Tetraclinis articulata especially the diterpenic substances hinokiol, hinokione, totarol and totarolone, and on the heartwood terpenes of the Alaskan conifer Chamaecyparis nootkatensis. A gas chromatographic study was carried out of the complex mixture of monoterpenes from the bark of the common juniper, Juniperus communis. An interesting new diterpene acid has been isolated from the bark of Juniperus communis.

MATHEMATICS

Aarhus U. (Denmark).
INVESTIGATIONS ON THE VALIDITY OF THE ARC-SINE LAW, by Erik Sparre Andersen. Technical summary rept. no. 2 on Contract AF 61(052)52. 29 Feb 60, 7p. 3 refs. AFOSR-TN-60-674.
Order from LC mi$1.80, ph$1.80 PB 149 584

For a sequence of r.v.'s $X_1, X_2, \ldots$ the r.v. N_n is defined as the number of positive sums among $S_1, \ldots, S_n$, where $S_k = X_1 + \ldots + X_k$. Under rather general assumptions on $X_1, X_2, \ldots$ the limit distribution of N_n/n is known to be the arc-sine law:

$$F(x) = \frac{2}{\pi} \arcsin x^{1/2} \quad 0 \leqq x \leqq 1.$$

New sufficient conditions for the validity of the arc-sine law for N_n have been obtained. Furthermore the limit distribution of N_n/n has been found in some special cases, where the arc-sine law does not hold. (Author)

Applied Mathematics and Statistics Labs., Stanford U., Calif.
ALMOST PERIODIC FUNCTIONS OF SEMIGROUPS, by K. Deleeuw and I. Glicksberg. Technical note no. 12 on Contract AF 49(638)294. 31 May 60, 83p. 14 refs. AFOSR-TN-60-484. AD-238 540.
Order from LC mi$4.80, ph$13.80 PB 148 740

The fundamental approximation theorem for almost periodic functions on groups is extended to certain commutative topological semigroups. (Author)

Applied Mathematics and Statistics Labs., Stanford U., Calif.
APPROXIMATIONS TO OPTIMAL POLICIES IN A DYNAMIC INVENTORY MODEL, by Donald M. Roberts. Technical rept. no. 12 on Contract Nonr-225(28). 29 July 59, 54p. 17 refs. AD-219 880.
Order from LC mi$3.60, ph$9.30 PB 147 798

An investigation is presented of the 2-bin policy which is characterized by 2 critical numbers, s and S, such that whenever the stock level falls below s, an order is placed to bring the level up to S, and otherwise no ordering is done. In approximating the critical numbers by numerical means, an attempt is made to give analytical formulas for determining the asymptotic reorder quantity under the following conditions; (1) all costs are linear, and the costs during any period are composed of a holding cost and a shortage cost, both payable at the end of a period, while the ordering cost is composed of a set-up cost and a unit cost payable whenever an order is placed; (2) demand in each period is an independent observation from a known distribution function; (3) the program lasts an infinite number of periods; and (4) the stock level can be negative (the backlog case). Cases are considered corresponding to instantaneous delivery of order items as well as fixed time lags in delivery. The supposition is made that the decision maker seeks to minimize the total expected costs, discounting future costs to the present.

Applied Mathematics and Statistics [Labs.] Stanford U., Calif.
ASYMPTOTIC VARIANCE AS AN APPROXIMATION TO EXPECTED LOSS FOR MAXIMUM LIKELIHOOD ESTIMATES, by William Commins, Jr. Technical rept. no. 46 on Contract N6onr-251(40). 30 Apr 59, 46p. 7 refs.
Order from LC mi$3.30, ph$7.80 PB 146 457

Applied Mathematics and Statics Labs., Stanford U., Calif.
ONE-SIDED INEQUALITIES OF THE CHEBYSHEV TYPE, by Albert W. Marshall and Ingram Olkin. Technical rept. no. 48 on Contract N6onr-25140. 6 Aug 59, 24p. 2 refs. AD-220 545.
Order from LC mi$2.70, ph$4.80 PB 148 159

A one-sided inequality of the Chebyshev type: Let $x = (x_1, \ldots, x_k)$ be a random vector with $Ex_i = 0$. Either (1) $Ex_i^2 = \sigma^2$, $Ex_ix_j = \sigma^2\rho$ $(i \neq j)$, $i, j = 1, \ldots, k$; or (2) $Ex_i^2 = \sigma_i^2$, $i = 1, \ldots, k$. In each case, a sharp upper bound (only involving the specified moments) for $P\{x_1 \geq 1 \text{ or } \ldots \text{ or } x_k \geq 1\}$ is obtained.

A formulation for more general one-sided bounds is also discussed. A one-sided analog of Kolmogorov's inequality: For every positive ε and every square integrable random variable X with zero expectation, $P\{X \geq \varepsilon\} \leq E(X^2)/[\varepsilon^2 + E(X^2)]$. An inequality is obtained that generalizes this in the same way that Kolmogorov's inequality generalizes Chebyshev's inequality. The inequality is proved and an example is given to show that inequality is achieved. The possibility of obtaining greater generality is also discussed. An extension to continuous parameter martingales is obtained, and a condition under which equality is achieved is given.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
OPTIMAL POLICY FOR DYNAMIC INVENTORY PROCESS WITH STOCHASTIC DEMANDS SUBJECT TO SEASONAL VARIATIONS, by Samuel Karlin. Technical rept. no. 13 on Contract Nonr-225(28). 31 July 59, 44p. 10 refs. AD-220 501
Order from LC mi$3.30, ph$7.80 PB 147 797

A study is made of a dynamic stochastic inventory problem in which the demand distribution may vary over successive periods in a cyclical fashion. This may reflect a situation where the demand undergoes seasonal variations. Subject to some conditions on the cost functions, an optimal policy for this model is characterized. A computational procedure is provided for determining explicitly the critical numbers which characterize the optimal policy. The inventory model considered is the standard one involving discrete time periods. A sequence of ordering decisions is to be made at the beginning of each of a number of periods of equal duration. The demand in each period is assumed to be a random variable with known probability distribution which may vary from period to period. Various costs are incurred during successive periods. The three main costs which influence the ordering decision are: (1) the purchasing cost, (2) a holding cost associated with the stock of inventories on hand, and (3) the shortage or penalty cost. The objective is to determine ordering policy which minimizes the cumulative expected costs. The problem is treated under instantaneous delivery assumption, and in the situation where a significant time lag in delivery is present.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
POLYA TYPE DISTRIBUTIONS OF CONVOLUTIONS, by Samuel Karlin and Frank Proschan. Technical rept. no. 14 on Contract Nonr-225(28). 24 Aug 59, 35p. 16 refs. AD-225 464.
Order from LC mi$3.00, ph$6.30 PB 148 162

New classes of totally positive kernels are characterized that arise from summing independent random variables and forming related first passage time distributions. A general theorem is obtained which asserts that for Pólya frequency densities of a given order, the probability that first passage into the set $[X, \infty]$ for the stochastic process of successive partial sums occurs at the n^{th} transition, is a totally positive function in the variables n, x of the same order. A different kind of characterization is given which shows that g(n, x), the n-fold convolution of a Pólya frequency density of order k extending over the whole real line, does not possess a restricted variation limiting property. Various applications of these results are noted. A number of totally positive functions are constructed by forming successive convolutions of Pólya frequency densities and then applying the general theorem. Several smoothening properties possessed by the kernel $f^{(n)}(x)$, the n-fold convolution of f, is established when it defines a linear transformation.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DISCRETE LINEAR PROGRAMMING, by Raoul J. Freeman and John G. Hocking. Sep 55, 11p. Memo. rept. no. 924.
Order from LC mi$2.40, ph$3.30 PB 149 994

This report released for sale to the public 31 Aug 60.

The question of obtaining discrete or integer solutions to linear programming problems is attacked. Starting from the continuous solution, a procedure is developed, whereby the best integral solution "near" the continuous solution is found, and then a method is indicated as to how to obtain the optimal discrete solution from that point. A numerical example is included to illustrate the technique. (Author)

Brown U. [Div. of Applied Mathematics] Providence, R. I.
EXTENSION TO THEORY OF TIME SERIES ANALYSIS. Quarterly rept. no. 6, 1 Nov-31 Jan 60, on Contract DA 36-039-sc-78130. [1960] 2p.
Order from LC mi$1.80, ph$1.80 PB 149 115

Brown U. Div. of Applied Mathematics, Providence, R. I.
FREQUENCY FUNCTIONS OF QUADRATIC FORMS BY CONVOLUTION, by W. Freiberger, and C. L C. Kalkman. Technical rept. no. 8 on Contract DA 36-039-sc-78130. Jan 60, 9p. DA-SC-78130/8; AD-235 442.
Order from LC mi$1.80, ph$1.80 PB 149 116

A mathematical method and corresponding computer program are described for the evaluation of the frequency function of a quadratic form in random normal variables. (Author)

California U., Los Angeles.
A POSTERIORI PROBABILITIES, by Wayne E. Smith. Rept. on Management Sciences Research Proj. [Contract Nonr-223(02)] 3 Sep 58, 9p. 5 refs. Research rept. no. 54.
Order from LC mi$1.80, ph$1.80 PB 148 831

Each time a person carries out any action, he is forced to to make at least an implicit estimate of probabilities connected with plausible outcomes of his action. As he carries out experiments or makes observations, his original probability estimates change, and as they change he may vary his strategy. The explicit purpose here is to examine the nature of these changes (if they are rational) and to examine the computational implications of making the changes quantitatively.

California U., Los Angeles.
AN A POSTERIORI PROBABILITY METHOD FOR THE DETERMINATION OF THE FUNDAMENTAL CONSTANTS OF ATOMIC PHYSICS, by Wayne E. Smith. Rept. on Management Sciences Research Proj. [Contract Nonr-223(02)] 10 Sep 58, 25p. 3 refs. Research rept. no. 55.
Order from LC mi$2.70, ph$4.80 PB 148 832

A description is given of the methods of a posteriori probability (as outlined in PB 148 831) as applied to the determination of some physical constants. A hypothesis is formulated concerning the errors in measurement and a test of this hypothesis is demonstrated. After rejecting the original hypothesis a new hypothesis is formulated involving various possible distributions of the errors in measurement each with an a priori probability. The method of obtaining a posteriori probabilities is discussed, the procedure followed is outlined, and the a posteriori probabilities are tested for sensitivity to the assumed values of various parameters.

California U., Los Angeles.
APPLICATION OF A POSTERIORI PROBABILITY TO THE ANALYSIS OF THE FREQUENCY OF DEMAND AND TO THE EFFICIENT MINIMIZATION OF A FUNCTION, by Wayne E. Smith. Rept. on Management Sciences Research Proj. [Contract Nonr-223(02)] 19 Sep 58, 17p. 10 refs. Research rept. no. 56.
Order from LC mi$2.40, ph$3.30 PB 148 833

The philosophy and method of a posteriori probability is outlined. The analysis of the frequency of demand is considered and a method of efficient computational minimization of a function is described which depends on the cost of the computation involved in evaluating the function.

California U., Los Angeles.
A STABILITY CRITERION AND ITS APPLICATION TO THE COMPUTATION OF THE ZEROS OF A POLYNOMIAL, by E. L. Aparo. Technical rept. on ONR Contract. 11 Sep 58, 8p.
Order from LC mi$1.80, ph$1.80 PB 148 839

A finite-iterative procedure is described for the computation of real and complex roots of a polynomial with real coefficients. It is valid also in the case of multiple roots, giving each root repeated as many times as its order of multiplicity.

Carnegie Inst. of Tech., Pittsburgh, Pa.
NOTES ON THE USE OF F IN THE ANALYSIS OF VARIANCE OF ATTRIBUTES DATA AND ON THE TRANSFORMATION OF MEASUREMENTS DATA TO ATTRIBUTES DATA, by Edwin G. Olds and John S. Lewis. Rept. on Research on Transformations on the Analysis of Variance, Contract AF 33(616)3878. May 60, 46p. 11 refs. ARL Technical note 60-118.
Order from OTS $1.25 PB 161 943

The distributions of test statistics, corresponding to F and χ^2/df, for single-factor experiments when replications are Bernonilli trials, are derived for small-sample cases. The relative advantages of the two statistics are considered when nominal percentage points are to be used. The problem of finding the best method of transforming measurements data from a two-factor experiment to attributes data is discussed and exemplified. (Author)

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
RATIONAL EXPECTATIONS AND THE THEORY OF PRICE MOVEMENTS, by John F. Muth. ONR Research memo. no. 65 on Planning and Control of Industrial Operations, Contract Nonr-760(01). Aug 59, 44p. 40 refs. AD-225 471.
Order from LC mi$3.30, ph$7.80 PB 148 170

A simple explanation is presented of the formation of informed predictions of future events (expectations). The general assumption called the rational expectations hypothesis, is that the expectations are essentially the same as the prediction of the relevant economic theory. To show that the hypothesis is not unreasonable it is applied to the theory of short-run commodity price movements as an alternative to the cobweb theorem. The theory is shown to have a superior predictive ability and to imply the cobweb effect. The theory also explains the behavior and economic effects of commodity carryover, which is not possible with the cobweb theory in its original form. The rational expectations hypothesis is stated in the following way: The expectations of firms or households (or the subjective probability distribution of outcomes) tend to be distributed, for the same information set, about the prediction of the theory (or the objective probability distribution of outcomes). The various forms of the cobweb theorem are summarized. The hypothesis is used to explain the price movements in a market affected by current production and consumption. The model is then extended to allow for inventory speculation. The empirical implications of the alternative models are then compared.

Colorado U., Boulder.
ON THE CONVERGENCE OF THE EVEN PART OF CERTAIN CONTINUED FRACTIONS, by W. J. Thron. Rept. on Contract AF 49(638)100. [1960] 8p. 4 refs. AFOSR-TN-60-764; AD-240 163.
Order from LC mi$1.80, ph$1.80 PB 149 573

Columbia U., New York.
ABELIAN EXTENSIONS OF DIFFERENTIAL FIELDS, by E. R. Kolchin. Technical rept. no. 2 on Contract Nonr-266(57). Oct 59, 21p. 5 refs. AD-227 745.
Order from LC mi$2.70, ph$4.80 PB 149 853

The Galois theory of differential field is concerned with strongly normal extensions of a differential field F with algebraically closed field of constants C of characteristic 0. A strongly normal extension of F with Galois group birationally isomorphic to the subgroup G_K of an algebraic group G defined over C, or to an algebraic subgroup of G_K, is called a G-extension of F. The strongly normal extensions are characterized which are A-extensions for some abelian variety A. Such an extension is called an abelian extension. The characterization found is in terms of solutions of certain kinds of differential equations, and generalizes the result previously discussed for the case in which the extension is of transcendence degree 1, i, e., A is of dimension 1.

Columbia U., New York.
MARKOV RENEWAL PROCESSES: DEFINITIONS AND PRELIMINARY PROPERTIES, by Ronald Pyke. Rept. on Contract Nonr-266(59). 3 Oct 59, 31p. 12 refs. CU-10-59-NONR-266(59) MS; AD-227 271.
Order from LC mi$3.00, ph$6.30 PB 149 852

The definition of and some preliminary results are presented on Markov renewal processes and semi-Markov processes. The close relationship between these 2 types of processes is described. The concept of regularity is introduced and characterized. A classification of the states of a Markov Renewal process is described and studied. (Author)

Columbia U., New York.
A STORAGE MODEL FOR CONTINUOUS INFINITELY DIVISIBLE INPUTS OF "POISSON" TYPE, by J. Gani and N. U. Prabhu (Karanatak U.). Rept. on Contract Nonr-266(59). [1959] 26p. 13 refs. CU-4-59-Nonr-266(59)MS, AD-216 578.
Order from LC mi$2.70, ph$4.80 PB 146 413

This work considers a dam subject to steady release, and with continuous inputs having infinitely divisible distributions of the 'Poisson' type. The properties of such inputs are specified, and an integro-differential equation for the distribution function F(z, t) of the dam content Z(t) at time t is derived. Using Laplace-Stieltjes transforms, a general equation is obtained for F(z, t) in terms of the input distribution, and the probability of emptiness F(O, t) of the dam. The probability distribution for the 'wet period' T is also found, and its relation to F(O, t) established; the first passage problem for Z(t) is then examined.

Control Systems Lab., U. of Illinois, Urbana.
SAMPLING DISTRIBUTION OF THE AUTOCORRELATION AND POWER SPECTRUM FUNCTIONS, by Leroy Augenstine. Rept. on Contract DA 36-039-sc-56695. Jan 57, 34p. 10 refs. Rept. no. R-78; AD-157 257.
Order from LC mi$3.00, ph$6.30 PB 149 399

Copenhagen U. (Denmark).
ON CERTAIN CONVERGENCE PROPERTIES FOR SEQUENCES OF INDICATORS, by O. Barndorff-Nielsen. Technical scientific note no. 2 on Contract AF 61(052)42. 19 Dec 59, 14p. 2 refs. AFOSR-TN-60-235.
Order from LC mi$2.40, ph$3.30 PB 149 580

This note contains some investigations of the connection between convergence properties for sequence of indicators $I_1, I_2, \ldots, I_n, \ldots$ and certain of their subsequences. An indicator is a random variable assuming only the values 0 and 1. The main result is Theorem 1, from which it follows that the random variable

$$\frac{I_1 + I_2 + \ldots + I_n}{n}$$

converges weakly (or in distribution) if and only if

$$\frac{I_{k_1} + I_{k_2} + \ldots + I_{k_n}}{n}$$

converges weakly, where $I_{k_1}, I_{k_2}, \ldots, I_{k_n}, \ldots$ is a "not too thin" subsequence of $I_1, I_2, \ldots, I_n, \ldots$. The results are applied to the question of the asymptotic behavior of the number of positive sums of random variables. (Author)

Digital Computer Lab., U. of Illinois, Urbana.
THE USE OF CHEBYSHEV MATRIX POLYNOMIALS IN THE ITERATIVE SOLUTION OF LINEAR EQUATIONS COMPARED TO THE METHOD OF SUCCESSIVE OVERRELAXATION, by Gene Howard Golub. (Doctoral thesis). Rept. on Contract N[6]ori-07130. 16 Mar 59, 137p. 9 refs. Rept. no. 85.
Order from LC mi$6.90, ph$21.30 PB 148 792

Contents:
On averaging processes
A modification of the averaging methods
The numerical behavior of the generated sequences
A numerical example

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
BOUNDS FOR EIGENVALUES AND THE METHOD OF INTERMEDIATE PROBLEMS, by Alexander Weinstein. Rept. on Contract AF 49(638)228. July 60, 26p. 16 refs. Technical note BN-212; AFOSR-TN-60-722. AD-239 532.
Order from LC mi$2.70, ph$4.80 PB 149 100

This paper amplifies the contents of a lecture given in June 1960 at the International Symposium on Partial Differential Equations, Mathematics Research Center, University of Wisconsin. The paper gives an analysis of some recent developments in the theory of eigenvalues. (Author)

Johns Hopkins U., Baltimore, Md.
ON SOLUTIONS OF THE HELMHOLTZ EQUATION IN EXTERIOR DOMAINS, by Philip Hartman and Calvin Wilcox. Technical note no. 16 on Contract AF 18(603)41 and DA 11-022-ORD-2059. May 60, 38p. 20 refs. AFOSR-TN-60-582, AD-239 065.
Order from LC $3.00, ph$6.30 PB 148 930

This paper is concerned with the set of solutions W_H of (1) $\Delta V + V = 0$ defined on a part of Euclidean space E_p, $p \geq 2$, containing some region $|x| \geq \rho (\geq 0)$ and subject to the Herglotz condition (2) lim sup $r^{-1} \int_{\rho \leq |x| < r} |V(x)|^2 dx < \infty$ as $r \to \infty$.

Liège U. (Belgium).
RESEARCH IN HYPERBOLIC DIFFERENTIAL EQUATIONS, by Florent J. Bureau. Annual summary rept. on Contract AF 61(052)86. 15 Mar 60, 4p. AFOSR-TN-60-677.
Order from LC mi$1.80, ph$1.80 PB 149 585

Lockheed Aircraft Corp., Sunnyvale, Calif.
A GEOMETRICAL APPROACH TO THE SECOND-ORDER LINEAR DIFFERENTIAL EQUATION, by C. M. Petty. Technical rept. on Mathematics. June 60, 56p. 10 refs. LMSD-288250.
Order from LC mi$3.60, ph$9.30 PB 149 892

The strength of various assumptions on the properties of the solutions of the linear differential equation $\ddot{u} + R(t)\, u = 0$ are studied. A close relationship is established with a partial differential system, in the context of which is found a convenient setting for the theorems and proofs of the studies. Non-oscillatory equations are discussed separately. The major analytic relations are derived, and the major geometrical tools are developed. A surprisingly close relationship is established connecting the differential equation introduced with the geometry of the Minkowski plane. The major results in a possible classification theory are derived, with proofs drawing heavily on the analytic and geometrical tools previously discussed. (Author)

Michigan State U. [East Lansing]
NONPARAMETRIC TESTS FOR LOCATION AND SCALE PARAMETERS IN A MIXED MODEL OF DISCRETE AND CONTINUOUS VARIABLES. I, by Shashikala Sukhatme. Interim technical rept. no. 16 on Research in Multivariate Analysis, Contract DA 20-018-ORD-14735. 8 Mar 60, 34p. 18 refs. OOR rept. 1840.14-M; AD-235 464.
Order from LC mi$3.00, ph$6.30 PB 148 509

Let $Z_1, \ldots, Z_N$, where $Z_1 = (X_1, Y_1)$, be N independent observations from a bivariate distribution. Assume that the random variable X takes only two values, 1 and 0, with $P(X=1) = p$ and $P(X=0) = 1-p = q$. Let the conditional distribution of Y, given $X = j$ $(j = 0, 1)$, be $P(Y \leq y \mid X = j) = F_j(y)$. The hypothesis H: $F_1 = F_0$ is tested against the alternative A: $F_1 \neq F_0$.

Michigan State U. [East Lansing]
NONPARAMETRIC TESTS FOR LOCATION AND SCALE PARAMETERS ON A MIXED MODEL OF DISCRETE AND CONTINUOUS VARIABLES, II, by Shashikala Sukhatme. Interim technical rept. no. 17 on Research in Multivariate Analysis, Contract DA 20-018-ORD-14735. 16 Mar 60, 11p. 3 refs. OOR-rept. 1840.15-M; AD-235 503.
Order from LC mi$2.40, ph$3.30 PB 148 510

A rank test for dispersion and a two-sample run test are discussed in connection with the nonparametric tests for location and scale parameters in a mixed model of discrete and continuous variables. (Author)
(See also PB 148 509)

Michigan U. Research Inst., Ann Arbor.
ABSOLUTELY CONVERGENT POWER SERIES, by F. Bagemihl and G. Piranian. Technical note on Contract AF 49(638)633. June 60, 12p. 6 refs. 2913-2-T; AFOSR-TN-60-574; AD-239 274.
Order from LC mi$2.40, ph$3.30 PB 148 799

It has been known for some time that power series exist that map the unit circle C onto a Peano curve and that converge absolutely on C. The present note exhibits a new example which has the additional property that it maps the unit disk D onto a Riemann surface of finite area. The note also shows that it is possible for a power series to converge absolutely on C and to map C onto a Jordan curve that has both rectifiable and nonrectifiable arcs. A number of unsolved problems are stated. (Author)

Minnesota U., Minneapolis.
CONTRIBUTIONS TO THE THEORY OF RANK ORDER STATISTICS: COMPUTATION RULES FOR PROBABILITIES OF RANK ORDERS, by I. Richard Savage. Technical rept. no. 9 on Contract Nonr-2582(00): 1 Sep 59, 4p. 3 refs. AD-220 766.
Order from LC mi$1.80, ph$1.80 PB 148 912

Rules are given for computing the probabilities of rank orders for the 1- and 2-sample problems. For the 1-sample problem, the rule permits the computations for samples of size n from the results with samples of $n-1$. For the 2-sample problem the rule permits the computations for samples of size m and n from the results with samples of $m-1$ and n (m and $n-1$). Most computations, done analytically, are built up from smaller to larger sample sizes and the results have limited value, e.g., in checking numerical work. For Monte Carlo sampling, there is no reason for starting with the smaller samples. (Author) (See also PB 148 911)

Minnesota U., Minneapolis.
CONTRIBUTIONS TO THE THEORY OF RANK ORDER STATISTICS; THE TWO-SAMPLE CENSORED CASE, by U. V. R. Rao (Indiana U.), I. R. Savage, and M. Sobel (Bell Telephone Labs.). Technical rept. no. 8 on Contract Nonr-2582(00). 1 Sep 59, 19p. 4 refs. AD-220 765.
Order from LC mi$2.40, ph$3.30 PB 148 911

Rank order theory is developed for the 2-sample problem in which censoring of the observations has occurred, i.e., not all of the random variables are observed. The rank orders are not all equally likely under the null hypothesis and thus the likelihood ratios of rank orders are considered. In applying the results of this paper, there is a strong analogy to sequential analysis. The censoring scheme procedure corresponds to the stopping rule and in both cases the terminal decision procedure is based on the likelihood ratio. The detailed applications are not given of the present theory to either those procedures or the new ones introduced here. (Author) (See also PB 144 399)

Minnesota U. [Minneapolis].
NOTE ON THE TENSOR PRODUCT OF BANACH ALGEBRAS, by B. R. Gelbaum. Rept. on Contract AF 49(638)526. 18 June 60, 5p. 3 refs. AFOSR-TN-60-673; AD-239 606.
Order from LC mi$1.80, ph$1.80 PB 149 076

The relation between the maximal ideal space of a tensor product of Banach algebras and the Cartesian product of the maxima ideal spaces of the algebras is investigated from the standpoint of the kernal-hull topologies. (Author) (See also PB 135 361)

Minnesota U. School of Business Administration, Minneapolis.
SOME PROPERTIES OF THE SPEARMEN ESTIMATOR IN BIOASSAY, by Byron William Brown, Jr. Technical rept. no. 6 on Contract Nonr-2582(00). 1 June 59, 107p. 31 refs.
Order from LC mi$5.70, ph$16.80 PB 146 965

This paper presents an evaluation of the Spearman estimator, a non parametric estimator of μ.

Naval Ordnance Lab., White Oak, Md.
BOUNDS FOR EIGENVALUES OF THE FREE AND FIXED MEMBRANE BY FINITE DIFFERENCE METHODS, by Bert Hubbard. 31 May 60, 54p. 76 refs. NAVORD rept. 6874.
Order from OTS $1.50 PB 161 940

This paper gives explicit upper and lower bounds for the eigenvalues of both the free and fixed membrane problems in terms of the eigenvalues of analogous finite difference problems. In each case the difference between the upper and lower bounds is of the order of the mesh width. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
APPROXIMATIONS IN VARIATIONAL PROBLEMS, by Lu Ting. Rept. on Contract AF 49(638)445. July 60, 19p. 5 refs. PIBAL rept. no. 610; AFOSR TN-60-789.
Order from LC mi$2.40, ph$3.30 PB 149 899

If there are small terms (of the order $\epsilon \ll 1$) in the functional and/or in the accessory equation, the extreme of the functional taking into account the first order effect of those small terms can be obtained by the following procedure. The Euler equation or equations are approximated by omitting the small terms. The solution of the approximate Euler equation subjected to the exact accessory equations is then obtained. With this solution, the value of the functional evaluated without omitting any term differs from the true extreme by the order of ϵ^2. This statement is applied to the problem of optimum rocket trajectory. It is concluded that the relative simple solution of Dommasch and Barron does yield the correct optimum value taking into account the first order effect of aerodynamic forces and that of the variation of gravitational and centrifugal forces due to elevation. (Author)

Princeton U., N. J.
NONLINEAR DIFFERENTIAL EQUATIONS AND NONLINEAR OSCILLATIONS, by S. Lefschetz. Final rept. for 15 Aug 46-30 Sep 59 on Contract Nonr-1858(04). [1959] 34p. 25 refs.
Order from LC mi$3.00, ph$6.30 PB 148 601

Reviews the papers and personnel associated with the project.

RIAS, Baltimore, Md.
ON THE METHOD OF AVERAGING, by J. K. Hale. Rept. on Contract AF 49(638)382. May 60, 17p. 9 refs. Technical rept. 60-13; AFOSR-TN-60-270.
Order from LC mi$2.40, ph$3.30 PB 148 658

The method of averaging of van der Pol was devised to obtain periodic and almost periodic solutions of quasi-linear systems of differential equations. A theorem is stated for a particular case where this method has been justified mathematically and an example is given to illustrate the results. (Author)

Rice Inst., Houston, Tex.
A FLUX INTEGRAL FOR FUNCTIONS WHICH HAVE HARMONIC SUPPORT, by Guy Johnson. Rept. on Contract AF 49(638)632. 20 Apr 60, 38p. 19 refs. AFOSR-TN-60-444.
Order from LC mi$3.00, ph$6.30 PB 148 975

A flux integral for functions which have harmonic support is defined and its validity on rectifiable curves is established. A Gauss theorem yielding the mass distribution for a logarithmic potential of this class is shown to be valid for a domain whose boundary consists of a finite set of rectifiable Jordan curves. (Author)

Rutgers State U., New Brunswick, N. J.
DIFFERENTIAL FORMS OF BOUNDED p-VARIATION, by Victor L. Shapiro. Rept. on Contract AF 18(600)1595. 7 July 60, 27p. 6 refs. AFOSR-TN-60-759.
Order from LC mi$2.70, ph$4.80 PB 149 910

Stanford Electronics Labs., Stanford U., Calif.
A GENERALIZATION OF THE SAMPLING THEOREM, by D. A. Linden and N. M. Abramson. Rept. on Contract Nonr-225(44). 28 Aug 59, 11p. 6 refs. Technical rept. no. 1551-2; AD-225 884.
Order from LC mi$2.40, ph$3.30 PB 148 188

The sampling theorem for bandlimited functions allows one to reconstruct exactly a function containing no frequencies higher than W cycles per sec, given the values of the function at equispaced sampling points 1/2W sec apart. This theorem is generalized to allow reconstruction, given the values of the function and its first R derivatives at equispaced sampling points, (R+1)/2W sec apart. For large R, the R-derivative expansion approaches a Taylor's series weighted by a Gaussian density about each sample point. (Author)

Statistical Lab., Case Inst. of Tech., Cleveland, Ohio.
PERCENTILES OF THE BINOMIAL DISTRIBUTION, by F. C. Leone, G. E. Haynam and others. Rept. on Contract AF 49(638)361. June 60, 37p. 12 refs. AFOSR-[TN]-60-620; AD-239 715.
Order from LC mi$3.00, ph$6.30 PB 149 078

Tables of percentiles of the binomial distribution for sample sizes $n = 10(5)100$ and $\alpha = 0.0025, 0.005, 0.01, 0.025, 0.05, 0.1, 0.9, 0.95, 0.975, 0.99, 0.995,$ and 0.9975, are presented. A brief discussion is given of the methods of evaluating percentage points of the binomial distribution, including the use of these and other related statistical tables. Some applications of the tables are mentioned. These include sampling and life-testing problems and an example of the use of the tables in theoretical work. (Author)

Statistical Techniques Research Group, Princeton U., N. J.
A SURVEY OF SAMPLING FROM CONTAMINATED DISTRIBUTIONS, by J. W. Tukey. Technical rept. no. 33 on Contract DA 36-034-ORD-2297. Dec 59, 75p. 48 refs. OOR rept. 1715.32-M; AD-230 215.
Order from LC mi$4.50, ph$12.30 PB 148 434

Virginia Agricultural Experiment Station, Blacksburg.
A SHORT TABLE OF THE HYPERGEOMETRIC FUNCTION ${}_0F_1(c;x)$ by J. Edward Jackson. Technical rept. no. 8 on The Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). June 59, 7p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 146 405

Washington U., Seattle.
DEFORMATION THEORY OF COMPLEX MANIFOLDS, by Alfred Frölicher, Edward T. Kobayashi, and Albert Nijenhuis. Technical rept. no. 10 on Contract Nonr-477(15). 15 Oct 59, 152p. 23 refs. AD-233 802.
Order from LC mi$7.50, ph$24.30 PB 149 868

Contents:
Introduction to complex structures
Vector forms in differential geometry
The Dolbeault and GLA-cohomology groups
Deformation of complex structures
The concept of F-relatedness
Differentiable families of complex structures

Washington U., Seattle.
INVARIANCE OF VECTOR FORM OPERATIONS UNDER MAPPINGS, by Alfred Frolicher and Albert Nijenhuis. Technical rept. no. 9 on Contract Nonr-477(15). 15 Oct 59, 40p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 149 498

Yale U., New Haven, Conn.
THE INVERSE FUNCTION THEOREM IN BANACH ALGEBRAS, by Einar Hille. Rept. no. 1 on Contract AF 49(638)224. Apr 59, 11p. 3 refs. AFOSR TN-59-330; AD-213 651.
Order from LC mi$2.40, ph$3.30 PB 146 450

This report contains a proof of the inverse function theorem formulated for Frechet analytic functions with domain and range in a Banach algebra. A complex parameter α is introduced in the function and the inverse function is obtained as a power series in α. The procedure makes it possible to use Cauchy's method of Calcul des limites for the convergence proof. (Author)

MATHEMATICS

Computing Devices

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
METHODS FOR OBTAINING COMPLETE DIGITAL CHAINS, by Bernard Lippel and Irving J. Epstein. 30 June 57, 18p. 8 refs. Technical memo. no. M-1850 AD-143 540.
Order from LC mi$2.40, ph$3.30 PB 149 383

Two methods are described and proved for obtaining complete digital chains (chain coded sequences which contain all the possible permutations of p kinds of symbols taken n at a time). A generalized permutation method for complete chains is also given. Possible engineering applications for chain codes are considered.

Computation Lab., Harvard U., Cambridge, Mass.
DESIGN AND OPERATION OF DIGITAL CALCULATING MACHINERY, by Howard Aiken. Progress rept. no. 38, 10 Feb-10 May 55, on Contract AF 33(038)9461. [1955] 157p. 2 refs. AD-62 231.
Order from LC mi$7.50, ph$24.30 PB 150 300

This report released for sale to the public 19 Sep 60.

This report contains the results of computations completed on the Mark I and Mark IV Calculators. The coordinate determination of ground points on aerial photographs is discussed. A mathematical description of a non-linear eigenvalue problem is presented. The solution of nineteen linear second order differential equations with two point boundary conditions is reported.

Dunlap and Associates, Inc., Stamford, Conn.
HUMAN DECISION MAKING AS RELATED TO AIR SURVEILLANCE SYSTEMS, by Andrew P. Chenzoff, Richard L. Crittenden and others. Technical rept. no. 1 on Contract AF 19(604)6164. 10 June 60, 128p. 471 refs. DA rept. no. 300-1; AFCCDD-TR-60-25.
Order from LC mi$6.30, ph$19.80 PB 149 215

This report presents a review of the literature on decision making. The objectives of this survey were: (1) to describe some of the decision making information now available in the areas of mathematics, experimental psychology, sociology and systems research; (2) to identify areas for further experimentation on human decision making. For many years to come human decision making will remain of great practical importance for many kinds of decisions even in those situations where machines are being used to the fullest extent. These experiments will therefore consider as far as possible those aspects of decision making that humans must undertake in air surveillance. (Author)

Electronics Research Lab., U. of California, Berkeley.
RECENT ADVANCES IN THE FIELD OF SAMPLED DATA AND DIGITAL CONTROL SYSTEM, by E. I. Jury. Rept. on Contract AF 18(600)1521. 20 Oct 59, 39p. 49 refs. Series no. 60, issue no. 256; AFOSR-TN-59-1017; AD-233 272.
Order from LC mi$3.00, ph$6.30 PB 146 738

Theoretical aspects are described of the progress made in the field of Sampled-Data and Digital Control Systems during the last few years. The material is classified into the following major topics: (1) linear theory, (2) statistical theory, (3) nonlinear theory, (4) time-varying theory, and (5) digital control systems. These topics are briefly described and methods of analysis and design with their major purposes and achievements are enumerated. Each category is documented with a brief list of references which might serve as a quick aid to new investigators in this field. A brief survey of digital control systems is discussed, and it is indicated how the above mentioned topics can be extended to these systems. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
MATHEMATICAL NEUROPHYSIOLOGY, by J. D. McKnight, Jr. Technical memo. Oct 59, 8p. LMSD-288038; AD-227 196.
Order from LC mi$1.80, ph$1.80 PB 148 941

The purpose was to abstract the essential mathematical elements of the classical studies made since the mid-thirties by various researchers and to extend and elaborate these elements where possible and expedient.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
COMMON PROGRAMMING LANGUAGE TASK. PART II. AUTOMATIC CODE TRANSLATION SYSTEM (ACT), by A. W. Holt, W. J. Turanski, and D. L. Meginnity. Final rept. for 1 May 58-30 June 59 on Project ADAR, Task D, Contract DA 36-039-sc-75047. 31 July 59, 143p. AD59URI, v. 4A.
Order from LC mi$7.20, ph$22.80 PB 149 394

The study is divided into four portions, the first three of which are directly concerned with the ACT system, while the fourth (Appendix) is an example of a specialized code- Symbolic Logistico-Administrative Code (SLAC). The sections are concerned, respectively, with a general description of the Automatic Code Translation System (general purpose allocation interpreter and "core library", etc), a description of the allocation interpreter, and a discussion of Canonical Form. The SLAC System, which comprises the Appendix, has a direct relation with the section on Canonical Form. (Author)

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
INFORMATION RETRIEVAL AND THE DESIGN OF MORE INTELLIGENT MACHINES, by Harry J. Gray, Jr., Oliver Aberth and others. Final rept. for 1 May 58-31 June 59, on Project ADAR, Task E, Contract DA 36-039-sc-75047. 31 July 59, 216p. 15 refs. AD59URI, v. 5; AD-235 999.
Order from LC mi$9.60, ph$33.30 PB 149 395

In order to reduce the requirements on the personnel who use data processing systems, the systems should be designed to have more intelligence. From study of human processes, a multiple list structure for information is proposed and studied. When applied to an information retrieval problem, it is found to be up to 30,000 times faster than conventional techniques. Results of investigations into the design of an optimized system are given. It is shown that the multiple list structure can perform with greater efficiency all that the Newell-Simon IPL can. Techniques are explored for the retrieval of information having descriptors which are not the same as those under which the item was filed. Results of a study of the nervous systems are given leading to specification of a parallel-access information bank which may be more efficient than the multiple list structure. Finally, some results of psychological experiments on human beings are successfully predicted from the theory of the multiple list structure. (Author)

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
HUMAN FACTORS AFFECTING CONSOLE DESIGN IN THE FIELDATA SYSTEM, by Charles F. Hoban, R. Omer Lucier, and R. Flood. Final rept. for 1 May 58-30 June 59 on Project ADAR, Task B, Contract DA 36-039-sc-75047. 31 July 59, 41p. 1 ref. AD59UR1, v. 2; AD-235 998.
Order from LC mi$3.30, ph$7.80 PB 149 392

The role of human factors in system development in general, with particular reference to their treatment in the Army FIELDATA system, is studied. The consoles of the computer family being designed for the Signal Corps are then analyzed in detail as man/machine interface. The limited capacity of the Signal Corps for human factors studies, together with their methods of compensating for this lack, are noted and discussed. A critical examination is given of the parallel, rather than sequential development plan that has been adopted in the FIELDATA system. On the basis of observations made during visits to the producers of the FIELDATA equipment, console design in this family is discussed. Some of the problems analyzed include invariances in logic and console topography of different computers, and the complexities of a multifunctional console. Among the specific recommendations for improved console design are arabic numeral keyboards, redundant state-indicators and mechanical guards. (Author)

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
WHAT IS A CODE? by G. W. Patterson, W. I. Landauer, and E. J. Parker. Final rept. for 1 May 58-30 June 59 on Project ADAR, Task F, Contract DA 36-039-sc-75047. 31 July 59, 43p. 12 refs. AD59URI, v. 6. AD-236 000.
Order from LC mi$3.30, ph$7.80 PB 149 396

This study involves the definition of the word "code", and the word's relation to current meanings. It also defines syntactical subbases, syntactical bases, and it explains the formalized mathematical model of rules for forming expressions from these characters, known as a concatenation algebra. A code is a nonsingular transformation from a syntactical base into another syntactical base, and one that is effectively calculable. The process of coding is that of finding the expression in the code language, and decoding is the inverse action - both of which must be capable of being programmed on a computer. (Author)

National Bureau of Standards, Washington, D. C.
TRANSISTORIZED BUILDING BLOCKS FOR DATA INSTRUMENTATION, by J. A. Cunningham and R. L. Hill. Sep 60, 74p. 2 refs. Technical note 68.
Order from OTS $2.00 PB 161 569

The National Bureau of Standards has developed a number of modular transistorized digital circuits that have been used in automatizing many data recording and preliminary processing tasks encountered in its scientific operations. These versatile building blocks can be connected together systematically to form digital circuits that accept raw data from experimental equipment and transpose these data into a form suitable for input to a high-speed electronic computer. These blocks can be used where: (1) data are produced in large volumes; (2) data taking is extremely fast, extremely slow, or extremely precise; (3) a need exists to minimize human error, tedium and eyestrain; or (4) computation is extensive. This report describes 5 major packages and 8 special-purpose packages.

Naval Weapons Lab., Dahlgren, Va.
SUBROUTINES FOR THE NORC CRT PRINTER, by A. V. Hershey. 9 Mar 60, 45p. 8 refs. NWL rept. no. 1686; AD-234 557.
Order from LC mi$3.30, ph$7.80 PB 147 814

The computing programs in a curve plotting routine, a stereographic routine, and a character plotting routine are described. Some experimental tests with these routines are believed to be consistent with the following postulates: (1) between the datum points for a curve there is an optimum spacing which will give a distortion-free plotting of the curve for any compression of the scaling and (2) the visual interpretation of abstract stereograms is consistent with a mental impression that a central point in every image is located at the same absolute distance. (Author)

Princeton U., N. J.
THE DEVELOPMENT OF THE PRINCETON UNIVERSITY THREE-DIMENSIONAL ANALOG COMPUTING FACILITY, AND THE DEVELOPMENT OF THE PRINCETON UNIVERSITY LIFTING LINE CALCULATOR, by Whiting R. Willauer. Rept. on Contract Nonr-1858(14). June 58, 71p. 6 refs. Aeronautical Engineering rept. no. 424.
Order from LC mi$4.50, ph$12.30 PB 147 611

This report describes the development of the Princeton University Three-Dimensional Analog Computing Facility, and the modification of the Princeton University Two-Dimensional Analog Tank so that it could yield solutions to Prandtl's lifting line equation. The theory necessary for the operation of the two facilities is given. The methods of construction of the tanks, models, and electrical circuits are presented. The operation of the tanks and the difficulties en-

countered are discussed. Finally, recommendations for the expansion of the facilities and the better utilization of the existing equipment are presented. (Author)

Zemanek, Heinz, Vienna (Austria).
PROGRAMS FOR LOGICAL DATA PROCESSING, by V. Kudielka, H. Zemanek and others. Final rept. for 1 Feb 59-31 Jan 60 on Contract DA 91-591-EUC-1062. 29 Feb 60, 198p. 35 refs. AD-235 961.
Order from LC mi$8.70, ph$30.30 PB 149 452

Contents:
Conventional logical algebra
- The function in the logical algebra
- Rules for logical computing
- Switching networks and logical algebra
- Minimization

Sequential logical algebra
- Time sequences
- Sequential functions
- Sequential networks
- Application of information theory

Operations on logical functions
- The representation of logical variables and functions
- Sequential formula translation
- Communication with physical objects

Automatic minimization
- Different procedures
- The minimization procedure by McCluskey
- An automatic minimization procedure
- Commentaries on the minimization program
- Three examples

MECHANICS

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE HERTZ PROBLEM FOR A RIGID SPHERICAL INDENTER AND A VISCOELASTIC HALF SPACE, by S. C. Hunter. Technical rept. no. 1 on Contract DA 19-020-ORD-4750. Mar 60, 34p. 8 refs. Rept. no. DA-4750/1; OOR rept. no. 1892. 2-E; AD-236 958.
Order from LC mi$3.00, ph$6.30 PB 148 440

The penetration of a viscoelastic half space by a rigid spherical indenter is investigated in a quasi static approximation. Solutions to the problem are obtained for monotonic contact radius $r_1(t)$ and for the case where $r_1(t)$ possesses a single maximum. The analysis is used to estimate the duration of contact and coefficient of restitution for the Hertzian impact of a spherical indenter on a Maxwell solid. (Author)

Florida U. Engineering and Industrial Experiment Station, Gainesville, Fla.
EFFECT OF MEMBRANE FORCES ON LATERAL VIBRATIONS OF RECTANGULAR PLATES, by Marc Trubert and William A. Nash. Technical note no. 2 on Contract AF 49(638)328. May 60, 60p. 23 refs. AFOSR-TN-60-437.
Order from LC mi$3.60, ph$9.30 PB 148 786

A solution to the problem of finding the natural modes of vibration of a rectangular plate loaded by membrane forces, i.e. tension (or compression), in the middle plane, is sought by the perturbation technique. The eigenvalues and eigenfunctions for the plate subjected to tension are deduced from the known eigenvalues and eigenfunctions for the plate with no tension, for the usual boundary conditions, by the use of series involving powers of the tension. General expressions for the series are formulated using the eigenfunctions of the plate with no tension as normal functions. The exact solution of the problem is given for the case of simple supported edges. A second application is made to a clamped square plate.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON SOME NEW CONTINUATION FORMULAS AND UNIQUENESS THEOREMS IN THE THEORY OR ELASTICITY, by J. H. Bramble and L. E. Payne. Rept. on Contract AF 49(638)228. July 60, 32p. 8 refs. Technical note BN-213; AFOSR-TN-60-723.
Order from LC mi$3.00, ph$6.30 PB 149 101

New formulas for the continuation of the solution to the equations of elasticity across a spherical boundary are obtained. In addition certain new boundary value problems in elasticity are considered. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
THE BUCKLING OF A THICK CIRCULAR PLATE USING A NON-LINEAR THEORY, by Chester B. Sensenig. Rept. on Contract AF 49(638)161. Dec 59, 20p. 3 refs. IMM-NYU 262; AFOSR-TN-60-41; AD-233 366.
Order from LC mi$2.40, ph$3.30 PB 146 748

The stability of equilibrium for an isotropic circular cylinder when compressed along its curved lateral surface is studied. The compression on the curved part of the boundary is assumed to be such that the generators of the cylinder remain vertical straight lines, and such that no shear stress is developed. The problem is treated by making use of the non-linear 3-dimensional theory of elasticity. The formulation of the theory uses Lagrange coordinates and matrix notation. No restrictive assumptions are made concerning the thickness of the plate, and the displacements and strains are not assumed to be small. When the cylinder is compressed, the uniform plane strain satisfies all the conditions of the exact non-linear theory. A small perturbation is made, and critical pressures are found together with the corresponding modes of buckling. Only buckled modes with symmetry about the axis of the cylinder are considered.

Naval Research Lab., Washington, D. C.
FRACTURE TESTING OF HIGH-STRENGTH SHEET MATERIALS UNDER CONDITIONS APPROPRIATE FOR STRESS ANALYSIS, by G. R. Irwin. 27 July 60, 48p. 5 refs. NRL rept. 5486.
Order from OTS $1.25 PB 161 474

This report describes and justifies a method for evaluating fracture toughness of thin sheet metals. The criteria of toughness is taken as a parameter K which characterizes the intensity of the stress field surrounding the crack tip. At fixed load, this intensity grows with crack length; when it can no longer be counteracted by the fracture toughness, crack growth becomes unstable. The field intensity parameter at this point represents a material property of fracture toughness K_c. To obtain a measure of this property, the procedure provides for tensile testing of a sheet specimen containing sharp notches or initial cracks oriented normal to the applied tensile stress. Observations of load and crack length at onset of fast fracture permits evaluation of the fracture toughness parameter K_c. In order to test specimens of convenient width, the measured crack length must be corrected for the influence of the plastic zone surrounding the crack tip. The theoretical basis for this is given in an appendix. A basis for estimating slow crack growth prior to instability without direct measurement is also appended to the text. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
CREEP BENDING OF ANNULAR PLATES, by Sharad A. Patel and B. Venkatramam. Rept. on Contract AF 49(638)302. May 60, 25p. 8 refs. PIBAL rept. no. 559; AFOSR-TN-60-528.
Order from LC mi$2.70, ph$4.80 PB 148 315

The present report is concerned with the creep bending of annular plates subjected to pure bending moments. Annular plates on simple and fixed supports are considered, and the analyses are carried out on the bases of the elastic analogue and a creep flow law formulated in similar terms to those of the plastic flow laws. Solutions for moments and deflections are presented. (Author)

Aerodynamics and Pneumatics

Aeroelastic and Structures Research [Lab.] Mass. Inst. of Tech., Cambridge.
GUST LOADS IN RIGID AND ELASTIC AIRPLANES, by R. L. Bisplinghoff, G. Isakson, and T. F. O'Brien. Rept. on Contract NOas-8790. 15 Aug 49, 115p. 21 refs. ATI-130 859.
Order from LC mi$6.00, ep$19.80 PB 150 081

This report released for sale to the public 31 Aug 60

Contents:
The rigid airplane in incompressible flow
Gust loads at high subsonic speeds.
Gust loads at supersonic speeds.
Investigation of some coupling effects in the response of an elastic airplane to gusts.
The effect of vibrational response on the distribution of load
The effect of airplane size on the transient virbational response.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
YIELD CONDITIONS OF PLATES AND SHELLS BY MISES-HENCKY CRITERION, by T. H. H. Pian. Rept. on Contract AF 49(638)160. June 60, 19p. 7 refs. ASRL TR 76-3; AFOSR-TN-60-608.
Order from LC mi$2.40, ph$3.30 PB 149 157

Yield conditions for plates and shells under combined bending moments and stress resultants have been derived by using Mises-Hencky criterion. The relation is expressed in parametric form with three parameters. For several limiting cases, simple yielding conditions are obtained. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
INTERFERENCE BETWEEN A JET ISSUING LATERALLY FROM A BODY AND THE ENVELOPING SUPERSONIC STREAM, by Carlo Ferrari. Rept. on Contract NOrd-7386. Apr 59, 126p. 13 refs. Bumblebee rept. no. 286; AD-226 477.
Order from LC mi$6.30, ph$21.30 PB 150 157

This report released for sale to the public 13 Sep 60

An analysis is made of the interference forces exerted upon a cylindrical body in hypersonic flow from which a jet is issuing laterally out of a circular orifice. The characteristics of the jet are first examined in order to define its centerline path and its cross-sectional shape. Once the shape of the jet is known in approximation, an approach based on Lighthill's treatment of the hypersonic blunt-body problem is employed to find the shock stand-off distance ahead of the jet spout and to approximate the flow field between the shock and the surface of the jet. It is assumed that viscosity does not alter the total interference forces acting on the body, although it is known from physical observation that separation does occur ahead of the shock, with the result that the induced pressures are reduced in magnitude and spread over a larger region of the adjacent cylinder than is premised in the idealized mathematical model employed here. A comparison is made between the calculated results and what has been measured in wind-tunnel experiments, with good confirmation of the trends and magnitudes, despite the fact that the empirical data on jet interference were obtained at lower Mach numbers (2.84 and 3.90) than those for which this present theory should be most applicable. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
COMPARISON OF LINEARIZED TRANSONIC FLOW THEORY WITH EXPERIMENTAL PRESSURE DISTRIBUTIONS ABOUT A PARABOLIC-ARC BODY OF REVOLUTION, by M. Pindzola. Rept. on ARO, Inc., Contract AF 40(600)800. Aug 59, 27p. 4 refs, AEDC TN-59-89; AD-220 255.
Order from LC mi$2.70, ph$4.80 PB 147 879

The pressure distributions obtained by linearized theory for transonic flow, which is based on a linear variation of the axial perturbation velocity, are compared to those obtained experimentally on a parabolic-arc body of revolution. Distributions obtained by

linearized subsonic and supersonic flow theory are also included for comparison. The subsonic and supersonic theories are shown to agree more favorably with the experimental data than with the transonic theory, except in the forward portion of the body in the Mach number range very near 1.0. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
DETERMINATION OF DAMPING DERIVATIVES FROM FREE-OSCILLATION TESTS OF NON-LINEAR SYSTEMS USING ENERGY RELATIONS, by C. J. Welsh, L. K. Ward, and G. R. Ahsmuhs. Rept. on ARO, Inc., Contract AF 40(600)800. June 60, 26p. 5 refs. AEDC-TN-60-104.
Order from LC mi$2.70, ph$4.80 PB 148 961

An energy analysis of the damping of a linear oscillatory system has been made and extended to non-linear wind-tunnel configurations tested over a large amplitude range. It is shown that the measured amplitude decay of the free-oscillation motion of such configurations can be an invalid measurement of the stability of the system and can induce appreciable errors in the computed damping derivatives. An approximate procedure for handling amplitude traces of non-linear configurations tested in wind tunnels and by which equivalent viscous damping derivatives can be obtained is given. Experimental damping data measured at M = 8 over a Reynolds number range of 0.5×10^6 to 1×10^6 based on body diameter for a flared afterbody re-entry shape indicate that the approximate procedure is quite adequate. (Author)

Arnold Engineering Development Center, Tullahoma, Tenn.
FORCE AND PRESSURE TESTS OF AN AGARD CALIBRATION MODEL B AT A MACH NUMBER OF 8, by L. D. Kayser and C. R. Fitch. Rept. on ARO, Inc., Contract AF 40(600)-800 S/A 11(60-110). July 60, 36p. 10 refs. AEDC TN-60-34.
Order from LC mi$3.00, ph$6.30 PB 149 197

Body-wing and body-only configurations of the AGARD Calibration Model B were tested at a nominal Mach number of 8 and Reynolds numbers from 0.8 to 11.0×10^6 based on model length. Forces and moments for both configurations were obtained from internal, strain-gage balance measurements. Also, force and moment coefficients for the body-only configuration were obtained by numerical integration of pressure distributions. The lift-curve slope and aerodynamic center obtained at Mach 8 compared favorably with data obtained from other tunnels at various Mach numbers. The only significant Reynolds number effect was the higher drag coefficient at the lower Reynolds numbers. (Author)

Avco-[Everett] Research Lab., Mass.
THE DIFFERENCES BETWEEN SATELLITE AND BALLISTIC MISSILE RE-ENTRY PROBLEMS, by F. R. Riddell and J. D. Teare. Sep 58, 31p. 12 refs. Research rept. 31.
Order from LC mi$3.00, ph$6.30 PB 147 197

The purpose of this paper is to point out the significant differences in the critical heating and deceleration problems which are faced in re-entry of the atmosphere from different types of trajectories. To do this we discuss two specific cases which are of current interest, the re-entry of long-range ballistic missiles and the re-entry of satellite vehicles.

Ball Brothers Research Corp., Boulder, Colo.
THE DESIGN AND PERFORMANCE OF THE BENT OGIVE POINTING CONTROL, by O. E. Bartoe, R. E. Hathaway and others. Final technical rept. on Contract AF 19(604)2656. Apr 60, 124p. AFCRC-TR-60-259.
Order from LC mi$6.30, ph$19.80 PB 148 476

An instrument called the Bent Ogive Pointing Control has been designed to facilitate measurements of the solar spectrum on rocket probe experiments. Solar pointing controls have been flown in upper atmospheric experiments since 1951 and in general have been used to orient spectrographic instruments at or relative to the sun. The Bent Ogive Pointing Control as described in this report is unique in its configuration in that the Ogive or nose cone is hinged and bent normal to the major rocket axis to achieve the desired results.

Brown U. Div. of Engineering, Providence, R. I.
HEAT TRANSFER FROM SURFACES OF NON-UNIFORM TEMPERATURE DISTRIBUTION. PART II. TURBULENT TRANSFER FROM ISOTHERMAL SPANWISE STRIPS ON A FLAT PLATE, by H. H. Sogin and R. J. Goldstein. Rept. on Contract AF 49(638)46. Feb 60, 47p. 22 refs. AFOSR-TN-60-647.
Order from LC mi$3.30, ph$7.80 PB 149 454

Experiments were performed on the mass transfer by forced convection from naphthalene strips on a flat plate to an air stream at ordinary temperature and pressure. Turbulence was induced in the boundary layer by means of a wire trip. In all cases there was a hydrodynamic starting length upstream of the strips. The ratio of this inert length to the total length was varied from about 0.80 to 0.96. The flow was practically incompressible with Reynolds number, based on the total length, varying from 175,000 to 486,000. The Schmidt number was 2.5. The experimental results fall in proximity to the Seban step function factor when they are reduced after the mass-momentum analysis of Deissler and Loeffler for a surface of uniform vapor pressure. When Kármán's formulation of the mass-momentum analogy is assumed, the data fall between the values predicted by the Seban and by the Rubesin expression for the step function factor. The results are well correlated by the Colburn analogy in conjunction with the Rubesin step function factor. (Author)
(See also PB 139 919)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
BEHAVIOR OF SMALL REGIONS OF DIFFERENT GASES CARRIED IN ACCELERATED GAS FLOWS, by George Rudlinger and Lowell M. Somers. Rept. on Project Squid, Contract Nonr-1858(25). Mar 59, 39p. 17 refs. Technical rept. CAL-76-P.
Order from LC mi$3.00, ph$6.30 PB 146 544

Small regions in a flow where the density is different from that of the surrounding gas do not exactly follow accelerated motions of the latter, but move faster or slower depending on whether their density is smaller or larger than that of the main flow. This behavior cannot be quantitatively explained by treating a gas "bubble" as a hypothetical solid particle of the same density because a gas bubble cannot move relative to the surrounding gas without being transformed into a vortex which absorbs part of the energy of the relative motion. To illustrate the acceleration effect, the flow velocity behind known pressure waves in a shock tube is compared with the observed velocity of a bubble produced by a spark discharge. A theory is developed which permits computing the response of such bubbles to accelerations.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
CHEMICAL NONEQUILIBRIUM EFFECTS ON HYDROGEN ROCKET IMPULSE AT LOW PRESSURES, by J. Gordon Hall, A. Q. Eschenroeder, and J. J. Klein. Rept. on Contract AF 18(603)141. Nov 59, 12p. 7 refs. Rept. no. AD-1118-A-8; AFOSR-TN-59-1192; AD-229 134.
Order from LC mi$2.40, ph$3.30 PB 146 541

Calculations of nonequilibrium hydrogen flows were investigated for a lower range of pressures as well as a wider range of temperatures and nozzle geometry than previously considered. The calculations were made by using an approximate method of analysis for such flows. A comparison with exact numerical solutions show the criterion to give an accurate prediction of the frozen dissociation level. The approximate method is particularly convenient for determining the limiting specific impulse, I_∞, attained by expansion to infinite area and zero pressure.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SPECTROSCOPIC TECHNIQUE FOR TEMPERATURE-DENSITY MEASUREMENTS IN OXYGEN-BEARING FLOWS, by W. H. Wurster and C. E. Treanor. Rept. on Contract AF 18(603)141. Dec 59, 47p. 13 refs. Rept. no. AD-1118-A-10; AFOSR-TN-59-1089.
Order from LC mi$3.30, ph$7.80 PB 148 773

The absorption spectrum of shock-heated molecular oxygen has been measured photoelectrically in the wavelength range 2280 to 2870 Å. Four wavelength bands were used, each about 20 Å wide. The oxygen temperatures ranged from 1500 to 4000°K, and the density from 0.01 to 2.0 atmospheres. The photoelectric results for the 20 Å bands were correlated with previous high-dispersion photographic measurements of transition probabilities and line widths for O_2. This correlation is shown in graphical form, and the use of this absorption technique to determine a temperature-density parameter for oxygen bearing flows is discussed. (Author)

Flight Dynamics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
DESIGN PROCEDURES FOR COMPUTING AERODYNAMIC HEATING AT HYPERSONIC SPEEDS, by Wilbur L. Hankey, Jr. Richard D. Neumann, and Evard H. Finn. Rept. on Hypersonic Gas Dynamic Heating. June 60, 171p. 142 refs. WADC Technical rept. 59-610.
Order from OTS $3.00 PB 161 937

The basic concept of lifting and nonlifting re-entry vehicles is discussed and approximate trajectories presented. Analyses of flow properties and the mechanism of molecular excitation and dissociation are based on the available energy of the flow. The principle of radiation cooling of lifting re-entry vehicles is contrasted with the heat sink and ablation techniques for nonlifting re-entry vehicles. Regions of maximum heating are shown for both modes of re-entry with the equations for laminar and turbulent flow. The swept-wing lifting body at angle of attack is analyzed showing the heating equations for both leading edges and wing surfaces and including the influence of internal radiation, wall construction, and transient heating effects. Finally, graphs and charts are presented for the rapid calculation of heating rates for lifting and nonlifting re-entry bodies. (Author)

General Electric Co., Schenectady, N. Y.
INCREASE IN LIFT PRODUCED BY INTERACTION BETWEEN A CYLINDRICAL BODY AND WINGS OR TAIL FINS: CORRELATION FOR DESIGN PURPOSES BASED ON THEORY AND LIMITED TEST RESULTS, by John R. Weske. Rept. on Project Hermes [Contract DA 30-115-ORD-23] Aug 47, declassified 17 Nov 58, 28p. 7 refs. Rept. no. 55144.
Order from LC mi$2.70, ph$4.80 PB 149 464

The available wind-tunnel data at supersonic speeds relating to interference effect between wings or fins and slender bodies upon the resultant lift are correlated by means of existing theory. Distinction is made between body-wing and wing-body interaction (effect of body on the wing lift and vice versa, respectively). It is found that for wings or fins not too close to the tip nor to the base the effect of body upon the wing contributes the major portion of the increase of lift due to interference, and that it can be determined with satisfactory approximation by Beskin's method of calculation. Wing-body interaction, -i. e. effect of wing upon the body - is small compared with body-wing interaction, and may, therefore, as a first approximation be disregarded when using the Beskin method of computing body-wing interaction, particularly at angles of attack less than 6°, since the latter appears to give results slightly high for these small angles.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL STUDY OF HELIUM DIFFUSION IN THE WAKE OF A CIRCULAR CYLINDER AT M=5.8, by William Mohlenhoff. Rept. on Hypersonic Research Project, Contract DA 04-495-ORD-1960. 20 May 60, 115p. 23 refs. Memo. no. 54.
Order from LC mi$6.00, ph$18.30 PB 149 362

An experimental study of the diffusion of helium in the wake of a circular cylinder was conducted in the GALCIT hypersonic wind tunnel at a Mach number of 5.8. The cylinder was constructed of material having random porosity and was mounted with its axis perpendicular to the stream. The light gas was injected in small amounts

and the thermal conductivity method was utilized to detect the concentration of helium in the air at points downstream. Problems in the utilization of the thermal conductivity method for low sample densities were overcome by suitable calibration. Flow in the wake of the cylinder was found to display characteristically similar behavior at a few diameters downstream, with respect to decay and spread of the concentration. Reynolds number similarity was established in the laminar case, but turbulent Reynolds number similarity may require reference to momentum thickness, which was not possible with the present data. Profile data was somewhat marred by a tunnel pressure perturbation, but many of the important conclusions were not affected. The profiles appear to follow the theoretical Gaussian distribution in the similar region. The thermal conductivity method is quite promising as a means of tracing the diffusion of one binary gas constituent in another, as applied to hypersonic wind tunnel experiment. It will also serve in the analysis of transition and turbulence, and of the lateral spreading of the turbulent fluid into the rest of the wake region behind the bow shock. (Author)

Illinois U. Engineering Experiment Station, Urbana.
RESEARCH ON TRANSONIC AND SUPERSONIC FLOW OF A REAL FLUID AT ABRUPT INCREASES IN CROSS SECTION (WITH SPECIAL CONSIDERATION OF BASE DRAG PROBLEMS), by W.H. Korst, W. L. Chow, and G. W. Zumwalt. Final rept. on Technical rept. 392-5; AFOSR-TR-60-74.
Order from LC mi$7.50, ph$24.30 PB 149 174

A general theory for pressures and temperatures in separated transonic and supersonic flows is developed using a physically perceptive model composed of simplified flow components. The principle of interaction between dissipative and free stream flow regions, allows one to distinguish between inviscid flow configurations and superimposed jet mixing regions. Treatment of the latter is based on concepts previously developed and on tabulated results (including theoretical Stanton Numbers and Drag Coefficients) for fully developed isoenergetic and non-isoenergetic constant pressure turbulent (Pr_t=1) compressible two-dimensional mixing regions. A great variety of problems in internal and external flow is analyzed theoretically, ranging from the classical base pressure problem to the performance of supersonic ejectors and the detailed study of the jet-slipstream interaction (afterbody-) problem in jet engine and rocket propulsion. (Author)

Institute of Engineering Research, U. of California, Berkeley.
FLOW STUDIES IN AN ARC HEATED LOW DENSITY SUPERSONIC WIND TUNNEL, by C. L. Brundin, L. Talbot, and F. S. Sherman. Rept. on Contract AF 49(638)502. 15 Apr 60, 42p. 10 refs. HE-150-181; Series no. 132, issue no. 2; AFOSR-TN-60-592.
Order from LC mi$3.30, ph$7.80 PB 148 009

A series of experiments were carried out to evaluate several methods for determining the properties of the flow produced in a supersonic low density arc-heated wind tunnel, using argon as the test gas. These experiments included stagnation point Langmuir probe and heat transfer measurements, impact pressure surveys, and some qualitative spectroscopic studies. A typical set of operating conditions indicated by the measurements were $M \cong 6$, $P_{static} \cong 1$ mm Hg in the free jet, centerline stagnation temperature $T_t \cong 5000^{\circ}$ K, and approximately 0.2% ionization with an electron temperature of about $2 \times 10^{4\circ}$K. (Author)

James Forrestal Research Center, Princeton, N. J.
AN "UNUSUAL" AERODYNAMIC STAGNATION TEMPERATURE EFFECT, by Irvin Glassman and James E. A. John. Rept. on Project Squid, Contract Nonr-1858(25). Dec 58, 9p. 7 refs. Technical rept. PR-88-P.
Order from LC mi$1.80, ph$1.80 PB 148 821

In a program concerned with the mixing of compressible jets with quiescent air, experimental measurements were obtained in which stagnation temperatures along the centerline of the jet (T_c°) were greater than either the uniform initial stagnation temperature of the jet (T_j°) or the ambient temperature (T_a). This effect was most evident when the initial Mach number was the greatest and when the ratio T_j°/T_a was at a minimum (unity for the actual experimental cases).

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME I, PART TWO: FLUID MECHANICS. Technical rept. for Jan 59-Jan 60. Jan 60, 203p. 62 refs. LMSD-288139.
Order from LC mi$9.30, ph$31.80 PB 148 399-1

Contents:
Shock-tube experiments simulating entry into planetary atmospheres
A note regarding stagnation-point radiation heat transfer
Formation of nitric oxide behind strong shock waves in air
Steady two-dimensional flow with a transverse magnetic field (LMSD-48 423)
Studies of sputtering by beam technique
Some reflected shock parameters in N_2 and O_2
Stagnation-point heat transfer measurements in hypersonic, low-density flow
Comparative studies of vibrational relaxation in nitric oxide
Charge and magnetic field interaction with satellites
On meteoritic impact
(See also PB 148 399)

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME III: FLIGHT DYNAMICS AND SPACE MECHANICS. Technical rept. for Jan 59-Jan 60. Jan 60, 460p. 108 refs. LMSD-288139.
Order from LC mi$11.10, ph$69.60 PB 148 399-3

Contents:
Topological structure of the space of trajectories for the restricted problem of three bodies (LMSD-49 781)
Minimum transfer time for a power-limited rocket (LMSD-49 769)
Fuel requirements for crude interplanetary guidance
On the anomalies in the movement of the perigee due to oblateness and air drag for critical values of inclination
The local accuracy of doppler orbit determination (LMSD-285 536)
On the motion of a satellite about a planet with rotational symmetry (LMSD-288 067)
Researches in interplanetary transfer (LMSD-285 061)
Mass considerations in ring-supported solar sails
Mechanics problems of spaceflight (LMSD-288 073, AD-231 349)
Spin-induced forced resonant behavior of a ballistic body re-entering the atmosphere
Spin-induced forced resonant behavior of a ballistic body having stable nonlinear aerodynamic properties
Optimization of trajectories
Evaluation of the motion and aerodynamic characteristics of high-fineness-ratio re-entry configurations
(See also PB 148 399-2)

Midwest Research Inst., Kansas City, Mo.
TABLES OF COEFFICIENTS FOR COMPRESSIBLE FLUTTER CALCULATIONS, by Yudell L. Luke. Rept. on Contract AF 33(038)6473. Aug 50, 95p. 34 refs. AF Technical rept. no. 6200; ATI-92 221.
Order from LC mi$5.40, ph$15.30 PB 150 299

This report released for sale to the public 19 Sep 60.

The purpose of this report is to facilitate the work of the analyst determining the flutter characteristics of a system in compressible flow. To date, tables of aerodynamic coefficients for both subsonic and supersonic flow are to be found in a number of widely dispersed sources. As a rule, each source employs a different notation and no consistency exists in the choice of reference axes. Here, all of the existing tables are brought together under a convenient notation and referred to a convenient set of axes. In the incompressible case, the tables published by Smilg and Wasserman are widely used and so their notation and system of reference axes are followed here. The report also includes some tables which are useful if further values of aerodynamic coefficients need be computed. To facilitate such calculations, some of the existing tables have been extended to cover a wider range of values. (Author)

National Research Labs., Ottawa (Canada).
A HEAT-FLUX-METER FOR USE WITH THIN FILM SURFACE THERMOMETERS, by R. F. Meyer. 26 Apr 60, 32p. 4 refs. Aeronautical rept. LR-279.
Order from LC mi$3.00, ph$6.30 PB 149 198

Thin film surface thermometers may be used to measure the heat transfer to a body on which they are mounted if the assumption of one-dimensional heat transfer to the body is made. Generally the interpretation of the surface temperature history to determine the heat transfer requires the numerical evaluation of an integral. This report describes a simple resistance-capacity network which, when used with the thin film thermometer, enables the heat transfer to be recorded directly. (Author)

Naval Ordnance Lab., White Oak, Md.
A SUMMARY OF EXPERIMENTAL MAGNUS CHARACTERISTICS OF A 7 AND 5-CALIBER BODY OF REVOLUTION AT SUBSONIC THROUGH SUPERSONIC SPEEDS, by John E. Greene. 4 Aug 58, 52p. 5 refs. Aerodynamics research rept. 35; NAVORD rept. 6110; AD-219 366.
Order from LC mi$3.60, ph$9.30 PB 147 567

An experimental investigation of the Magnus force and moment characteristics of two different length bodies of revolution at spin rates and angles of attack comparable with full-scale projectiles and rockets was made. Experimental results are presented for a 7-cal length body at Mach numbers from M=0.22, through M=2.46, and for a 5-cal length body at M=0.22, and M=1.75 through M=2.87. In addition, variation of the Magnus characteristics with changes in the nose shape of the 7-cal body at subsonic speeds and the 5-cal body at supersonic speeds are also included. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
THE LAMINAR DIFFUSION BOUNDARY LAYER WITH EXTERNAL FLOW FIELD PRESSURE GRADIENTS, by Judson R. Baron and Paul B. Scott. Rept. on Contract AF 49(638)245. Dec 59, 73p. 10 refs. Technical rept. 419; AFOSR-TN-[60-830].
Order from LC mi$4.50, ph$12.30 PB 149 342

An analysis and sample solutions are presented for the two-dimensional laminar boundary layer in the presence of foreign gas injection and a non-uniform external flow field. Similarity restrictions are given and numerical results shown for the case of helium injection into an external air flow at vanishing Mach number. The external flow field is described by a natural extension of the Falkner-Skan "wedge" solutions. Pressure gradients prove to have appreciable effects upon skin friction, heat transfer, and boundary layer separation. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
EXPERIMENTAL INVESTIGATION OF THE DOWNSTREAM INFLUENCE OF STAGNATION POINT MASS TRANSFER, by Paul A. Libby and Robert J. Cresci. Final rept. for 1 July 58-Nov 59 on Solid State Research and Properties of Matter, Contract AF 33(616)5994. Apr 60, 53p. 20 refs. [PIBAL rept. 520] WADC Technical note 59-210; AD-230 766.
Order from OTS $1.50 PB 161 919

Results are presented of an experimental investigation of the downstream influence of localized mass transfer in the stagnation region of a blunt body under hypersonic flow conditions. The coolant is injected through a porous plug coaxial with the center line of symmetry of the model. Tests were carried out in a Mach 6 wind tunnel with stagnation temperatures of approximately 1600°R and with a stagnation pressure of approximately 600 psia. Four different gases were injected over a range of mass flows. Heat transfer on the impermeable section was measured under isothermal wall conditions; for the higher rates of mass flow, adiabatic surface temperatures were also determined. Theoretical analysis of the boundary flow is investigated to establish the similarity parameters for

the flow system. These parameters permit the extrapolation of the test results to other flow conditions provided laminar flow prevails. Helium is found to be the most efficacious coolant. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
TURBULENT HEAT TRANSFER ON BLUNT-NOSED BODIES IN TWO-DIMENSIONAL AND GENERAL THREE-DIMENSIONAL HYPERSONIC FLOW, by Roberto Vaglio-Laurin. Rept. on Aerodynamic Research, Contract AF 33(616)3265. Sep 58, 49p. 22 refs. WADC Technical note 58-301; AD-206 050.
Order from LC mi$3.30, ph$7.80 PB 149 283

Recent results obtained for three-dimensional laminar boundary layers are extended to the turbulent case. It is shown that in the presence of highly cooled surfaces and of moderate Mach numbers of the outer stream, the crossflow and the pertaining Reynolds stresses in a general three-dimensional turbulent boundary layer are negligible even for large transversal pressure gradients. The demonstration assumes that Reynolds analogy is satisfied by the flow in the streamline direction; subsequently, the validity of this assumption is established by extending a correlation due to Mager between-two-dimensional compressible and incompressible turbulent boundary layers. From a study of the transformation and of its implications, a rapid method for the analysis of the boundary layer flow under the subject conditions is established. In the absence of general three-dimensional data, a comparison with experiments and with the predictions of other known analyses is presented for several axisymmetric configurations; the results of the method proposed here exhibit good agreement with the data. The equations governing the mean motion in a general compressible three-dimensional turbulent boundary layer are derived in an appendix. (Author)

Princeton U., N. J.
EXPERIMENTAL MIXING PROFILES OF A MACH 2.6 FREE JET, by Edward T. Pitkin and Irvin Glassman. Rept. on Project Squid, Contract Nonr-1858(25). Aug 58, 10p. 7 refs. Technical rept. PR-83-P.
Order from LC mi$1.80, ph$1.80 PB 146 542

Princeton U., N. J.
NUMERICAL SOLUTIONS OF SHOCK-INDUCED UNSTEADY BOUNDARY LAYERS, by S. H. Lam. Rept. on Contract AF 49(638)465. Aug 59, 41p. 1 ref. Rept. 480; AFOSR-TN-59-926.
Order from LC mi$3.30, ph$7.80 PB 147 265

In the present report, numerical solutions for the shear function $\phi(\alpha, \beta)$ and the Reynolds analogy coefficient Ra are presented. The symbols used here will follow those used in Reference I. The calculations were performed on the Wright Field Univac Scientific 1103 digital computor using the Wright Field "CHIP" interpretive system. It was found that the iteration procedure suggested in Reference I was successful in generating solutions of good accuracy for the shear function $\phi(\alpha, \beta)$. However, because of the lack of a suitable "momentum integral correction" procedure, the iteration for the enthalpy function $H(\alpha, \beta)$ was found to be unsatisfactory. (Author)

Princeton U., N. J.
SOME EXPERIMENTAL STUDIES OF THE SEPARATION OF SUPERSONIC TURBULENT BOUNDARY LAYERS, by Seymour M. Bogdonoff. Rept. on Contract AF 18(600)498. June 55, 22p. 28 refs. Rept. no. 336; OSRTN-56-64; AD-81 056.
Order from LC mi$2.70, ph$4.80 PB 150 294

This report released for sale to the public 19 Sep 60.

An experimental study of shock wave turbulent boundary layer interaction, covering a range of geometries and Mach numbers from 1 to 3.85, has been completed. The present paper summarizes the results of a series of some detailed studies and provides a framework which can be used to predict separation, peak pressure ratios, and the pressure ratio before separation over the entire Mach number range. (Author)

Research Labs. for the Engineering Sciences, U. of Virginia, Charlottesville.
AN EXPERIMENTAL STUDY OF THE REDUCTION IN DRAG ON A ROTATING CYLINDER WHEN HELD AT MODERATELY LOW PRESSURES FOR EXTENDED PERIODS OF TIME (THE SOAKING EFFECT), by A. R. Kuhlthau. J. H. Bodine, and J. E. May. Rept. on Contract NOrd-18211. Mar 60, 42p. 4 refs. Rept. no. AST-2849-101-60U.
Order from LC mi$3.30, ph$7.80 PB 148 390

The "soaking effect" is an observed reduction in drag which occurs when the concentric cylinder apparatus is allowed to stand for many hours at reduced pressure. The details of the procedure for observing this effect are clarified. The one real conclusion that can be drawn from this series of experiments is that the so-called "soaking effect" is more complicated than earlier experimentation has indicated. No information is yet at hand which can provide a clear explanation of the drag reduction.

Rome U. (Italy).
SIMILAR SOLUTIONS IN RE-ENTRY LIFTING TRAJECTORIES, by Luigi Broglio. Technical note no. 3 on Contract AF 61(052)198. Dec 59, 35p. 3 refs. SIARgraph no. 54; AFOSR-TN-60-678.
Order from LC mi$3.00, ph$6.30 PB 149 586

This paper deals with the analysis of re-entry trajectories. The two general equations of motion are written down by considering all the external forces, i.e., aerodynamic drag, lift, force of gravity. The equations themselves are then made nondimensional by taking as reference point the one corresponding to the deceleration peak; in this way the ballistic parameter $W/c_D A$ can be eliminated, and the only remaining parameters are the value of deceleration peak, the flight path angle at deceleration peak and the lift/drag ratio. Two important features are to be pointed out: (a) the equations are exact also at high altitudes; (b) the solution, being independent of the body shape, can be considered of an universal character.

Stanford U., Calif.
INFLUENCE COEFFICIENTS FOR RADIATION IN A CIRCULAR CYLINDER, by E. W. Parkes. Rept. on Contract AF 49(638)223. Mar 60, 13p. SUDAER no. 92; AFOSR-TN-60-415.
Order from LC mi$2.40, ph$3.30 PB 148 508

A table of influence coefficients is calculated from which the distribution of absorbed radiation in a long circular cylinder having any distribution of emitted radiation can readily be determined. Lambert's law of diffuse emission and reflection is assumed, and the coefficient of absorbivity is supposed constant. A table of functions for the distribution of reflected radiation after each reflection up to the tenth is also given, so that the results can be compared with non-Lambertian systems. (Author)

Stanford U., Calif.
TOROIDAL SHELLS WITH NONSYMMETRIC LOADING, by W. Flügge and C. R. Steele. Rept. on Contract Nonr-225(16). 1 Oct 59, 95p. 13 refs. Div. of Engineering Mechanics Technical rept. no. 122; AD-229 108.
Order from LC mi$5.40, ph$15.30 PB 149 506

Contents:
Equations for thin shell of revolution
  Equations of equilibrium
  Kinetic relations and Hooke's law
  Evaluation of stress resultants
  Separation of variables
  Fundamental ordinary differential equations
Membrane theory for toroidal shells
  Membrane equations and membrane force solutions
  Inextensional deformation solution
  Deformations due to membrane forces
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Derivation of single equation for shell of revolution
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  Validity of results
Solution of nonhomogeneous equation
  Improved membrane force solution
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  Improved inextensional deformation solution
  Stress resultants and deformations for improved inextensional deformation solution
  Improved non-singular membrane force solution for n=1
  Surface loads

Technische Hochschule, Munich (West Germany).
PRACTICAL NUMERICAL METHODS OF THREE-DIMENSIONAL SUPERSONIC FLOW, by Robert Sauer. Technical (Final) rept. on Contract AF 61(514)1080. 1 Mar 60, 33p. 2 refs. AFOSR-TR-60-40.
Order from LC mi$3.00, ph$6.30 PB 149 578

The reported research pertains to the following subjects: Linear supersonic flow (l. s. f.) past slender bodies of arbitrary shape; l. s. f. past wing-body combinations; l. s. f. past oscillating bodies; the "area rule" in l. s. f.; two dimensional unsteady, non linear flow; investigations on the numerical methods for linear and non-linear supersonic flow equations.

University of Southern California. Engineering Center, Los Angeles.
INVESTIGATION OF CIRCULATION CONTROL, by Philip Lamson and Frederick O. Smetana. Final rept. on Contract NOas-55-498-d. 31 Mar 58, declassified 9 June 58. 49p. 13 refs. USCEC rept. 49-101; AD-205 395.
Order from LC mi$3.30, ph$7.80 PB 147 576

A correlation study of data from various sources has been made to aid in determining how available blowing air can best be applied. It is well established that if the available blowing momentum lies in the boundary-layer-control region, then the best use of this momentum is tangential blowing over a deflected flap. A correlation of existing data reveals that blowing over a flap is superior to trailing edge blowing even when the C_μ lies in the supercirculation region. This fact is explained on the basis of the present experimental results which clearly point out the importance of the "sink effect" mechanism.

Hydrodynamics, Hydraulics, and Hydrostatics

California Inst. of Tech., Pasadena.
UNSTEADY SUPERCAVITATING FLOWS, by T. Y. Wu. Rept. on Contract Nonr-220(28). July 59, 30p. 14 refs. Engineering Div. rept. no. 85-11; AD-225 264.
Order from LC mi$2.70, ph$4.80 PB 147 792

This work is confined to the case in which the flow at infinity is source-free, and hence the cavity volume will remain constant. However, the generalization of this argument to the case of separated flow in air would be open to question; for in this case of one-phase flow, the fluid inside the wake may actually consist of fluid particles originally outside due to the turbulent mixing in the unsteady motion.

California Inst. of Tech., Pasadena.
WATER WAVES GENERATED BY THIN SHIPS, by Milton S. Plesset and T. Yao-tsu Wu. Rept. on Contract Nonr-220(28). Oct 59, 37p. 4 refs. Engineering Div. rept. no. 85-14; AD-229 378.
Order from LC mi$3.00, ph$6.30 PB 149 508

The problem of interest is that of the water waves in a body of water of infinite depth generated by a thin ship of given hull form, moving with constant velocity U along a straight course of the otherwise undisturbed water surface. A particular method is evaluated for computing the velocity field at an arbitrary distance (not too near the ship) fixed in the fluid. A new proposal is made that the hull profile be represented by a double Fourier series with its half-periods spanning over the region occupied by the longitudinal mid-section of the ship. The convergence of this series representation is found to be satisfactorily rapid, especially when the tangent plane of the hull is every-

where continuous. In the latter case the longitudinal slope of the hull, which is the only partial derivative appearing in the analysis, is found in a specific case to be well represented by the partial derivative of the series. With this series representation of the hull, the analysis of the velocity field calculation is greatly reduced so that the final result can be expressed in terms of a combination of several single and double Fourier integrals which are susceptible to numerical methods. (Author)

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
A GENERALIZED THEORY OF THE IMPACT CHARACTERISTICS OF SURFACE-PIERCING, FULLY VENTILATED DIHEDRAL HYDROFOILS, by Peter Ward Brown. Rept. on Contract Nonr-263(20). July 59, 112p. 4 refs. Rept. no. 731; AD-225 740.
Order from LC mi$6.00, ph$18.30 PB 147 801

A theoretical analysis of the fixed-trim impact of a surface-piercing fully ventilated dihedral hydrofoil is presented. A basic differential equation of the motion is obtained based on the assumption that the instantaneous forces are quasi-steady and the same as those on hydrofoil running steadily at the instantaneous values of angle of attack, resultant velocity and draft. Integration of this equation leads to a straightforward method of calculating impact time histories. It is shown that each impact is characterized by an approach parameter, P_o, which depends on the trim and initial glide-path angles only. The chief impact characteristics including the maximum acceleration, elapsed time and draft at maximum acceleration, the maximum draft, and the rebound velocity are obtained as functions of the approach parameter. The analysis is extended to cover partial ventilation impacts as well as a number of special cases, including that of landing at the trim for zero lift in which it is found that the hydrofoil does not rebound after impact. The results of the experimental investigation confirm the theoretical predictions in every particular, both as regards the detailed time histories and the chief impact parameters. (Author)

Institute of Engineering Research, U. of California, Berkeley.
SHIP RESISTANCE IN UNIFORM WAVES AS A FUNCTION OF WAVE STEEPNESS AND BEAM OF THE SHIP, by O. J. Sibul. Rept. on Contract Nonr-222(18). Sep 59, 46p. 8 refs. Series no. 61, issue no. 18; AD-229 496.
Order from LC mi$3.30, ph$7.80 PB 148 617

A 5-foot model of Series 60, block coefficient 0.60, was used as the parent form. Two additional models were similar to the parent except for the beam, which was 0.75 of parent for one model and 1.25 of parent for the other. All of the models were towed in waves 5 feet long at seven different wave steepnesses between 0.0146 and 0.0684. The results indicate that the added resistance coefficient depends upon the beam of the ship, the Froude number, and the steepness of the waves. It has been pointed out that for steeper waves the model has definite speed ranges in which change in thrust would affect very little or not at all the forward speed of the model. The speeds between these particular ranges cannot be achieved in actual tests. An attempt has been made to relate this phenomenon to the discontinuity in damping moment curves as discussed by Havelock (Quarterly Transactions of the Institute of Naval Architecture, London, Vol. 100, no. 2, Apr 58). (Author)

Mellon Inst., Pittsburgh, Pa.
AN APPROXIMATION THEOREM FOR FUNCTIONALS, WITH APPLICATIONS IN CONTINUUM MECHANICS, by Bernard D. Coleman and Walter Noll (Carnegie Inst. of Tech.) Rept. on Contract AF 49(638)541 and National Science Foundation Grant NSF-G 5250. July 60, 35p. 8 refs. AFOSR-TN-60-826.
Order from LC mi$3.00, ph$6.30 PB 149 810

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Part I. The Approximation Theorem
Influence functions and histories
Retardation
Memory functionals
The approximation theorem
Part II. Applications
The concept of a simple fluid
Approximations of order n for simple fluids
Simple materials in general

Princeton U., N. J.
STATISTICAL EFFECTS RESULTING FROM THE PRESENCE OF MANY PARTICLES IN MOTION IN AN IDEAL FLUID, by Richard L. Peskin. Rept. on Project Squid, Contract Nonr-1858(25). June 59, 23p. 6 refs. Technical rept. PR-92-P.
Order from LC mi$2.70, ph$4.80 PB 146 539

The first approximation to the mutual Bernoulli forces between many particles is calculated for an ideal fluid. A fluctuation analysis on a single particle is performed using a single term approximation to the Bernoulli force. The anti-symmetric effects introduced by the velocity of the particle under consideration and the velocity dependent forces result in a systemic deceleration of the particle unless it has a very small speed in which case a systemic acceleration is observed. (Author)

Princeton U., N. J.
TRANSPORT PROCESSES IN TWO-PHASE TURBULENT FLOW, by Chang-Lin Tien. Doctoral thesis. Rept. on Contract Nonr-1858(25). June 59, 99p. 47 refs. Proj. Squid Technical rept. PR-91-T-R.
Order from LC mi$5.40, ph$15.30 PB 146 572

The basic mechanism of momentum transport in a two-phase flow field, i.e., solid particles in a fluid medium, is further studied as a complement of previous works. A knowledge of the decaying processes of turbulent motion in the solid phase is obtained. Statistical relations are obtained in closed forms such that the correlation, scale and intensity of one phase can be calculated from those of the other phase. The wall interference on the two-phase turbulent motion is discussed.

Statics, Kinematics, and Kinetics

J. G. Engineering Research Associates, Baltimore, Md.
VIBRATIONS OF THICK SHELLS IN A VACUUM AND IN AN ACOUSTIC MEDIUM. PART I. VIBRATIONS OF THICK SHELLS IN A VACUUM, by Joshua E. Greenspon. Technical rept. no. 1 on Contract Nonr-2733(00). Feb 59, 62p. 18 refs.
Order from LC mi$3.90, ph$10.80 PB 145 249

This report discusses the dynamic behavior of thick cylindrical shells. Wave velocities, frequencies, mode shapes, and stress distributions are given for a wide range of physical parameters. The object of this report is to point out some of the characteristics associated with the vibrations of thick shells and contrast these features with those of the thin shell and solid bar. The three dimensional theory of elasticity is used in the analysis. (Author)

Watertown Arsenal Labs., Mass.
BUCKLING CHARACTERISTICS OF CORRUGATED CYLINDERS. PART II. SUMMARY, by Joseph F. Cheatham. July 60, 34p. 2 refs. Technical rept. no. WAL TR 715/3-Pt. 2.
Order from LC mi$3.00, ph$6.30 PB 149 334

In this investigation approximately fifty tests were conducted upon corrugated cylinders. The parameters, which were varied in the tests, were (1) the configuration of the corrugation, (2) the height of the cylinder, (3) the radius of the cylinder, and (4) the material of which the cylinder was fabricated. The buckling data were satisfactorily correlated to existing theories of buckling. (Author) (See also PB 142 430)

METALLURGY

Aviation Gas Turbine Div. [Westinghouse Electric Corp., Lester, Pa.]
DEVELOPMENT OF NIOBIUM-BASE ALLOYS, by Richard T. Begley and William N. Platte. Rept. for 1 June 58-1 June 59 on Metallic Materials, Contract AF 33(616)5754. May 60, 132p. 26 refs. WADC Technical rept. 57-344, Part IV.
Order from OTS $2.75 PB 161 936

Vacuum tensile data were obtained for pure niobium from room temperature to 1371 C (2500 F). The data for niobium followed the general pattern exhibited by other pure refractory metals. The ductile-brittle transition (in impact) for commercial purity, arc melted niobium was close to room temperature. The effect of binary additions of Ti, Zr, Hf, V, Mo, W, Re, Al, and Y on the hardness and workability of niobium was determined. Nb-Ti and Nb-Y alloys had excellent cold workability. Mechanical property data were obtained at room temperature and 1093 C (2000 F) on niobium containing additions of Ti, Zr, Hf, V, Mo, and W. Of the elements studied, vanadium additions were the most effective strengtheners. Nb-Zr and Nb-Hf alloys having high oxygen contents had very good high temperature properties. It appears that the interaction of oxygen with the alloy addition may be responsible for the high strength. Tensile data were also obtained on alloys having ternary and quaternary additions of Ti, Zr, Hf, and Mo. Nb-Ti-Zr-Hf alloys exhibited yield strengths well in excess of 40,000 psi at 1093 C (2000 F). Welding studies on a number of niobium alloys containing additions of Ti, Zr, Hf, V, and W were carried out. Satisfactory welds were obtained in all the alloys studied. Bend test data were obtained on the weld specimens. (Author)

Battelle Memorial Inst., Columbus, Ohio.
ELECTRODEPOSITION OF CHROMIUM ALLOYS AND STUDY OF ELEVATED-TEMPERATURE PROPERTIES OF CERTAIN ELECTRODEPOSITED METALS AND ALLOYS, by P. T. Woodbury, W. G. Hespenheide and others. Technical progress rept. no. 4, 1 Dec 54-1 Feb 55, on Contract NOas-54-706-c. 15 Feb 55, 28p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 148 736

One of the objectives of the work in this report period was to continue the elevated-temperature oxidation studies of electrodeposited metals in liquid- and vapor-phase molybdenum trioxide. Another objective was to determine the effect of changing the composition of chromium-iron alloy on its coefficient of thermal expansion and permanent change in length after heat treatment. Another objective was to determine the expansion and contraction behavior of electrodeposited cobalt-tungsten alloy and of a specimen of stress-free nickel.

Battelle Memorial Inst., Columbus, Ohio.
ELECTRODEPOSITION OF CHROMIUM ALLOYS AND STUDY OF ELEVATED-TEMPERATURE PROPERTIES OF CERTAIN ELECTRODEPOSITED METALS AND ALLOYS, by G. R. Schaer, P. T. Woodberry, and others. Technical progress rept. no. 6, 1 Apr-1 June 55, on Contract NOas-54-706-c. 15 June 55, 21p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 148 737

One of the objectives of the work during this period was to determine whether alternate layers of nickel and chromium plate could be diffused at 100 or 1150 C to form a nickel-chromium alloy. A second objective was to confirm the superiority of stress-free nickel plate over stressed nickel plate as regards denseness after heat treatment. A third objective was to compare the hot hardness of chromium with chromium-iron alloy plates. (See also PB 148 736)

Battelle Memorial Inst., Columbus, Ohio.
ELECTRODEPOSITION OF CHROMIUM ALLOYS AND STUDY OF ELEVATED-TEMPERATURE PROPERTIES OF CERTAIN ELECTRODEPOSITED METALS AND ALLOYS, by G. R. Schaer, J. A. Gurklis and others. Technical progress rept. no. 7, 1 June-1 Aug 55, on Contract NOas-54-706-c. 15 Aug 55, 38p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 148 738

The objectives of the work during this report period were as follows: (1) to study the density and structure of the diffusion alloy of nickel-chromium electroplates; (2) to measure the oxidation of this diffusion alloy at 980 C in air and in liquid molybdenum trioxide; (3) to compare the changes in density resulting from heat treating nickel-chromium laminate, nickel plate from an all-chloride bath, watts-type nickel, low-contraction chromium, and Crack Free chromium; (4) to apply the diffusion alloy to molybdenum disilicide-coated molybdenum specimens; and (5) to investigate the adherence of chromium-iron alloy plate on steel. (See also PB 148 737).

Climax Molybdenum Co. of Michigan, Detroit.
DEVELOPMENT OF TUNGSTEN-BASE ALLOYS, by M. Semchyshen and R. Q. Barr. Interim rept. no. 2, 1 Jan-30 Apr 59, on Contract NOas-58-847-c. 1 May 59, 18p. AD-217 783.
Order from LC mi$2.40, ph$3.30 PB 149 991

This report released for sale to the public 31 Aug 60.

W-Zr: Elevated-temperature hardness measurements were made on a W-Zr casting which was prepared by vacuum arc-casting a pressed, sintered, and swaged W bar and adding Zr sponge at a uniformly increasing rate. The elevated-temperature hardness increased with Zr content. Comparing data obtained from X-ray intensity measurements with the hardness values indicated that elevated-temperature hardness does not increase linearly with Zr content, but shows less sensitivity to changes in alloy content at the higher Zr levels. W-Ta: Samples of a W-graded Ta heat were subjected to a 1600°F hardness test. The effects of alloying on hardness were more pronounced at 1600°F than at room temperature. Other samples were tested up to 2400°F. The data showed that the hardness values between about 1200° and 2000°F appeared to be changing about linearly with Ta content. Indications were that the curves will tend to merge at higher temperatures. W-Hf: An ingot of W graded with Hf was cast. Slices of the ingot are being cut for test specimens. W-Co: An ingot was cast with an intended Co range from 0 to 5%.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DESIGN INFORMATION OF NICKEL-BASE ALLOYS FOR AIRCRAFT AND MISSILES, by R. J. Favor. D. A. Roberts, and W. P. Achbach. Rept. on Contract AF 18(600)1357. 20 July 60, 153p. 35 refs. DMIC rept. 132.
Order from OTS $3.00 PB 151 090

Tensile, compressive, shear, and bearing properties of some nickel-base alloys for aircraft and missiles have been assembled and evaluated. Tentative design curves showing the effect of temperature on these properties are presented in a format consistent with the design document, MIL-HDBK-5 (superseding ANC-5) Strength of Metal Aircraft Elements. These data will be reviewed in October, 1960, by the ANC-5 Panel before the design curves, or modifications of them, can be included in MIL-HDBK-5. In addition to the mechanical-property data, background information on these alloys is presented to aid in the selection of alloys for given elevated-temperature applications. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
METALLURGICAL CHARACTERISTICS OF A-286 ALLOY, by Hiram Brown. [Rept. on Contract AF 18(600)1375]. 26 July 60, 10p. 2 refs. DMIC memo. 59.
Order from OTS $0.50 PB 161 209

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SELECTED REFERENCES TO ASTIA DOCUMENTS ON MACHINING, by F. W. Boulger and M. B. Gold. [Rept. on Contract AF 18(600)1375] 11 Aug 60, 51p. 133 refs. DMIC memo. 61.
Order from OTS $0.50 PB 161 211

The references were selected from appropriate sections of the Technical Abstract Bulletin prepared by the Armed Services Technical Information Agency (ASTIA). They have been grouped under the following headings: machining practices; tool materials; machining properties (machinability); program-controlled tools; alternate methods of machining; machine tools; metal-cutting phenomena; cutting fluids; automated processes; miscellaneous.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
SELECTED SHORT-TIME TENSILE AND CREEP DATA OBTAINED UNDER CONDITIONS OF RAPID HEATING, by Donald P. Moon and Ward F. Simmons. Rept. on Contract AF 18(600)1375. 17 June 60, 88p. 121 refs. DMIC rept. 130.
Order from OTS $2.25 PB 151 088

This report is a graphical presentation of selected short-time elevated-temperature strength data obtained under conditions of rapid heating. Stress-versus-temperature curves of tensile strength, yield strength, and stress to produce 1 per cent creep strain or rupture in designated times are presented in 64 figures. Data are given for 28 alloys in sheet form, including 3 aluminum alloys, 6 titanium alloys, 2 alloy steels, 3 tool steels, 6 Cr-Ni-Fe alloys, and 8 superalloys of general interest. In addition, an extensive bibliography contains references to 121 reports and articles pertaining to test methods and equipment and to very-short-time data for these and many other materials. (Author)

Illinois U., Urbana.
SOME PROPERTIES OF VANADIUM AT SUBATMOSPHERIC TEMPERATURES, by J. A. Hren, C. M. Wayman, and T. A. Read. Rept. on Contract AF 49(638)420, 15 Sep 59, 9p. 8 refs. AFOSR-TN-59-1003; AD-227 357.
Order from LC mi$1.80, ph$1.80 PB 149 278

The nature of the resistivity-temperature relation and the proposed allotropy in V was investigated. Resistivity measurements were made on Ca-reduced V of 99.7% purity. The specimen and thermocouple were immersed in a Dewar vessel containing isopentane. A constant temperature was maintained for more than sufficient time to make the necessary measurements. Resistance measurements were made on specimens in

the annealed, vacuum-degassed, and cold-worked condition. The results showed no indication of any sudden discontinuity; however, a deviation from linearity existed at about 200°K. The measurements on heating and cooling were in agreement. Young's Dynamic modulus was measured as a function of temperature for polycrystalline specimens of 99.7% purity. No discernible deviation from linearity was apparent. X-ray diffraction studies were conducted through the same temperature range. Results indicated that the suggested allotropy in V appears to be doubtful, at least in the temperature range examined.

Materials Advisory Board, National Research Council, Washington, D. C.
COMMITTEE ON REFRACTORY METALS. VOLUME I. SUMMARY. Rept. on Contract DA 36-039-sc-76436. 15 Oct 59, 40p. Rept. MAB-154-M, vol. I; AD-228 252.
Order from LC mi$3.00, ph$6.30 PB 150 077-1

This report released for sale to the public 31 Aug 60.

Contents:
Raw materials
Extraction processes and capacity
Refractory metals sheet program
Protective coatings
Facilities in the U.S.A. for fabricating mill products of the refractory metals
Alloy development
Chemical analyses
Joining of refractory metals
Basic research in refractory metals

Materials Advisory Board, National Research Council, Washington, D. C.
COMMITTEE ON REFRACTORY METALS. VOLUME II. PANEL REPORTS. Rept. on Contract DA 36-039-sc-76436. 15 Oct 59, 331p. 135 refs. Rept. MAB-154-M(1); AD-234 708.
Order from LC mi$11.10, ph$51.60 PB 150 077-2

This report released for sale to the public 31 Aug 60.

Contents:
Report on the fabrication of refractory metals by non-conventional methods
Report on the joining of refractory metals
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  Report of the raw materials group
  Report of the applications group
Report of the panel on vanadium
  Report of the raw materials group
  Report of the applications group
Report of the panel on rhenium
Report of the panel on the platinum-group metals
(See also PB 150 077-1)

Naval Radiological Defense Lab., San Francisco, Calif.
A RADIOMETRIC METHOD FOR DETERMINING SPECIFIC HEAT AT ELEVATED TEMPERATURES, by C. P. Butler and E. C. Y. Inn. 20 May 58, 27p. 6 refs. Research and development technical rept. USNRDL-TR-235; AD-200 857.
Order from LC mi$2.70, ph$4.80 PB 149 267

The validity of radiometric method for the measurement of specific heat of metals as a function of temperature at elevated temperatures is investigated. The method consists in heating a small specimen of metal by radiation from a carbon arc and then allowing it to cool by radiation to the walls of an evacuated chamber. The specimens are coated with platinum black so that they have an emissivity of 1.0. From the area, mass, and cooling rate, the specific heat at any temperatures below the maximum may be obtained. Six pure metals have been measured and the results compared to the handbook values. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
PLATINUM AND ALLIED METALS. July 60, 8p. 118 refs. OTS Selective Bibliography SB-420.
Order from OTS $0.10 OTS SB-420

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations. Reports listed cover metals, alloys, and compounds of platinum and allied metals (such as palladium, osmium, iridium and rhodium). These include reports added to the OTS collection during the period 1945 to July 1960.

Ferrous Metals

Battelle Memorial Inst., Columbus, Ohio.
AN INVESTIGATION OF THE EFFECTS OF SOLUTE ELEMENTS ON MAGNETOELASTIC DAMPING AND COERCIVITY IN VERY PURE IRON, by R. E. Maringer and G. K. Manning. Summary rept. on Contract Nonr-2606(00). 1 Oct 59, 24p. 16 refs. AD-227 776.
Order from LC mi$2.70, ph$4.80 PB 149 865

Data are presented showing the time and temperature dependence of the damping in zone-melted iron containing small amounts of carbon. The differences in the damping of magnetized and unmagnetized specimens are assumed to represent the magnetoelastic contribution to the damping. The magnetoelastic contribution increases with increasing temperature in the vicinity of the Snoek peak, shifting the temperature and distorting the shape of this peak. At lower temperatures, the damping decreases with time after the removal of an a-c field. The kinetics of this damping

decrease are similar to those of the time-dependent decrease in permeability after demagnetization. Relaxation timea calculated for this "magnetoelastic aftereffect" are in excellent agreement with those associated with the interstitial diffusion of carbon in alpha iron. Measurements of the temperature dependence of the induced voltage in a transformer-type apparatus have revealed a sigmoidal increase in the induced voltage with increasing temperature. This increase is apparently related to the temperature-dependent increase in magnetoelastic damping, and calculated relaxation times indicate that the interstitial diffusion of carbon is responsible. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
TURNING OF HIGH-STRENGTH STEELS IN THE HARDNESS RANGE OF 330 TO 560 BRINELL, by C. T. Olofson. [Rept. on Contract AF 18(600)1375]. 15 July 60, 44p. 34 refs. DMIC memo. 58.
Order from OTS $0.50 PB 161 208

This report contains information and data on the turning of steels of hardness levels up to 560 Brinell. The problems of machining these steels are minimized if rigidity of machine, tool, and workpiece, and adequate power to maintain cutting speed exist throughout cutting. The proper selection of feeds, speeds, and depths of cut appropriate to recommended tool materials and designs are important for adequate tool life and metal removal rates.

Naval [Weapons Lab.] Dahlgren, Va.
METHOD FOR DETERMINING CRACK EXTENSION FORCE Gc/IN HIGH STRENGTH STEEL SHEETS AND PLATES: TESTS OF HOMOGENEOUS AIRCRAFT ARMOR PLATE 1/8 INCH THICK, by H. E. Romine. July 58, 10p. 3 refs. NPG Technical memo. no. T-22/58.
Order from LC mi$1.80, ph$1.80 PB 150 144

This report released for sale to the public 12 Sep 60.

The primary objective was the development of a test for determining Gc of steel sheets about 7/64 inch thick and having a hardness of about 45 R_C. This is a progress report on procedures for testing flat sheet or plate material (tests on curved specimens may require more complex loading).

Rodman Lab., Watertown Arsenal, Mass.
THEORETICAL AND PRACTICAL ASPECTS OF VACUUM INDUCTION MELTING OF HIGH-STRENGTH STEELS, by Philip S. Schaffer. Rept. on Industrial Preparedness Measure. Mar 60, 74p. 13 refs. Rept. no. RPL 10/17.
Order from OTS $2.00 PB 161 928

Optimum vacuum induction melting, refining, casting and solidification procedures are employed to develop methods of improving general quality and, in particular, obtaining mechanical properties heretofore unattainable in high-strength 4340 steel castings. Theoretical considerations of crucible-melt reactions, deoxidation, desulfurization, degassification, dissociation and volatilization are applied to the conduct of vacuum heats. It is seen herein that utilizing vacuum induction technology to reduce residual gas content and decrease nonmetallic inclusions, ductility and toughness, especially at the ultra high-strength levels, are substantially improved in vacuum melted steels over conventional air melting procedures. (Author)

Light Metals

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
A STUDY OF THE STRAIN-HARDENING AND CUMULATIVE DAMAGE BEHAVIOR OF 2024-T4 ALUMINUM ALLOY IN THE LOW-CYCLE FATIGUE RANGE, by Richard D'Amato. Rept. for 1 Jan-31 Dec 59 on Mechanics of Flight, Contract AF 33(616)3310. Apr 60, 108p. 19 refs. WADD Technical rept. 60-175.
Order from OTS $2.50 PB 161 905

An experimental fatigue investigation in the range of life between 1 and 10000 cycles to failure was conducted with a series of round tapered specimens of 2024-T4 aluminum alloy. The specimens had a minimum diameter of 0.356 inch and a maximum diameter of 3/4 inch with taper radii of 1 1/2, 0.6 and 0.3 inch. Cycling tests were carried out between limits of local strain based upon the change in diameter at the minimum section or strain across the specimen based upon the change in length of the tapered section. Fatigue data for each of the three specimen types can be represented by two straight line segments when range of strain was plotted against cycles to failure on log-log scales. One line segment covered the life range 4 to 1000 cycles and the other above 1000 cycles. When the data for each of the configurations was normalized with respect to its local strain at failure in a static tensile test, all of the data was represented by the same two straight line segments. Using data from the literature for the endurance range above 10000 cycles to failure, the entire fatigue range from 1 to 10^7 cycles to failure was discussed. The fatigue behavior at zero mean strain of the 0.6 inch radius specimens in terms of range of local strain is directly related to that determined by cycling the specimens between fully reversed limits of strain across the specimen. The strain-hardening behavior of the three configurations were compared and effects of mean strain and rate of straining were considered. The relationship between the appearance of the fracture surfaces and the endurance of the specimens was discussed. (Author)

National Bureau of Standards, Washington, D. C.
INVESTIGATION OF BEARING CREEP OF TWO FORGED ALUMINUM ALLOYS, by Leonard Mordfin, Nixon Halsey, and Philip J. Granum. Aug 60, 22p. 8 refs. Technical note 55.
Order from OTS $1.00 PB 161 556

Fourteen bearing specimens of 7075-T6 and 2014-T6 forged aluminum alloys were tested in creep at 400°F. The 2014-T6 specimens had greater creep resistance and less ductility than the 7075-T6 specimens. For each material the bearing creep resistance varied directly with edge distance and bolt tightness. Prior exposure of the 2014-T6 alloy to elevated temperature reduced its bearing creep resistance. The validity of a previously proposed theory of creep in bolted joints was examined using the test data together with results from an earlier study. The theory was found to hold for 7075-T6 but not for 2014-T6. (Author)

Watertown Arsenal Labs., Mass.
MECHANICAL PROPERTIES OF TITANIUM ALLOYS AS A FUNCTION OF HEAT TREATMENT AND SECTION SIZE, by Charles F. Hickey, Jr. July 60, 61p. 1 ref. WAL TR 405.2/7.
Order from OTS $1.75 PB 161 799

The mechanical properties of 6Al-4V, 6.5Al-3Mo-1V, and 6Mo-3Al titanium alloys were obtained as a function of section size and heat treatment. Sections of 2-, 3-, 4-, and 6-inch diameter rounds were studied, with each alloy being subjected to two solution temperatures, followed by three aging temperatures. Tensile and impact data were obtained in all cases. As a result of the findings, optimum heat treatment for the investigated conditions were established for each alloy. Other factors, such as specimen location, directionality, and microstructure, are discussed. (Author)

Structural Metallurgy and Corrosion

British Non-Ferrous Metals Research Association.
THE PROPERTIES OF GRAIN BOUNDARIES. Annual technical rept. no. 1 to 30 Apr 60 on Contract DA 91-591-EUC-944. May 60, 21p. 10 refs.
Order from LC mi$2.70, ph$4.80 PB 149 431

An investigation is being carried out on the effect of such variables as alloy content, applied stress and temperature on the time dependent sliding of two grains at a common plane grain boundary in bicrystal specimens and also on the creep of crystalline material in single crystals, of copper and dilute copper based alloys.

Crucible Steel Co. of America, Syracuse, N. Y.
DEVELOPMENT OF A DUCTILE, OXIDATION-RESISTANT AND HIGH STRENGTH SINGLE-PHASE (AUSTENITIC) ALLOY BASED ON Fe-Al-Mn-C SYSTEM, by R. C. Gibson. Bimonthly progress rept. no. 3, 15 Feb-15 Mar 60, on Contract NOas 60-6025-c. May 60, 11p.
Order from LC mi$2.40, ph$3.30 PB 148 785

Studies performed on an Fe-Al-C-Mo-W-V base alloy containing additions of nickel and copper indicated that copper lowered stress-rupture properties and improved oxidation resistance. Nickel additions increased stress rupture and room temperature tensile properties of the base alloy but had little effect on oxidation resistance. (Author) (See also PB 148 003)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STRESS-CORROSION CRACKING OF Ti-5Al-2.5 Sn, by Hiram Brown. [Rept. on Contract AF 18(600)1375] 4 Aug 60, 14p. DMIC memo. 60.
Order from OTS $0.50 PB 161 210

A large number of unexplained cracks were encountered in the fabrication of complex assemblies of Ti-5Al-2.5Sn. These were not the usual stress cracks, but, instead, consisted of regular families of cracks in certain areas. Laboratory investigation and a survey of technical literature indicated that the cracking was similar to stress-corrosion cracking due to chlorides. In order to see whether stress-corrosion cracking as a result of residual trichloroethylene could take place during heat treating, a series of tests was performed.

Manufacturing Labs., Inc., Cambridge, Mass.
RESEARCH AND DEVELOPMENT ON THE EFFECTS OF HIGH PRESSURE AND TEMPERATURE ON VARIOUS ELEMENTS AND BINARY ALLOYS, by J. S. Harvey, L. Kaufman and others. Rept. for 1 July 58-30 Sep 59 on Metallic Materials, Contract AF 33(616)5996. Apr 60, 99p. 17 refs. WADC Technical rept. 59-655.
Order from OTS $2.25 PB 161 920

High-pressure high-temperature apparatus capable of subjecting test specimens to 100,000 atmospheres at temperatures above 1500°C was designed and constructed. High hydrostatic pressure lowers the temperature of martensitic transformations in Fe-Ni alloys and expands the temperature range of the gamma loop in the Fe-Ni system. The precipitation hardening process in both Al-Cu and Cu-Be alloys is inhibited and modified when carried out at high hydrostatic pressure. The use of pressure during heat treatment of various steels results in transformation products different in structure from those normally obtained, and also retards the temperature reactions. High-pressure high-temperature processing of the Pt-C, Pd-C, and Ni-C systems results in the formation of a new phase. Preliminary experiments indicate that the Ti-N phase diagram is significantly modified by pressure. (Author)

Michigan U., Ann Arbor.
THE EFFECTS OF STRAIN ON THE INTERFACIAL ENERGIES OF SOLIDS, by S. Floreen, E. E. Hucke and D. V. Ragone. Rept. on [Contract AF 49(638)422] 9 Nov 59, 17p. 25 refs. AFOSR-TN-59-1253; AD-233 780.
Order from LC mi$2.40, ph$3.30 PB 146 740

Surface energy and the grain boundary energy of a solid changes with the elastic strain in the following manner;

$$f^S = f^S_o + k\epsilon^2$$

$$f^G = f^G_o + j\epsilon^2.$$

Paint Lab., Mare Island Naval Shipyard, Vallejo, Calif.
EVALUATION OF TEFLON (TETRAFLUOROETHYLENE RESIN) AS A PROTECTIVE COATING AND DRY LUBRICANT FOR SHIPS' SURFACES, by John R. Saroyan. Rept. on Protective Coatings for Ships. 26 Aug 55, 37p. 5 refs. Mare Island Test no. 346.
Order from LC mi$3.00, ph$6.30 PB 148 857

This report released for sale to the public 29 Aug 60.

Several hundred bearing and friction surfaces of various submarine parts were successfully coated with Teflon (tetrafluoroethylene resin). Preliminary results for short period use has indicated excellent performances. Such Teflon coated parts operate freely and show no evidence of salt deposition when subject to seawater. (Author)

Rock Island Arsenal Lab., Ill.
THE EVALUATION OF PETROLEUM BASE RUST PREVENTIVES BY LONG TERM EXPOSURE AND ACCELERATED LABORATORY TESTS. ADDENDUM I. RESULTS AFTER TEN YEARS OF EXPOSURE, by Van Y. S. Hong. 5 Feb 60, 42p. 23 refs. Technical rept. 60-325.
Order from LC mi$3.00, ph$6.30 PB 146 993

Machine gun bolts with specially prepared surfaces were coated with eleven materials including three noninhibited and eight inhibited petroleum base rust preventives and were exposed to three types of simulated field service conditions. At specifiec time intervals covering a period of ten years, the coated bolts were removed, decoated, and evaluated. At the end of ten year test period, analysis of the results indicated that suitable rust preventive materials may be selected for specific time and type of exposures. (Author)

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Virginia U., Charlottesville.
PHOTONEUTRON CROSS SECTIONS OF COBALT AND MANGANESE, by P. A. Flournoy, R. S. Tickle, and W. D. Whitehead. Technical note on Contract AF 49(638)176. June 60, 22p. 21 refs. AFOSR TN-60-658; AD-238 123.
Order from LC mi$2.70, ph$4.80 PB 148 343

The total photoneutron yields of Mn^{55} and Co^{59} have been carefully measured from threshold to approximately 30 Mev. Analysis of these data using the Leiss-Penfold matrix indicates that the cross sections for both elements show a splitting in the giant resonance region in accord with the predictions of the classical hydrodynamic model. The Mn^{55} peaks occur at energies of $16.8 \pm .25$ Mev and $19.75 \pm .25$ Mev corresponding to cross sections of 90 mb and 77 mb respectively. Co^{59} maxima occur at $16.75 \pm .25$ Mev and $18.75 \pm .25$ Mev with cross sections of 109 mb and 92 mb. The cross sections $\sigma(\gamma,n) + \sigma(\gamma,2n) + \sigma(\gamma,np) + \ldots$ integrated to 25 Mev are 627 Mev-mb for Mn^{55} and 709 Mev-mb for Co^{59}. Breit-Wigner resonance lines were fitted to both cross sections and the intrinsic quadrupole moments determined from these fits are $+.78 \pm .10$ barns for manganese and $+.76 \pm .11$ barns for cobalt. (Author)

Elementary Particles

Cambridge U. (Gt. Brit.)
SINGLE PARTICLE SINGULARITIES IN SCATTERING AND PRODUCTION AMPLITUDES, by J. Gunson and J. G. Taylor. Technical scientific rept. no. 5 on Contract AF 61(052)233. Jan 60, 20p. 12 refs. AFOSR-TN-60-278; AD-234 216.
Order from LC mi$2.40, ph$3.30 PB 147 619

A proof of analyticity properties in momentum transfer of the amplitude for certain physical processes is given here. In particular we justify the use of extrapolation in the scattering angle, at a fixed energy, to obtain the pion- nucleon coupling constant from photoproduction data, for photon laboratory energies up to 1BeV. This extrapolation procedure to obtain strange particle parities and coupling constants is also justified for certain strange particle production and scattering processes. (Author)

Cambridge U. (Gt. Brit.)
UNSTABLE PARTICLES IN A GENERAL FIELD THEORY, by J. Gunson and J. G. Taylor. Technical scientific note no. 6 on Contract AF 61(052)233. Feb 60, 12p. 6 refs. AFOSR-TN-60-679.
Order from LC mi$2.40, ph$3.30 PB 149 587

The problem of unstable particles in quantum field theory is treated as one of the interpretation of complex singularities appearing in the analytic continuation of scattering amplitudes into unphysical sheets of their Lorentz invariant variables. Suitable continuations are shown to hold under certain restrictive assumptions in a general field theory, making use of unitarity and causality of the S-matrix. The extra singularities appearing in the continuation are fixed isolated poles, in accordance with a conjecture of Peierls. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
QUENCHING OF MAGNETIC MOMENTS IN NUCLEI, by S. D. Drell and J. D. Walecka. Technical note no. 19 on Contract AF 49(638)388. June 60, 42p. 15 refs. Technical note 388-19; AFOSR-TN-60-714.
Order from LC mi$3.30, ph$7.80 PB 149 575

Starting from the premise that with modern dispersion-theoretical techniques one has a reliable method for calculating the anomalous magnetic moment of a nucleon, the modification or "quenching" of this moment has been calculated for a nucleon in nuclear metter. The effect considered here is due to the fact that nucleons are not allowed by the exclusion principle

to recoil into states already occupied by other nucleons in the nucleus. The actual technique used in the calculation is to sum all the Feynman diagrams that are included in the dispersion theory calculation of the single nucleon moment. The nucleon propagator is then written as a sum over states and those states are removed in which the nucleon is inside the Fermi sea. The result is that the anomalous moment is reduced by by $\simeq 7\%$. (Author)

Johns Hopkins U., Baltimore, Md.
AUGER RATE IN μ MESIC ATOMS, by A. Pevsner, R. Strand and others. Rept. on Contract AF 18(603)143. May 60, 10p. 24 refs. AFOSR-TN-60-463.
Order from LC mi$1.80, ph$1.80 PB 148 957

A study has been made of the K Auger transitions in the light elements of nuclear emulsions. Of 3382 stopping μ-mesons, 1016 were observed to decay. 5 of these had associate short-range electrons whose energies were consistent with the K transitions of CNO. 2 of these 5 are attributed to the K Auger transitions of CNO, while the remaining 3 are attributed to higher Auger transitions in AgBr.

Johns Hopkins U., Baltimore, Md.
THE MASS OF THE Λ° HYPERON, by J. Lodge, F. Anderson and others. Rept. on Contract AF 18(603)143. May 60, 9p. 9 refs. AFOSR-TN-60-462.
Order from LC mi$1.80, ph$1.80 PB 148 956

The mass of the Λ°-hyperon has been measured using nuclear emulsions: $M_{\Lambda} = 1115.55 \pm 0.15$ Mev. (Author)

Miami U., Coral Gables, Fla.
INTERACTIONS AND DECAY OF HYPERONS PRODUCED IN K^- CAPTURE STARS AT REST, by M. Blau, C. F. Carter, and A. Perlmutter. Rept. on Contract AF 49(638)97. 31 May 60, 46p. 24 refs. AFOSR-TN-60-745.
Order from LC mi$3.30, ph$7.80 PB 149 332

The results of an investigation of hyperon interactions and decays are presented. Several inelastic interactions are described. The mean free path for nuclear interactions of charged Σ hyperons in emulsion is found to be 11 ± 4 cm in the energy range 10 - 200 Mev.

National Bureau of Standards, Washington, D. C.
SINGLE SCATTERED NEUTRONS FROM AN ISOTROPIC POINT SOURCE, by E. R. Mosburg, Jr. and W. M. Murphey. July 60, 11p. 4 refs. Technical note 63.
Order from OTS $0.50 PB 161 564

A calculation was made to determine the number of particles from an isotropic source which will reach a detector after scattering once in the medium surrounding the detector and source. The simple result obtained is applicable when the separation of the detector and the source is much less than the mean free path of the particle in the medium. The particular case of 14.1 Mev neutrons in air was considered. It was found that 44 percent of the single scattered neutrons had scattering angles of less than 30 degrees. (Author)

Instruments and Installations

Battelle Memorial Inst., Columbus, Ohio.
EXPERIMENTAL AND RESEARCH WORK ON NEUTRON DOSIMETRY, by H. C. Gorton, O. J. Mengali and others. Quarterly progress rept. no. 3, 15 Nov 59-14 Feb 60, on Contract DA 36-039-sc-78924. 15 Feb 60, 30p.
Order from LC mi$2.70, ph$4.80 PB 149 378

The effects of dose rate on the sensitivity to fast-neutron radiation of the experimental silicon-rectifier dosimeters were compared by exposing two sets of units to like amounts of radiation from the General Atomic TRIGA Reactor and the Battelle Research Reactor No significant dependence of device characteristics on the rate of irradiation was observed. In addition, valuable information was obtained on radiation-induced changes in lifetime and, consequently, on the current-voltage characteristics of the experimental units. Two types of read-out circuits have been developed, one of which employs the radiation-induced change in forward current at a fixed voltage and the other radiation-induced changes in lifetime. (See also PB 147 981)

Convair, Fort Worth, Tex.
CALIBRATION OF STANDARD 50 CC AND 900 CC IONIZATION CHAMBERS, by C. F. Malone and V. M. Davis, Rept. on [Contract AF 33(038)21117]. 8 Mar 54, 31p. MR-N-34; CVAC-255T.
Order from LC mi$3.00, ph$6.30 PB 149 993

This report released for sale to the public 13 Sep 60.

The calibration of eight 50-cc and eight 900-cc ionization chambers and their related electrometers is described. Data charts are included which show electrometer readings as functions of electrode voltage changes, percent collection of ions as a function of field strength, electrometer response--a function of pressure in the ion chamber, directional properties of ionization chambers, and dose rate as a function of source-detector separation distance.

Naval Radiological Defense Lab., San Francisco, Calif.
A SIMPLIFIED FILM DOSIMETER FOR FISSION NEUTRONS, by S. W. Ross and E. Tochilin. 4 Apr 58, 23p. 19 refs. Research and development technical rept. USNRDL-TR-224.
Order from LC mi$2.70, ph$4.80 PB 150 147

This report released for sale to the public 12 Sep 60.

A film dosimeter technique has been developed for fast neutron monitoring of reactor personnel. The method takes advantage of the rapid build-up of ther-

mal neutrons when fast neutrons are allowed to penetrate a hydrogenous moderator. The badge consists of a 3/4-inch thick polyethylene frontpiece that is worn on the belt against the body. A combination of silver and tin filters are matched so as to produce equal film blackening from either x- or gamma-rays. Fast neutron exposure is determined from film blackening under radioactive silver produced by capture of the moderated neutrons. The badge contains a sensitive gamma-ray dosimeter film together with a nuclear track emulsion. The dosimeter film serves as both a fast neutron and gamma-ray dosimeter. The nuclear emulsion is read whenever an overexposure is indicated or under any other conditions were a more accurate evaluation of the fast neutron dose is warranted. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
THEORETICAL ANALYSIS OF RADIOMETER PERFORMANCE, by H. G. Ferris. 13 Jan 59, 17p. 1 ref. Research and development technical rept. USNRDL-TR-311, AFSWP-1119; AD-216 542.
Order from LC mi$2.40, ph$3.30 PB 148 850

A theoretical analysis of the thermal behavior of water-cooled thin foil radiometers is carried out. The expression for the heat balance in the circular foil of the radiometer is derived. The steady state solution, $T/t = 0$, subject to certain boundary conditions, yields an expression for thermal sensitivity. This relationship when applied to the three radiometers in common use at NRDL indicates that they operate linearly over their entire ranges (0 to 10, 0 to 50, and 0 to 100 Cal/cm^2) with a maximum error of 2 percent when maximum irradiance is incident on the foil. Solving the heat balance equation, subject to the same boundary, conditions, by means of the Laplace Transformation, an expression for reaction time results: $\tau = \frac{0.416R^2}{K}$

Applying this relationship to the three NRDL instruments yields reaction times of 0.016, 0.004, and 0.004 sec, respectively. (Author)

Nuclear Engineering and Power

Convair, Fort Worth, Tex.
AN ELECTROPLATED NEUTRON THERMOPILE FOR THE 3-Mw GTR, by F. P. Harmon. Rept. on Contract AF 33(600)32054. 20 Feb 59, 27p. 3 refs. NARF-59-20T; MR-N-226.
Order from LC mi$2.70, ph$4.80 PB 150 016

This report released for sale to the public 25 Aug 60.

A neutron-sensitive thermopile which utilizes an electroplating technique for making thermoelectric couples has been developed. This technique offers improved flexibility in design at reduced cost in that it eliminates the usual soldered or welded couples. The thermopile described in this report was constructed for use in the Ground Test Reactor. It consists of a large number of equally spaced junctions extending the length of the reactor core. The signal output is therefore proportional to the integral of the thermal flux distribution along the length of the thermopile. Other features of the thermopile include (1) 100 B^{10}-coated hot junctions and 100 bare cold junctions positioned for ambient-temperature compensation; (2) sensitivity of 10 microvolts per kilowatt reactor power at 2.5 inches from the reactor face; and (3) a time constant of less than one second. Methods used in determining the characteristics of the thermocouple are described in an appendix. (Author)

Nuclear Radiation Lab., U. of Illinois, Urbana.
THE MAGNETIC FIELD PROGRAM FOR THE UNIVERSITY OF ILLINOIS SPIRAL RIDGE CYCLOTRON, by J. O. Ballance, J. L. Friedes and others. Status rept. Technical rept. no. 11 on Contract Nonr-1834(05). Oct 59, 34p. 5 refs. AD-233 131.
Order from LC mi$3.00, ph$6.30 PB 149 476

As soon as the first measurements were analyzed, it was discovered that the magnetic field of the cyclotron was radically different from the expected shape. Efforts were then directed towards the design of a correction coil which would correctly shape the magnetic field. Extensive measurements were made in this connection. This report correlates the data gathered from these measurements and sets forth the techniques developed for the measurements. (Author)

Nuclear Reactions

Naval Radiological Defense Lab., San Francisco, Calif.
DETERMINATION OF Np^{239}, "TOTAL FISSIONS", Mo^{99}, AND Ce^{141} IN FISSION PRODUCT MIXTURES BY GAMMA-RAY SCINTILLATION SPECTROMETRY, by L. D. McIsaac. 5 Jan 56, 17p. 8 refs. Research and development technical rept. USNRDL-TR-72.
Order from LC mi$2.40, ph$3.30 PB 150 146

This report released for sale to the public 12 Sep 60.

A gamma-ray scintillation spectrometric method, involving no other chemistry than sample dissolution, has been developed for the rapid determination of Np^{239} and "Total Fissions" in fission-product samples. A single channel NaI(Tl) scintillation spectrometer was used, and analysis required about 1 hour. The 140-Kev gamma-rays of Tc^{99m} and Ce^{141} were used while the 105-Kev gamma ray plus conversion X ray accompanying the decay of Np^{239} was employed to measure the Np^{239} concentration. Determination of the disintegration rates of Mo^{99}, Tc^{99m} and Ce^{141} is also possible by this technique. An accuracy of about 10 per cent or better can be obtained. (Author)

Pennsylvania U., Philadelphia.
STUDIES IN PHOTONUCLEAR REACTIONS, by J. Halpern, K. Geller and others. Annual rept. on Contract AF [49](638)454. June 60, 193p. 93 refs. AFOSR-TN-60-889; AD-239 360.
Order from LC mi$8.70, ph$30.30 PB 149 006

A summary is given of research on neutron separation energies and betatron energy calibration; photoactivation studies of carbon and oxygen; and inelastic scattering of electrons from nuclei.

Vienna U. (Austria).
THE SIGMA-NEUTRON INTERACTION, by G. Eder. Scientific note no. 2 on Contract AF 61(052)265. 23 Nov 59, 5p. 1 ref. AFOSR-TN-60-25; AD-232 068.
Order from LC mi$1.80, ph$1.80 PB 146 713

The potential between a Σ-particle and a neutron due to exchange of pions is calculated in a static theory. A strangeness and isobaric spin conserving interaction is considered. Second and fourth order terms in the coupling constant are evaluated. It can be shown, that the singlet spin potential is more attractive than the triplet spin potential, in agreement with some experimental evidence. (Author)

Radioactivity

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
SCATTERED GAMMA RADIATION MEASUREMENTS FROM Co^{60} CONTAMINATED FIELD, by Clayton L. Schlemm, Alexander E. Anthony, Jr. and Zolin G. Burson. Jan 59, 126p. 15 refs. AFSWC-TN-59-6; AD-232 439.
Order from LC mi$6.30, ph$19.80 PB 149 987

This report released for sale to the public 31 Aug 60.

A 90° sector of a circle of 604-ft radius was contaminated with cobalt-60 point sources to an approximate level of 1.72 millicuries psf. as a means of simulating an area approaching an infinite contaminated field. Radiation measurements were made in an open hole with a PDR-27A radiac instrument and Dupont 553 film to determine the percentage of the total radiation which is due to scattered radiation (skyshine). It was found to be approximately $10 \pm 4\%$. These measurements were made at selected points from approximately 36 in. above to 25 in. below ground level. Data were obtained in a miniature basement to determine the attenuation of the skyshine by various thicknesses of concrete on the roof. Additional data were obtained to determine the energy of the scattered radiation as a function of the angle above the plane, using a total absorption gamma spectrometer. The unshielded effective energy for dose considerations ranged from 0.90 to 0.12 mev for elevation angles from 10° to 80° above the plane. (Author)

Defense Atomic Support Agency, Washington, D. C.
HIGH ALTITUDE SAMPLING PROGRAM (HASP), SPECIAL REPORT, by Albert K. Stebbins, III. 1 June 60, 244p. 29 refs. DASA 532B.
Order from OTS $3.50 PB 161 916

This report outlines the results of the HASP program in its effort to determine the role played by the stratosphere in the world-wide distribution of radioactive fallout from nuclear weapons tests. The sampling network has collected 10^8 standard cubic feet of air from 57°S to 71°N up to 70,000 feet. Stratospheric inventories of Sr-90 have been calculated for the periods November 1957 to December 1958, January to August 1959, and September to November 1959 to be respectively 0.95, 0.81, and 0.7 megacuries. Concentrations have been greater in the Northern Hemisphere by a factor of 2 or 3 over the Southern Hemisphere. The Sr-90 maximum occurs in the equatorial regions around 90,000 feet and slopes down to around 70,000 feet in the polar regions. A semi-empirical application of Gaussian diffusion is described which suggests that hot clouds injected in the equatorial stratosphere spread in the North-South direction with mixing coefficients near 5×10^8 cm^2/sec. An Injection-Depletion model is offered which indicates that as much as 50% of the material produced in a megaton ground surface burst comes down in local fallout. Removal from the stratosphere occurs at different rates depending on altitude and latitude of injection and season of the year. Surface concentrations of Sr-90 are displayed as a function of latitude and time.

Institute of Engineering Research, U. of California, Berkeley.
PREDICTION, MONITORING AND ESTIMATION OF RADIOLOGICAL FALLOUT PATTERNS FOR CIVIL DEFENSE, by A. Broido, R. R. Read, and R. W. Shephard. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 1 Aug 59, 38p. 20 refs. Series no. 2, issue no. 17.
Order from LC mi$3.00, ph$6.30 PB 150 014

This report released for sale to the public 15 Sep 60.

This report describes, without technical details, the theoretical and computational bases of a probabilistic approach to prediction, monitoring, and estimation of radiological fallout patterns. The approach can lead to the design of a monitoring system for the quantitative assessment of the completed fallout distribution in which the patterns can be obtained to a specified accuracy with fewer monitoring locations than would be required for the purely empirical approach of graphic interpolation between observations.

Institute of Engineering Research, U. of California, Berkeley.
TECHNIQUE FOR DESIGNING AND EMPLOYING A RADIOLOGICAL MONITORING SYSTEM FOR THE EVENT OF ATTACK, by Robert R. Read. Interim rept. on Civil Defense Research Project, Contract CD-SR-58-40. 10 Apr 59, 30p. 2 refs. Series no. 2, issue no 22.
Order from LC mi$2.70, ph$4.80 PB 150 015

This report released for sale to the public 15 Sep 60.

This report presents a method for estimating fallout iso-intensity contours on the basis of ground monitored radiological measurements and of a probabilistic model describing the behavior of such measurements. This method can be used either for interpolation among several measurements or for the "downwind" prediction of additional hazardous areas where fallout has not yet occurred. Using such an estimation procedure as a basis, the report describes a technique for determin-

ing what radiological measurements are necessary for a ground monitoring system, including the specification of which regions are to be monitored. (Author)

National Bureau of Standards, Washington, D. C.
CALIBRATION OF FIVE GAMMA-EMITTING NUCLIDES FOR EMISSION RATE, by J. M. R. Hutchinson. Aug 60, 23p. 14 refs. Technical note. no. 71.
Order from OTS $0.75 PB 161 572

Mercury-203 and niobium-95 were calibrated by a $4\pi\beta$-γ coincidence method for γ-emission rate, zinc-65 by comparison with the 1.12 Mev peak of scandium-46, sodium-22 by a γ-annihilation-quanta coincidence method and by a triple coincidence method, and strontium-85 by x-γ coincidence counting. The accuracy of the calibration in all cases was $\pm$ 2%. The half-life of the isomeric state of rubidium-85 was measured and found to be 0.98 microseconds. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
LITERATURE SURVEY OF CONCRETES FOR NUCLEAR RADIATION SHIELDING, by Meldon Merrill and W. L. Cowell. Final rept. 28 June 60, 29p. 41 refs. Technical rept. 084.
Order from OTS $0.75 PB 161 910

A survey was made to determine the extent of knowledge about materials used as aggregates in concrete. Information is presented on (1) mix designs incorporating various types of heavy aggregates, (2) available cost data relating to construction methods and aggregates, (3) problems associated with heavy concretes during construction, and (4) nuclear shielding properties for concretes. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
NOMOGRAM FOR RADIOACTIVITY IN GROSS FISSION PRODUCT ANALYSES, by M. H. Rowell and E. C. Freiling. 22 May 57, 6p. Research and development technical rept. USNRDL-TR-159; AD-139 583.
Order from LC mi$1.80, ph$1.80 PB 149 266

A nomogram is presented which facilitates calculations involving the age and size of fission product samples and the fission yields, half lives, and residual activities of the individual fission product nuclides. Although all important fission products of half-life greater than 1 hr are conveniently indicated, the nomogram is applicable to many more. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

New York U. Coll. of Engineering, N. Y.
DEVELOPMENT OF TECHNIQUES FOR THE EVALUATION OF HIGH ALTITUDE PRESSURE SUITS, by Renato Contini, Rudolfs Drillis, and Lawrence Slote. Rept. on Human Engineering Evaluation for Pressure Suits, Contract AF 33(616)3592. Dec 59, 130p. 115 refs. WADC Technical rept. 58-641.
Order from OTS $2.75 PB 161 899

The principal purpose of this study is to develop objective criteria to facilitate the selection of that pressure suit or component which permits the operator maximum function. A secondary purpose is to make available to the manufacturer of the suit or component objective data from which he may improve the design of the item. The techniques and methodologies associated with biomechanics were studied for their application to pressure-suited personnel. Physiological and psychological techniques were investigated for their usefulness in the over-all evaluation. Only the basic movements of the upper extremities were considered. Nonetheless, the methods can be applied generally to other body segments, and, therefore, an over-all evaluation of a pressure suit or suit component can be accomplished. (Author)

Sierracin Corp., Burbank, Calif.
MA-3 ELECTRICALLY HEATED FACEPIECE. Rept. on Development of Pressure Suit System, Contract AF 33(616)3746. Jan 60, 26p. Engineering rept. ER-59-269; WADD Technical rept. 60-88; AD-235 995.
Order from LC mi$2.70, ph$4.80 PB 146 662

A proprietary, transparent, electrically conductive coating, "Sierracote III," was successfully incorporated into laminated, formed, optically and thermally satisfactory facepieces. Success in the heating of polyester-vinyl laminates was achieved in a shorter than anticipated period. This permitted the addition of surface coated parts of monolithic acrylic structure to the program. (Author)

PHYSICS

Air Force Missile Development Center, Holloman AFB, N. Mex.
MATHEMATICA MEMORABILIA: LECTURE NOTES ON APPLIED MATHEMATICS; UNDERLYING EQUATIONS OF MAGNETOHYDRODYNAMICS, by Karl Pohlhausen. Lecture notes compiled in the summer of 1959 at Cloudcroft, New Mexico. 1960, 110p. 43 refs. AFMDC-TR-60-8.
Order from LC mi$5.70, ph$16.80 PB 148 205

Contents:
Ordinary linear differential equations with constant coefficients: a classical method; Laplace transformation
Non-linear ordinary differential equations: first-order equations; second-order equations
Variational methods
Hydrodynamics
Heat transfer
Magnetohydrodynamics

Acoustics

Brown U., Providence, R. I.
NONLINEAR SONIC PHENOMENA, by Wesley L. Nyborg. Final rept. on Contract AF 18(603)54. 31 May 60, 63p. 13 refs. AFOSR-TR-60-70; AD-238 441.
Order from LC mi$3.90, ph$10.80 PB 148 558

Theory has been developed for a particular sonic characteristic, acoustic streaming, in terms of the equations of nonlinear acoustics. Detailed experimental investigations have been made of streaming patterns under conditions of interest, and of the effects of streaming on surface processes. Papers included in the report are:
Acoustic streaming near a boundary, AFOSR TN-57-792, pub. in the Jnl. of the Acoustical Society of America 30:329-339, Apr 58
Cavitation microstreaming, pub. in the Jnl. of the Acoustical Society of America 31:54-64, Jan 59
Microscopic eddying near a vibrating ultrasonic tool tip, AFOSR TN-58-991, pub. in Jnl. of Applied Physics 30:949-950, June 59
Sonically-induced microstreaming near a plane boundary. I. The sonic generator and associated acoustic field, AFOSR TN-60-539
Sonically induced microstreaming applied to a surface reaction, AFOSR TN-59-253, pub. in the Jnl. of the Acoustical Society of America 31:706-711, June 59
Effects of acoustic microstreaming at electrodes, AFOSR TN-60-538, pub. in Proceedings of the Third International Congress in Acoustics, Stuttgart, Germany, Sep 59
Imbedded thermistor for boundary layer measurements, AFOSR TN-58-992, pub. in the Jnl. of the Acoustical Society of America 31:249-250, Feb 59.

California U., Los Angeles.
ULTRASONIC ABSORPTION AND DISPERSION IN GASEOUS DIBROMOMETHANE, by Norman J. Meyer. Technical rept. no. 15 on Contract Nonr-233(48). July 59, 74p. 37 refs.
Order from LC mi$4.50, ph$12.30 PB 147 800

Ultrasonic speed of sound and absorption measurements have been made in gaseous dibromomethane at 296°K. and at pressures between 0.5 and 15.0 mm. Hg. A continuous selection of frequencies between 13 and 80 Kcs was used, generated as pulsed sine waves. Independent vibrational relaxation processes were found at 7.0 and 125 Mc/atmos, with corresponding relaxation times of 3.02×10^{-8} and 0.146×10^{-8} secs. A third relaxation process was not within the experimental range of the apparatus. Seven of the nine vibrational modes have sufficient population at 296°K to contribute to the various relaxation processes. Primarily based upon the specific heat contributions of each mode, the assignments of the various modes relaxing at the different relaxation times were made. (Author)

Michigan U. Research Inst., Ann Arbor.
THE CONCEPT OF THE IDEAL OBSERVER IN PSYCHOPHYSICS, by W. P. Tanner, Jr., T. G. Birdsall, and F. R. Clarke. Technical rept. no. 98 on Contract AF 19(604)2277. Apr 60, 45p. 3 refs. 2659-6-T; AFCRC-TR-59-54.
Order from LC mi$3.30, ph$7.80 PB 148 804

This report discusses the manner in which the concept of the ideal observer serves as a tool for the development of a description model of human performance in the detection and recognition of signals. (Author)

Michigan U. Research Inst., Ann Arbor.
DETECTION OF COMPLEX SIGNALS AS A FUNCTION OF SIGNAL BANDWIDTH AND DURATION, by C. D. Creelman. Technical rept. no. 99 on Contracts AF 19(604)2277 and Nonr-1224(22). Jan 60, 20p. 14 refs. 2659-8-T; AFCRC-TR-59-59. Also appears as Rept. no. 6 of Speech Research Lab.
Order from LC mi$2.40, ph$3.30 PB 148 805

An experimental examination of the efficiency of human observers in detecting a stimulus waveform which consists of a train of damped sinusoids is reported. The signal duration and degree of damping (or spectral bandwidth) were varied, with the energy of the signal held constant. Bandwidth is shown to affect human detection more at long than at short durations. (Author)

Naval Research Lab., Washington, D. C.
THEORETICAL ANALYSIS OF MONOSTATIC REFLECTION IN THE FAR FIELD OF RIGID, FINITE OBJECTS, by W. G. Neubauer. Interim rept. 12 July 60, 4 refs. NRL rept. 5467.
Order from LC mi$2.70, ph$4.80 PB 145 244

The solution to the approximate integral form of the reflection in the "far field" has been developed as well as a graphical, or numerical, method for the case of a rigid, finite plane rotated about an edge and for a wedge shape. The reflection may be conveniently presented in diagrams in the complex plane. Extension of the method has been made to the case for the reflection amplitude at any orientation of a reflector. Physically measurable quantities are required in the evaluation of this sum. Although the evaluation is not exact, rapid, or inclusive of all reflection mechanisms, it does make possible the derivation of the reflection from shapes not analytically describable by a means other than the methods which give the reflection in terms of the radii of curvature of the reflecting surface. (Author)

Electricity and Magnetism

Air Force Cambridge Research Center, Bedford, Mass.
THERMOELECTRIC PHENOMENA, by A. D. Johnson. Dec 59, 48p. 7 refs. AFCRC-TR-59-362.
Order from LC mi$3.30, ph$7.80 PB 148 968

This report is intended to serve as an introduction to thermoelectricity. It consists of three parts: the history, advantages, limitations, and applications of thermoelectricity; a physical picture of thermoelectricity, using energy level diagrams; and an accounting of the type and extent of research effort currently devoted to the subject in this country, including references to materials that appear most promising. (Author)

[Army] Signal [Research and Development Lab.] Fort Monmouth, N. J.
MEASUREMENT OF PERMEABILITY AND Q OF MAGNETIC MATERIALS OVER THE FREQUENCY RANGE OF 50 TO 500 MEGACYCLES, by Isidore Bady and Robert Franklin. 30 Sep 55, 70p. 5 refs. Engineering rept. 1159.
Order from LC mi$3.90, ph$10.80 PB 149 418

Four methods for measuring the complex permeability of magnetic materials are given. These are based on the use of a Q meter, cavity resonator, slotted line, and VHF bridge. Test procedures and formulas are given. All formulas are derived. The advantages and disadvantages of the various methods are discussed and sources of errors noted. Tests performed on several samples show very good agreement among the methods. Where discrepancies do occur, the reasons for these discrepancies are discussed. (Author)

Geophysical Inst., U. of Alaska, College.
A NOTE ON HARMONIC ANALYSIS OF GEOPHYSICAL DATA WITH SPECIAL REFERENCE TO THE ANALYSIS OF GEOMAGNETIC STORMS, by Masahisa Sugiura. Scientific rept. no. 1 on Contract AF 19(604)2163. 18 Apr 60, 16p. 6 refs. UAG-R108; AFCRC-TN-60-410; AD-238 213.
Order from LC mi$2.40, ph$3.30 PB 149 757

Some geophysical characteristics tend to have a fixed distribution relative to the sun. An example is the distribution of air temperature on an ideal earth that is perfectly symmetrical (e.g., in its pattern of land and water) about its axis of rotation. In such a case the geophysical characteristic at any fixed station on the earth undergoes a daily variation that depends only on local time (and latitude and season). This simple pattern of daily change may be modified by intrinsic changes in the solar influences on the earth. The harmonic components of the daily variation at any station may in this case undergo phase changes, in some respects corresponding to Doppler shifts of frequency in optical or sonic phenomena. Care is then needed if the results of harmonic analysis are to be properly interpreted. Such interpretation is discussed with reference to the parts Dst and DS of the magnetic storm variations. Like caution must be observed in cases where the amplitude of a harmonic variation changes, with fixed phase. (Author)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by H. V. Anderson, Joseph S. Mathias and others. Quarterly progress rept. no. 1, 15 July-15 Oct 53, on Contract DA 36-039-sc-42580. 15 Oct 53, 38p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 149 599

An extension of the investigation of the influence of time of annealing at 675°C on the response to magnetic annealing is reported. X-ray evidence indicates that the amount of ordered structure present does increase with annealing time in a manner similar to the residual induction. Further investigation of the iron-cerium system, though continuing to provide materials with higher inductions than the base of U. S. S. pure iron, failed to provide improvement over pure iron specimens produced by the same technique. Preliminary work on the iron-beryllium system indicated a distinct increase of residual induction and coercive force with aging in a magnetic field. (Author)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by H. V. Anderson, Joseph S. Mathias and others. Quarterly progress rept. no. 2, 15 Oct 53-15 Jan 54, on Contract DA 36-039-sc-42580. 15 Jan 54, 34p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 149 600

The study of the influence of annealing temperature on response to magnetic annealing of the 50% iron-50% cobalt alloys was extended to include series at 720°C and 740°C. The results indicate that the maximum response obtainable appears to be independent of the annealing temperature, though the annealing time required to achieve the response decreases at the higher temperatures. The coercive force peak obtained on annealing at 675°C becomes almost non-existent at 740°C. The iron-cerium alloy investigations indicate a marked increase in coercive force and little change in induction at 10 to 100 oersteds on increasing the cerium content to 1 and 2%. The variation of B_r/B_s ratio with cerium content appears quite marked. The magnetostriction value of the 1% cerium alloy was fo found to be 1-1.5 microinches per inch ± 0.5 at 40 oersteds. Attempts to add carbon to the MnSb alloy markedly decreased the saturation. (Author) (See also PB 149 599)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by H. V. Anderson, Joseph S. Mathias and others. Quarterly progress rept. no. 3, 15 Jan-15 Apr 54, on Contract DA 36-039-sc-42580. 15 Apr 54, 92p. 55 refs.
Order from LC mi$5.40, ph$15.30 PB 149 601

One phase of the studies of ordering and magnetic annealing of the 50% iron - 50% cobalt alloy has been completed. These studies indicate that for this alloy: (1) The ordering appears to take place by two mechanisms, atomic rearrangement and nucleation and growth; (2) the maximum B_r/B_s ratio, and maximum response to magnetic anneal was obtained for the specimens treated to produce the greatest degree of order; (3) at longer annealing times anneals with the field applied continuously were more effective than anneals with the field on cooling only. A new program has been initiated on the phase of the work directed towards development of soft magnet materials with higher induction at fields of ten and one hundred oersteds. This program involves the determination of the influence of grain size on magnetic properties of alloys of 4% Molybdenum-balance iron. (Author) (See also PB 149 600)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by H. V. Anderson, Joseph S. Mathias and others. Quarterly progress rept. no. 4, 14 Apr-15 July 54, on Contract DA 36-039-sc-42580. 15 July 54, 45p. 21 refs.
Order from LC mi$3.30, ph$7.80 PB 149 602

The iron molybdenum alloy investigations indicate a marked dependence of magnetization characteristics on annealing treatment. The best averaged properties obtained to date in the investigations of these alloys are 18,100 and 15,550 gauss at fields of 100 and 10 oersteds respectively. The work done to date on magnetic alloys of non-ferromagnetic materials is summarized. Magnetic data have been reported for Mn-Sb, Mn-Ge and Mn-B binary alloys as well as some ternary alloys with carbon or boron. The calibration method for the magnetostriction measuring equipment has been improved. (Author) (See also PB 149 601)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by H. V. Anderson, Marvin C. Y. Lee and others. Quarterly progress rept. no. 5, 15 July-15 Oct 54, on Contract DA 36-039-sc-42580. 15 Oct 54, 27p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 149 603

Further results on the iron molybdenum investigations are reported. Slightly higher values of B_{100} (18100-18400 gauss) and B_{10} (15620-15850 gauss) were obtained for the 5% molybdenum alloy than thos previously reported for the 4% alloy, though tere was a concurrent increase in coercive force from approximately 0.50 oersteds. Preliminary tests on additional alloys of Manganese indicated ferromagnetism in alloys of Mn-Sn, Mn-C-Sn, Mn-Zn, Mn-Cd, Mn-C-Cd, as well as other complex alloys of the Heusler type. Initial test results are reported for alloys of Mn_xSn_y and $(Mn_4Sn)_xC_y$ types. (Author) (See also PB 149 602)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by Marvin C. Y. Lee, Joseph S. Mathias and others. Quarterly progress rept. no. 6, 15 Oct 54-15 Jan 55, on Contract DA 36-039-sc-42580. 15 Jan 55, 59p. 19 refs.
Order from LC mi$3.60, ph$9.30 PB 149 604

Work has been initiated on the iron 6.4% silicon alloy in the hope of determining the relation, if any, between the ordering reaction and the response to annealing in a magnetic field. The first series of rings prepared appear free of defects but show an abnormally low permeability. The studies of the influence of grain size on the magnetic properties of the iron-molybdenum alloy have been completed. The results as reported indicate a decrease of coercive force and an increase of low field permeability with increased grain size. The induction at high fields appears to decrease slightly with increased grain size. Further tests have been made on the Mn-Sn-C system and the Mn-Sb-C system. (Author) (See also PB 149 603)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by Marvin C. Y. Lee, Ernest Costello, and others. Quarterly progress rept. no. 7, 15 Jan-15 Apr 55, on Contract DA 36-039-sc-42580. 15 Apr 55, 36p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 149 605

The critical temperatures for ordering of the Fe-6.1% Si and the Fe-5.2% Si alloys appear to be approximately 645°C and 630°C respectively. By preannealing the iron powders in hydrogen, rings of 5.2 and 6.4% Si - balance iron have been produced with permeabilities in the annealed condition in the range to be expected from such alloys. Further magnetic results are reported for the systems Mn-Sn-C and Mn-Sb-C. Further standard X-ray patterns were run for several of the phases expected to be present in the Mn-Sn-C investigation. The "d" values are presented in this report though metallographic studies and crystal structure analyses have not been performed. (Author) (See also PB 149 604)

Institute of Research, Lehigh U., Bethlehem, Pa.
RESEARCH STUDY ON THE IMPROVEMENT OF MAGNETIC MATERIALS, by Marvin C. Y. Lee, Joseph S. Mathias and others. Final rept. for 16 July 53-15 July 55 on Contract DA 36-039-sc-42580. 15 July 55, 40p. 26 refs.
Order from LC mi$3.00, ph$6.30 PB 149 606

The studies of the influence of time and temperature on the response of the 50% iron - 50% cobalt alloys to heat treatment in a magnetic field have been completed as have the studies of the influence of grain size on the magnetization curve and coercive force of iron-molybdenum. The results of these investigations are summarized. Magnetic data have been obtained on a number of alloys of manganese including alloys in the binary systems Mn-Ge, Mn-Sb, Mn-B, and Mn-Sn and the ternary system Mn-C-Sn. Some data have also been reported on preliminary studies of the Mn-Sb-C and Mn-Sb-B systems. Preliminary studies have been made of other alloys of manganese and of chromium as well as of the iron-beryllium system. Work has progressed on the construction of equipment for measuring high temperature magnetostriction and magnetocrystalline anisotropy. (Author) (See also PB 149 605)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
A SOLUTION FOR THE MAGNETIC FIELD IN FERROMAGNETIC LAMINATIONS WITH NON-LINEAR B-H CHARACTERISTICS, by K. T. Lian. Rept. on Contract Nonr-839(05). 22 Sep 59, 33p. 7 refs. Research rept. R-766-59; PIB-694; AD-229 995.
Order from LC mi$2.40, ph$3.30 PB 148 897

A technique is described for determining the field distribution inside a ferromagnetic lamination or slab when the material is excited by a step of magnetic field (H) applied to the surface. The functional form of the solution is found to be independent of the shape of the B-H characteristic. (Author)

Scripps Institution of Oceanography, U. of California, La Jolla.
GEOMAGNETIC WESTWARD DRIFT AND IRREGULARITIES IN THE EARTH'S ROTATION, by Michael G. Rochester (U. of Utah). Final rept. on Contract Nonr-2216(03). 15 July 59, 58p. 19 refs. AD-220. 218.
Order from LC mi$3.60, ph$9.30 PB 148 186

Bullard's (1950) rigid-sphere model for the steady westward drift of the Earth's non-dipole magnetic field is extended to include the magnetic coupling provided by the presence of the higher multipole fields at the core-mantle boundary. If the first 6 harmonics of the observed surface field are taken into account, the retarding couple on the mantle is increased by a factor of 1.6. Using this result it would follow from Bullard's specialized model of the core that the geomagnetic dynamo mechanism generates a toroidal field of several hundred gauss in the deep interior of the core. Time-dependent perturbations of the mantle-core coupling are investigated, and it is shown that reasonable fluctuations of the fields at the core-mantle boundary are capable of explaining changes in the length of day at the rate of order 1 msec in 10 yr. The argument provides additional evidence that the mean electrical conductivity in the bottom 2000 km of the mantle is at least 10^{-9} emu. A summary of knowledge of the distribution of electrical conductivity with depth in the Earth is given. (Author)

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
A YEAR'S SAMPLING OF HIGH-FREQUENCY ARCTIC SIGNALS, by H. S. Marsh. Apr 60, 49p. 13 refs. AFCRC-TR-60-125.
Order from LC mi$3.30, ph$7.80 PB 148 967

This report covers a year's intermittent sampling at Scituate, Mass., on various High-frequency Arctic signals, predominantly the Thule 12- and 18-Mcps slant-sounder signals, with particular interest in Arctic blackout occurrences. The limited sampling possible, plus the abnormality of "normal" Arctic ionospheric conditions reduced the information gained on blackout morphology. Several definite trends that emerged are presented. Other ionospheric anomalies observed, including normal relative-frequency diurnal and seasonal variations, contrasted with their expansions during magnetic disturbances and approaching blackout conditions; brief thermal dropouts of interfering signals around sunrise and sunset and validity of Appleton-Beynon 'curved layer, thin earth' geometry when the signal is close to the MUF, are examined in some detail. (Author)

Antenna Lab., Ohio State U. Research Foundation, Columbus.
THE EVALUATION OF INCOMPLETE NORMALIZATION INTEGRALS AND DERIVATIVES WITH RESPECT TO THE ORDER OF ASSOCIATED LEGENDRE POLYNOMIALS, by Raphael Tsu. Rept. on Monostatic and Bistatic Measurement of Scattering Shapes and Synthesis of Scattering Shapes, Contract AF 19(604)6157. 1 Apr 60, 23p. 7 refs. Rept. 1073-3; AFCRC-TN-60-376.
Order from LC mi$2.70, ph$4.80 PB 148 789

Material pertinent to scattering pattern synthesis is presented. The evaluation of the incomplete normalization integrals and derivatives with respect to the order of associated Legendre Polynomials are presented. These integrals arise from the study of a scatterer which has a minimum average scattering cross section in a given cone. The formulas of $(\partial P_\nu/\partial \nu)_{\nu=n}$ for n = 0, 1, 2 are obtained in closed form. Various recurrence relations are derived.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE VELOCITY DISTRIBUTION IN A MOLECULAR BEAM, by F. O. Vonbun. 15 Mar 60, 13p. 7 refs. USASRDL Technical rept. 2103; AD-236 952.
Order from LC mi$2.40, ph$3.30 PB 149 385

The velocity distribution in a mean of molecules after it has been subjected to an inhomogeneous, cylindrical electric or magnetic field is calculated. The molecules under consideration are under the influence of a force directed toward the axis of the focusing or separating system. The resulting velocity distribution is a simple analytical function in which, p, N, q and x are practical parameters of the focusing system and the molecule itself. Expressions are derived for the average and most probable velocities in a beam leaving the focuser, as well as for the increase in total flux from the end of the focuser due to the applied field. A simple formula is given for the effectiveness of separation of molecules in various quantum states. (Author)

Case Inst. of Tech., Cleveland, Ohio.
SCATTERING OF A PLANE WAVE ON A FERRITE CYLINDER AT NORMAL INCIDENCE, by W. H. Eggimann. Scientific rept. no. 11 on Contract AF 19(604)3887. 25 Feb 60, 26p. 3 refs. AFCRC-TN-60-380. AD-237 887.
Order from LC mi$2.70, ph$4.80 PB 148 194

The diffraction of a plane wave on a circular ferrite cylinder at normal incidence is investigated. The scattered field is found as a series of cylinder functions. The amplitude and phase of the scattered field have been calculated on a digital computer for various values of cylinder radius and permeability of the ferrite. Approximation formulas for the thin cylinder and the far field have been developed. It is found that the field is asymmetrical with respect to the scattered direction of the incident field. For certain values of the parameters, the scattered field has the form of a spiral wave, due to the precession of the magnetic dipole currents. Application of ferrite rods in scanning antenna systems seem feasible. (Author)

Defense Research Lab., U. of Texas, Austin.
DIELECTRIC WAVEGUIDES AND RADIATORS, by Chester M. McKinney, Jr. Doctoral thesis. Rept. on Contract NOrd-9195. Sep 50, 278p. 79 refs. Bumblebee Series rept. no. 138.
Order from LC mi$11.10, ep$45.60 PB 149 616

This report released for sale to the public 13 Sep 60.

Contents:
Mode exciters and transducers for electromagnetic waves
Dielectric waveguides of circular cross section
Dielectric radiators

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
POLARIZATION ANALYSIS AND SYNTHESIS, by Harold L. Newman. Rept. on Contract DA 36-039-sc-75012. 10 Mar 59, 29p. 7 refs. Technical memo. no. EDL-M183; AD-213 825.
Order from LC mi$2.70, ph$4.80 PB 147 441

Problems involved in matching the polarization of a transmitter to that of a particular incoming signal are examined. This includes consideration of the parameters required for the specification of polarization, the effect on power transfer between antennas of errors in matching polarization, various means whereby polarization parameters may be measured and synthesized, and determination of the requirements of the major components of a system which will automatically accomplish polarization detection, analysis, and synthesis. (Author)

Hughes Research Labs., Malibu, Calif.
TIME DOMAIN SIDELOBE SUPPRESSION, by H. H. Hougardy. Quarterly rept. no. 3, 1 Oct-31 31 Dec 59, on Contract AF 30(602)2021. [1960] 41p. 4 refs. RADC-TN-60-76; AD-237 680.
Order from LC mi$3.30, ph$7.80 PB 148 087

Analytic studies have been continued in the areas of optimum modulation forms, systems compatibility, and error analysis. A method of synthesizing the modulation for a linear array in terms of a desired sidelobe level is established, and the time domain linear array theory is extended to modulated two-dimensional apertures. Performance of time modulated antennas with regard to gain, tracking sensitivity and utility in Doppler systems is considered. Results of initial efforts on an error analysis of a modulated cosine-on-a-pedestal distribution are presented. In addition, the experimental effort in developing a receiver detection system is discussed. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
A THEORY OF BUNCHING PHENOMENA IN MAGNETICALLY CONFINED BEAMS FOR FAST-WAVE MICROWAVE TUBES, by Michio Nakano. Rept. on Contract AF 19(604)4143. 1 Oct 59, 70p. Research rept. R-772-59; PIB-700; AFCRC TN-60-109; AD-234 016.
Order from LC mi$3.90, ph$10.80 PB 146 328

The possibility of high power generation from the initial gyration energy in magnetically confined electron beam through the fast-wave interaction at the cyclotron resonance is studied. It is shown that this bunching is possible in a gyrating beam interacting with an RF magnetic field. Microwave generation in plasma media is considered, because phenomena in a fully ionized plasma have much in common with those in a high density electron beam. The study of the mechanism of bunching pheomena in magnetically confined media suggests many interesting applications such as new types of amplifiers, oscillators and other relative devices. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
INTERFERENCE SUPPRESSION FOR AUTOMOTIVE IGNITION SYSTEMS, by A. Mason Brown. Final rept. 18 Feb 60, 23p. 3 refs. Technical rept. 070; AD-234 876.
Order from LC mi$2.70, ph$4.80 PB 147 812

A low-cost radio interference suppression harness for automotive ignition systems is being developed and is based on the following premises: (1) the mild steel sheet-metal stampings could be substituted for bronze castings as suppression shields; and (2) that standardized parts might be designed to fit all engines. Fabrication of the shielding components from sheet metal successfully resulted in providing satisfactory suppression characteristics. Standardization of parts to include 3 different types of engines was partially successful.

Molecular Physics and Spectroscopy

Arkansas U., Fayetteville.
ATOMIC SPECTROSCOPIC INVESTIGATION OF NUCLEAR PROPERTIES, by R. H. Hughes. Technical rept. on Contract AF 18(603)26. Feb 60, 21p. 17 refs. AFOSR-TR-60-28; AD-233 294.
Order from LC mi$2.70, ph$4.80 PB 146 753

A study of the isotope shifts in the atomic spectra of the medium-weight elements was undertaken. Experimental data were obtained on the isotope shifts in the spectra of strontium, molybdenum, and ruthenium. An apparent correlation was discovered between the binding energy of the last pair of neutrons, obtained from mass spectroscopic data, and isotope shifts. (Author)

Colorado U., Boulder.
HIGH PRECISION MICROWAVE SPECTROMETER FOR 60 kMc, by Robert W. Zimmerer. Doctoral thesis. Technical rept. no. 3 on Contract Nonr-1147(05). Aug 59, 17p. 5 refs. AD-226 157.
Order from LC mi$2.40, ph$3.30 PB 148 873

A high precision microwave spectrometer incorporating several novel ideas was developed to measure the fine structure of the rotational levels of oxygen. The transitions lie between 50 and 65 kmc. The spectrometer is quite dependable. It was used for many hr of continuous operation with no adjustment. Three 60,000,000 kc oxygen lines were measured to 5 kc. The measurements are made by tuning first to one side of the absorption peak and then the other while counting the frequency against the 100 kc national standard. To record the line shape the 15 mc oscillator is tuned through the absorption line by a motor drive. The Zeeman components can be recorded by increasing the bias current in the Zeeman coil until they are resolved in the quiescent field. A normal line recording superposed on a recording of the Zeeman components is shown. The Zeeman components compare nicely with the theoretical expectation. Any contribution by the π lines was very small.

Gates and Crellin Labs. of Chemistry, Calif. Inst. of Tech., Pasadena.
THE ACTIVATION ENERGY OF INVERSION IN SUBSTITUTED 1-METHYLAZIRIDINES (N-METHYLETHYLENIMINES) MEASURED BY THE NUCLEAR MAGNETIC RESONANCE TECHNIQUE, by A. Lowenstein and John D. Roberts. Technical rept. no. 6 on Contract Nonr-220(26). 1 Sep 59, 15p. 13 refs. AD-225 557.
Order from LC mi$2.40, ph$3.30 PB 148 862

The activation energy ΔE, and frequency factor ν_o, for inversion in 1-methyl-2, 2-dimethylaziridine (I) and 1-methyl-2-methyleneaziridine (II) have been measured using the n-m-r- technique. The results are $\Delta E = 10.0$ Kcal. and $\nu_o = 5 \times 10^7$ sec.$^{-1}$ for I and $\Delta E = 6.4$ Kcal. and $\nu_o = 1 \times 10^9$ sec.$^{-1}$ for II. ΔE and and ν_o have also been measured for solutions of I in methanol and carbon tetrachloride. The results are: $\Delta E = 6.8$ Kcal.; $\nu_o = 2 \times 10^5$ sec.$^{-1}$ and $\Delta E = 7.8$ Kcal.: $\nu_o = 1 \times 10^6$ sec.$^{-1}$, respectively. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
DRIFT TUBE-MASS SPECTROMETER FOR STUDIES OF THERMAL-ENERGY ION-MOLECULE REACTIONS, by E. W. McDaniel and D. W. Martin. Technical rept. no. 3 on Contract AF 18(600)1524. 20 June 60, 34p. 21 refs. AFOSR-TN-60-661; AD-239 337.
Order from LC mi$3.00, ph$6.30 PB 148 965

Apparatus has been developed for the mass spectrographic study of ion-molecule reactions occurring under gas-kinetic conditions at thermal energies. Ions are produced inside a two-foot-long drift space containing gas at a pressure of up to 0.7 mm Hg. A thermionic source utilizing a thoriated iridium filament is used for this purpose. The ions diffuse down the drift tube under the action of a weak electric field and pass through a small aperture at the end into a field-free, two-stage differential pumping chamber. From the second stage of this chamber the ions enter a 60° magnetic deflection mass spectrometer. The number of ion-molecule collisions in the drift tube may be varied over a wide range by changing the source position and the gas pressure, and information concerning the nature and probability of various reactions is revealed by the resulting changes in mass spectra. The apparatus may also be used for surface reaction studies, ionic mobility measurements, and for crude investigations of the lifetimes of unstable ions against spontaneous disintegration. (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
EQUILIBRIUM EMISSIVITY CALCULATIONS FOR A HYDROGEN PLASMA AT TEMPERATURES UP TO 10,000°K, by D. Olfe. Technical rept. no. 14 on Contracts AF 18(603)2 and Nonr-220(03). May 60, 69p. 53 refs. AFOSR-TN-60-669; AD-239 405.
Order from LC mi$3.90, ph$10.80 PB 149 142

The important equilibrium emission processes in a hydrogen plasma have been investigated in the temperature range between 300°K and 10,000°K for pressures up to several hundred atmospheres. Representative emissivity calculations have been carried out for a transparent gas at a total pressure of 100 atmos and a mean beam length of 30 cm. Important emissivity contributions were made by the pressure-induced fundamental vibration-rotation band and rotational lines of H_2 at the lower temperatures, i. e., below approximately 4500°K. Above this temperature, the bound-free and free-free transitions of the H^- ion and the continuum and line radiation of the H atom are the most important contributors to the emissivity. The following emission processes were also investigated: the bound-free transitions of the H_2^+ ion, free-free transitions of colliding H atoms and H^- ions, electronic transitions of the H_2 molecule, quadrupole vibration-rotation transitions of the H_2 molecule, and vibration-rotation transitions of the HD molecule. In addition, the effects of the lowering of the ionization potentials by the fields of plasma ions and of the very broad wings of the Lyman α line have been considered. (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
SHOCK-TUBE MEASUREMENTS OF THE f-NUMBER FOR THE (0,0)-BAND OF THE OH $^2\Sigma \longrightarrow {}^2\Pi$ TRANSITIONS, by M. Lapp. Technical note no. 11 on Contract AF 18(603)2. May 60, 45p. 17 refs. AFOSR-TN-60-666; AD-239 582.
Order from LC mi$3.30, ph$7.80 PB 149 139

The f-number for the (0,0)-band of the $^2\Sigma \longrightarrow {}^2\Pi$ transitions of OH has been found to be $(0.9 \pm 0.5) \times 10^{-3}$. A shock tube was used to produce hot gas samples at temperatures from 3300 to 3900°K with equilibrium partial pressures of OH of 0.004 to 0.02 atm. The emission intensities were measured photoelectrically as a function of time behind the reflected shock in a selected spectral interval. These results were then related to the f-number by means of an absolute intensity calibration. (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
SHOCK-TUBE MEASUREMENTS OF THE HOMOGENEOUS RATE OF DECOMPOSITION OF NH_3 IN NH_3-Ar MIXTURES, by T. A. Jacobs. Technical note no. 12 on Contract AF 16(603)2. May 60, 12p. 14 refs. AFOSR-TN-60-667; AD-239 584.
Order from LC mi$2.40, ph$3.30 PB 149 140

The advent of the shock tube and "fast" infrared detectors have now made possible a method for the measurement of the homogeneous decomposition rate. This paper reports the results of preliminary activation energy measurements for the homogeneous decomposition of NH_3. (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
VIBRATIONAL RELAXATION IN CYLINDRICAL CHAMBERS CONTAINING ISOTHERMAL, DILUTE GAS MIXTURES, by S. S. Penner, D. Olfe, and T. A. Jacobs. Technical note no. 13 on Contract AF 18(603)2. May 60, 14p. 9 refs. AFOSR-TN-60-668; AD-239 585.
Order from LC mi$2.40, ph$3.30 PB 149 141

The problem is considered of vibrational excitation in the presence of an external radiation field and deexcitation in the absence of the field for stationary, dilute systems in cylindrical containers in which surface deactivation of excited species is so effective as to reduce the concentration of vibrationally excited molecules to zero at the bounding surfaces. The rate of excitation in an external radiation field is examined and the subsequent rate of deexcitation when the external radiation field is removed.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
INTERFEROMETRIC DETERMINATION OF FAR INFRARED LINE WIDTHS, by Ernest V. Loewenstein. Progress rept. on Contract AF 18(600)1307. 1 Jan 60, 122p. 22 refs. AFOSR-TN-60-65.
Order from LC mi$6.30, ph$19.80 PB 149 162

A study has been made of pressure broadening of two pure rotational lines: the line of ammonia at 20 cm^{-1} and that of hydrogen chloride at 40 cm^{-1}. The data have been analyzed by the Ladenburg-Reiche method to obtain the widths of the lines. The experimental uncertainties present in the data made it necessary to use the calculated line strengths in order to arrive at values of the widths. In addition, the transmission spectra of several discs of sapphire have been measured. The channel spectrum arising in the sapphire has been analyzed for index of refraction and extinction coefficient. The channel spectrum shows clearly that sapphire is birefringent. The transmission of sapphire in the far infrared has also been determined.

Massachusetts Inst. of Tech., Cambridge.
INFRARED SPECTRA OF ADSORBED MOLECULES, by Carl W. Garland. Final rept. for 1 Nov 55-30 June 69 on Contract Nonr-1841(01). 30 Oct 59, 18p. 3 refs. AD-228 622.
Order from LC mi$2.40, ph$3.30 PB 149 515

An analysis is given of work on CO chemisorbed on rhodium and on the effect of poisoning with CS_2 on the spectrum of CO adsorbed on nickel. New work on the desorption of CO from nickel samples of varying composition and the reaction of CO with nickel surfaces to form $Ni(CO)_4$ is reported. Brief mention is made of some results for CO on cobalt samples. (Author)

Massachusetts Inst. of Tech., Cambridge.
SOLID-STATE AND MOLECULAR THEORY GROUP. Quarterly progress rept. no. 34 on Contract Nonr-1841(34). 15 Oct 59, 90p. 77 refs. AD-227 806.
Order from LC mi$4.80, ph$13.80 PB 149 517

Contents:
Energy bands in iron
Note on the structure of the 3d bands in iron group crystals
Atomic scattering factors for the iron transition series
Restricted and unrestricted Hartree-Fock calculations for atomic lithium
On the role of the equivalence restriction in molecular claculations
Interaction of a hole with mobile lattice ions in KCl
An inductive method for generating the irreducible representations of the group of spin coordinate permutations
Non-empirical calculations for small atoms
Non-empirical calculations for smale molecules
Computer techniques
Programming notes
Diatomic molecular integral program for IBM 704 computer
Solid state calculations
Symmetrized plane wave program
(See also PB 146 031)

Ohio State U. Research Foundation, Columbus.
OPTICAL CONSTANTS OF SOME IONIC CRYSTALS IN THE REGION OF THEIR FAR INFRARED EIGENFREQUENCIES, by Ely E. Bell and Raymond L. Brown. Scientific rept. no. 2 on Contract AF 19(604)4119. 17 Nov 59, 72p. 35 refs. AFCRC-TN-60-260; AD-233 492.
Order from LC mi$4.50, ph$12.30 PB 147 807

The percent transmission of LiF, NaCl, NaBr, KCl, KBr, and KI was measured in the far infrared region of strong absorption neighboring the eigenwavelength. This was done for 3 samples of each material. The samples were prepared by evaporating, in a high vacuum, thin films (0.1 to 1μ thick) of material onto collodion substrates. The transmission measurements were made for sample temperatures of about 300°K and about 100°K. From the transmission measurements the values of the eigenwavelength for each material were determined to within ±0.1μ at both temperatures. The classical dispersion formula was assumed to describe correctly the wavelength dependence of n and k in the region of strong absorption. Values for the constants of the dispersion formula were determined which gave good agreement between the measured transmission and the transmission calculated using an approximate transmission formula. These constants were used in the dispersion formula in the calculation of values of n and k for several wavelengths within the region of strong absorption. This was done for each material at both temperatures. Where similar data existed a comparison was made with the results obtained in the present work. In all cases the agreement was within the experimental accuracy of the investigation. (Author)

Padova U. (Italy).
ON THE ELECTRONIC AND MICROWAVE SPECTRUM OF FORMYL FLUORIDE, by G. Semerano. Final technical rept., for 1 Feb 59-31 Jan 60, on Contract DA 91-591-EUC-1050. [1960] 26p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 149 450

Contents:
Semiempirical calculations of the low energy levels of HFCO with emphasis on the comparison with analogous calculations for the formaldehyde levels
Vibrational analysis of the $n \rightarrow \pi$ transition
Rotational analysis by microwave spectroscopy
(See also PB 143 052)

Purdue Research Foundation, Lafayette, Ind.
THE ARC SPECTRUM OF CESIUM, by H. Kleiman and K. W. Meissner. Technical rept. no. 1 on Spectroscopic Research, Contract Nonr-1100(08). Oct 59, 39p. 31 refs. AD-228 375.
Order from LC mi$3.00, ph$6.30 PB 149 501

Precision measurements were made on 63 lines in the arc spectrum of Cs. The first 3 members of the principal series were measured interferometrically for the first time, allowing improvement in the level scheme. Comparison was made of the wavelengths emitted by 2 different light sources, a Geissler tube and an electrodeless discharge lamp, and a relative shift was found in the high members of the fundamental series. The term values found were fitted to extended Ritz type formulas with fair accuracy. The polarization formula was used to fit the fundamental series. (Author)

Stanford Research Inst., Menlo Park, Calif.
MASS SPECTROMETRIC STUDY OF THE HEATS OF DIMERIZATION OF THE ALKALI CHLORIDES, by Thomas A. Milne and H. Michael Klein. Technical note no. 6 on Contract AF 49(638)89. June 60, 29p. 46 refs. AFOSR-TN-60-512. AD-239 918.
Order from LC mi$2.70, ph$4.80 PB 149 159

The heats of sublimation of the important species in equilibrium with the five alkali chlorides have been determined using the Bendix time-of-flight mass spectrometer. The mass spectrometrically determined differences between the heats of sublimation of monomer and dimer have been combined with the best available value for the monomer heat of sublimation to calculate the dimerization energies for all five salts. For LiCl a trimerization energy was also determined. These results are compared with the results of previous studies. (Author)

Virginia U., Charlottesville.
ENERGY SPECTRUM OF THE PHOTONEUTRONS FROM GOLD, by R. F. Askew and A. P. Batson. Technical note on Contract AF 49(638)176. July 60, 19p. 7 refs. AFOSR-TN-60-790.
Order from LC mi$2.40, ph$3.30 PB 149 223

The energy spectrum of the neutrons produced at 90° to a gold target bombarded with 55 Mev bremstrahlung has been measured. Nuclear emulsions were used to detect the photoneutrons. The spectrum shows two peaks. The large peak at 1.25 Mev can be interpreted as due to the statistical decay of the compound nucleus. The smaller peak at about 5.5 Mev is assumed to come from a "direct" transition, as described by the Wilkinson model. In the appendix a new method is presented for the calculation of the corrections involved for those proton recoils which leave the emulsion. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
ELECTRIC-FIELD-INDUCED INFRARED SPECTRUM by R. W. Terhune. Rept. on Project Michigan, Contract DA 36-039-sc-78801. May 59, 15p. 14 refs. Rept. no. 2900-1-T.
Order from LC mi$2.40, ph$3.30 PB 147 275

A supplemental technique for molecular spectroscopy has been developed to measure very small percentage absorptions in the infrared at comparatively high resolution. Changes in transmission of 1 part in 10,000 with a resolution of 1 cm^{-1} at 4000 cm^{-1} were readily measured by modulating the absorption. Electric-field-induced absorption was observed for some 8 vibration-rotation transitions of H_2 and 7 of D_2. Also, the Stark effect on an infrared active vibration of NH_3 was observed. (Author)

Optics

Institute of Mathematical Sciences, New York U., N. Y.
A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS, by J. H. Rohrbaugh. Scientific rept. no. 10, 1 Dec 59-29 Feb 60, on Contract AF 19(604)2673, continuation of Contracts W28-099-ac-171, AF 19(122)4, and AF 19(604)1115. [1960] 13p. 3 refs. AFCRC-TN-60-561.
Order from LC mi$2.40, ph$3.30 PB 149 172

A comparison and evaluation is made of the low temperature specific heat and resultant Debye temperature variations for NaCl as calculated here by Arase as compared to the work of Lundquist and of Karo. Further testing and improvement of the spectrometer is also reported. (Author) (See also PB 145 651)

Naval Ordnance Test Station, China Lake, Calif.
DESIGN OF FOUR GENERAL-PURPOSE INFRARED LENSES, by J. R. Snyder. 18 Nov 59, 22p. 2 refs. NOTS TP-2430; NAVORD rept. 7041; AD-235 313.
Order from LC mi$2.40, ph$3.30 PB 147 810

Four infrared lenses have been designed for general purpose use in the wavelength region of 2.0 to 11.0μ. No aspheric surfaces or mirrors are employed. Focal-length to aperture ratios range from 5.0 to 1.13, focal lengths from 2.0 to 24.0 in. and fields covered from 2.0 to 40.0°. The image of a point source varies from 0.6 to 4 milliradians. (Author)

Razdow Labs., Inc., Newark, N. J.
DETERMINATION OF DESIGN DATA FOR THE TRACKER EVALUATING SYSTEM, by A. Razdow. Quarterly rept. no. 1, 12 Jan-15 Apr 59, on Optical Tracker Evaluation and Accuracy Test System, Contract DA 36-039-sc-78271. [1959] 66p.
Order from LC mi$3.90, ph$10.80 PB 148 337

The subject of this report is the analysis of the basic problems connected with the evaluation of optical target locator systems and the search for simple solutions to these problems. It deals specifically with the compilation of data for the exact calculation of the various dimensions and angles. A detailed analysis is made of the minimum requirements for the dimensional and angular tolerances design data for the determination of baselines and the definition of errors in the test system and system under test. (Author)

Razdow Labs., Inc., Newark, N. J.
DETERMINATION OF DESIGN DATA FOR THE TRACKER EVALUATING SYSTEM, by A. Razdow. Quarterly rept. no. 2, 16 Apr-17 July 59, on Optical Tracker Evaluation and Accuracy Test System, Contract DA 36-039-sc-78271. [1959] 86p.
Order from LC mi$4.80, ph$13.80 PB 148 338

The subject of this report is the analysis of the problem of dynamic evaluation of optical trackers, the analysis of pertinent problems of geodetic measurements, the application of astronomical techniques, the analysis of energy transmission of a light link, the investigation of external error producing factors, and a preliminary design plan for the evaluation system. One version of the evaluation system was breadboarded and tested on an Askania Cine-Theodolite. Formulae are derived for the location of a concealed axis of rotation with respect to an external point and also for the transformation of externally measured angles to the coordinate system of the optical tracker. The problem of the dynamic evaluation of infrared tracking systems is investigated and a solution proposed. (Author) (See also PB 148 337)

Razdow Labs., Newark, N. J.
DETERMINATION OF DESIGN DATA FOR THE TRACKER EVALUATION SYSTEM, by A. Razdow and Elliott F. Cameron. Quarterly rept. no. 3, 18 July-19 Oct 1959, on Optical Tracker Evaluation and Accuracy Test System, Contract DA 36-039-sc 78271. [1959] 33p.
Order from LC mi$3.00, ph$6.30 PB 148 339

The scope of this report includes the design parameters of the search beam, the definition of reference lines and checking of scale accuracy by astronomical means, and a design which includes the sensing of the angular velocity of the tracker and the synchronization of the target flashes with the mid exposure position of the camera shutter. This preliminary design is adaptable to servo driven and manually operated tracking instruments which may be equipped with either single frame cameras or intermittent motion picture cameras. The theory involved in the determination of the time of transit of a particular star at a given meridian is explained and illustrated with a detailed example. The application of this theory to the static and dynamic testing of an optical tracker is further developed. (Author) (See also PB 148 338)

Scripps Institution of Oceanography, U. of California, La Jolla.
ON THE STRUCTURE OF THE LIGHT FIELD AT SHALLOW DEPTHS IN DEEP HOMOGENEOUS HYDROSOLS, by Rudolph W. Preisendorfer. Rept. no. 3-5 on Contract NObs-72039. Mar 59, 50p. 6 refs. AD-216 039.
Order from LC mi$3.30, ph$7.80 PB 148 375

Recent experimental determinations of the up and downwelling irradiances in Lake Pend Oreille are studied with the purpose of explaining certain observed nonlinear trends in the semilog plots of these irradiances at shallow depths. A mathematical model which describes these irradiances is derived from the basic equations of radiative transfer. The model explains the observed phenomena in terms of the inherent optical properties of the medium and its external lighting conditions. On the basis of the cited experimental evidence and supporting theory hypotheses about light fields in all homogeneous natural hydrosols are proposed.

Visibility Lab., U. of California, San Diego.
THE CONTRAST TRANSMITTANCE DISTRIBUTION AS A POSSIBLE TOOL IN VISIBILITY CALCULATIONS, by Rudolph W. Preisendorfer and James L. Harris. Rept. on Contract NObs-72092. 1 Oct 58, 15p. 2 refs. SIO Ref. 58-68; AD-212 697.
Order from LC mi$2.40, ph$3 30 PB 148 377

The purpose of this note is to introduce the concept of the contrast transmittance distribution and to point out its potentially useful application to the general visibility problems in natural aerosols and hydrosols. It is shown that the contrast transmittance distribution: (a) can quite generally be assigned the status of an (apparent) optical property of scattering-absorbing media. (b) possesses certain useful analytical properties which are precisely analogous to those of the well-known beam transmittance function T_1. (c) can eliminate the need for the explicit determination of the volume attenuation function ε insofar as ε is required in the customary solution procedures of apparent contrast problems.

Visibility Lab., U. of California, San Diego.
A STUDY OF LIGHT-STORAGE PHENOMENA IN SCATTERING MEDIA, by Rudolph W. Preisendorfer. Rept. on Contract NObs-72092. Mar 59, 43p. 2 refs. SIO Reference 59-12; AD-213 774.
Order from LC mi$3.30, ep$9.30 PB 150 154

This report released for sale to the public 13 Sep 60.

Solid State Physics

Air Force Cambridge Research Center, Bedford, Mass.
THIN FILM EVAPORATION TECHNIQUES, by I. Berman. Mar 60, 13p. 8 refs. AFCRC-TN-60-382.
Order from LC mi$2.40, ph$3.30 PB 148 969

P-N junctions were made by evaporating aluminum upon N-type silicon held at fixed temperature. These junctions were measured by metallograph techniques. A description is given of the evaporating techniques and a discussion of the system is presented. (Author)

Armour Research Foundation, Chicago, Ill.
EXCESS NOISE IN SEMICONDUCTORS, by James J. Brophy. Rept. for 15 Nov 58-14 Nov 59 on Contract NOnr-1800(00). 22 Oct 59, 82p. 6 refs. ARF 1066, Summary rept. no. 4; AD-228 634.
Order from LC mi$4.80, ph$13.80 PB 149 505

Random electrical noise phenomena in solids was studied to understand the origin of 1/f noise in ZnO and to apply noise measurements to the problem of trapping transitions and neutral energy transport in

cadmium sulfide. A characteristic relaxation time of 500 μsec associated with exciton diffusion or other neutral transport in CdS was established from noise measurements. Under uniform illumination the current noise in single crystal CdS may be interpreted in terms of multiple trapping in shallow levels within 0.5 volts of the conduction band. Discrete levels at 0.36 and 0.43 volts were observed in lightly doped crystals. Noise measurements are particularly suitable for determination of frequency factors of such traps and values ranging from 10^8 to 10^{11} sec^{-1} are derived. It is possible to account semi-quantitatively for the 1/f noise present in some crystals on the basis of the exponential trap distribution determined from photoconductivity experiments and the constant frequency factor of these traps derived from low frequency noise measurements. (Author) (See also PB 144 274)

[Army] Signal [Research and Development Lab.]
Fort Monmouth, N. J.
MEASUREMENT OF THE COMPLEX DIELECTRIC CONSTANT OF VERY HIGH DIELECTRIC CONSTANT MATERIALS AT MICROWAVE FREQUENCIES, by Isidore Bady. 22 Apr 54, 52p. Technical memo. no. M-1569.
Order from LC mi$..60, ph$9.30 PB 149 419

Two methods for the measurement of the complex dielectric constant of very high dielectric constant materials at microwave frequencies are given. The first method is suitable for low loss or moderately lossy samples, and the second method is suitable for very lossy samples. In the first method, the sample is placed in a wave guide with a signal generator and slotted section (or pair of directional couplers) on one side, and a movable short on the other side. Measurement of the maximum and minimum VSWR's obtained when the position of the short is varied, gives sufficient information to calculate the complex dielectric constant of the sample. In the second method, the sample is placed in a wave guide with a signal generator and slotted section on one side, and a slotted section and movable short on the other side. Measurement of the ratio of the field intensities in the two slotted section as the short is adjusted to give resonance in the second slotted section, and measurement of VSWR in the first slotted section, give sufficient information to calculate the complex dielectric constant of the material. The sensitivity of the measurement can be increased by tuning out all or part of the mismatch on the generator side of the sample. (Author)

Case Inst. of Tech., Cleveland, Ohio.
THE PRESSURE VARIATION OF THE ELASTIC CONSTANTS OF SODIUM, by W. B. Daniels. Technical rept. no. 3 on Contract Nonr-1141(05). June 58, 25p. 22 refs.
Order from LC mi$2.70, ph$4.80 PB 147 262

The pressure variation of the single crystal elastic constants of sodium at room temperature using a modified ultrasonic pulse echo method are: $dC_{44}/dP = 1.63$, $dC'/dP = 0.226$, $dB_S/dP = 3.60$.

Detroit U., Mich.
THE STUDY OF PROPERTIES OF SINGLE CdS AND ZnS CRYSTALS FOR USE AS DETECTORS IN CRYSTAL COUNTERS, by S. J. Czyzak, H. Payne and others. Technical rept. no. 5, 1 Sep 58-31 Aug 59 on Contract Nonr-1511(01). 1 Oct 59, 37p. 27 refs. AD-227 777.
Order from LC mi$3.00, ph$6.30 PB 149 503

Progress is reported on the growing of single CdS and ZnS crystals. A new technique in powder preparation has produced single crystals of greater purity. By heat treating the grown crystals hexagonal ZnS crystals were produced more easily than the cubic ZnS crystals, the reaction in the latter being sluggish. More accurate data was obtained by employing new techniques and more sensitive apparatus in the measurement of the electrical properties of CdS and ZnS. Rechecking of data shows the results to be consistent. Electron polarizabilities of free positive ions were calculated. The work on dislocation studies of Zns single crystals is being continued. (See also PB 143 223)

Gordon McKay Lab. of Applied [Science] Harvard U., Cambridge, Mass.
MICROWAVE PROPERTIES AND APPLICATIONS OF GARNET MATERIALS, by G. P. Rodrigue. Scientific rept. no. 13 on Contract AF 19(604)1084. 15 Aug 57, 26p. 27 refs. AFCRC-TN-57-786; AD-133 740.
Order from LC mi$2.70, ph$4.80 PB 146 562

The known microwave properties of the new garnet materials are summarized briefly and compared to those of the more conventional ferrites. In order to facilitate the explanation of the operation of some new types of microwave devices, recent theories of ferromagnetic resonance developed by Suhl and by Walker are outlined. Possible applications of the yttrium garnet material include low frequency conventional microwave elements, frequency doublers and detectors, a new type of microwave limiter, and the recently announced ferromagnetic amplifier. The advantages that yttrium iron garnet offer in each of these devices are briefly discussed. (Author)

Horizons, Inc., Cleveland, Ohio.
FERROELECTRIC FILMS, by Richard A. Fotland. Final rept. on Contract AF 19(604)5499. Apr 60, 18p. 3 refs. AFCRC-TR-60-141.
Order from LC mi$2.40, ph$3.30 PB 148 817

Procedures have been evolved for preparing uniform 20 micron thick films of ferroelectric sodium niobate and barium-lead titanate ceramic materials. The procedure involves first grinding the materials to colloid size. The fine particles are then dispersed in water using a colloid mill and a deflocculent. Films are then formed on a glass plate, using an organic film as an interlayer, by pouring the suspension on the plate and allowing the water to evaporate. Separation of the film from the glass plate is accomplished by rapidly volatilizing the interlayer at a high temperature. Strict attention to details of cleanliness must be observed in order to prevent the formation of pinholes in the film. Vitrification of the films is performed with the films resting on a fine particle size, partially sintered zirconia layer. (Author)

Illinois U., Urbana.
COLOR CENTER REACTIONS IN THE ALKALI HALIDES, by Jack Kingsley. Technical note no. 2 on Research on the Electronic Properties of Nonmetallic Crystals, Contract AF 49(638)529. June 60, 129p. 40 refs. AFOSR-TN-60-635.
Order from LC mi$6.30, ph$19.80 PB 148 971

A variety of experiments have been performed with the object of understanding certain color center phenomena so as to shed light on the nature of the defects in the alkali halides and the mechanisms of their formation and destruction. More specifically, these experiments were directed toward the photoconductive, bleaching and restoration properties of the V_4 center and toward a study of the details of the processes involving the destruction of V_1 centers. The majority of the experiments were performed on potassium bromide.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
MOBILITY OF AN ELECTRON IN THE DONOR IMPURITY BAND OF A COMPENSATED SEMICONDUCTOR, by Alexei A. Maradudin and Barry S. Gourary (Applied Physics Lab., Johns Hopkins U.). Rept. on Contracts AF 18(600)1315 and NOrd-7386. Feb 60, 22p. 7 refs. Technical note. BN-190; AFOSR-TN-60-201; AD-234 103.
Order from LC mi$2.70, ph$4.80 PB 147 617

The motion of an electron is studied in an aperiodic one-dimensional potential consisting of a random linear array of attractive delta-function potentials of equal strength. It is shown that the ground state of this electron is nondegenerate, and that its energy is separated from that of the next higher energy state by a gap. These 2 results imply that mobility in such a system is an activated process. The relevance of the present model to impurity band conduction in nearly compensated semiconductors is pointed out, and its relation to the recent work of N. F. Mott [Can. J. Phys. 34:1356, 1956] is discussed. (Author)

Johns Hopkins U., Baltimore, Md.
STUDIES OF CONTACTS WITH BARRIERS IN BETWEEN, by Hans Meissner. Final rept. on Contract Nonr-248(49). Sep 59, 51p. 28 refs. AD-225 070.
Order from LC mi$3.60, ph$9.30 PB 148 889

Maryland U., College Park.
FREQUENCY SPECTRA OF LATTICES WHOSE PARTICLES INTERACT WITH LONG RANGE FORCES, by John A. Davies. Doctoral thesis. Rept. on Contract AF 49(638)399. Apr 60, 195p. 20 refs. Technical rept. no. 174; AFOSR-TN-60-386; AD-237 704.
Order from LC mi$8.90, ph$30.30 PB 149 538

The properties of the normal mode frequency spectra of lattices in which long range interactions exist between the lattice particles are studied for two- and three-dimensional crystal models. The models are (1) two-dimensional square lattices with either transverse vibrations normal to the plane of the lattice, or with longitudinal vibrations in the plane of the lattice; and (2) a three-dimensional simple cubic lattice. The types of interactions assumed to exist between lattice particle are pair potentials varying as inverse powers of the distance between the interacting particles. Long range interactions are found to give rise to types of singularities in the frequency spectrum, and its derivatives, which do not occur when only short range interactions exist in the lattice. The nature of these singularities is studied, and several examples are given. A treatment of lattice models having only short range interactions between constituent particles is given for purposes of comparison with the long range potential models. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
COEFFICIENTS OF CONDENSATION AND EVAPORATION, by J. P. Hirth and G. M. Pound. Technical rept no. 3 on Contract Nonr-760(17). 15 Oct 59, 35p. 50 refs. AD-229 107.
Order from LC mi$3.00, ph$6.30 PB 149 474

Since the relation between the vapor pressure of a substance and the flux of the substance leaving a surface in equilibrium with the vapor was developed, there has been a vast research effort to investigate the quantity α_j ambiguously called the condensation coefficient, the evaporation coefficient, or the accomodation coefficient. In general, α_j in condensation does not equal α_j in evaporation under similar experimental conditions as was assumed by early investigators. Also, there are often several factors affecting α_j which may or may not be mutually independent. This has resulted in doubtful interpretations of α_j in the literature. Accordingly, the following treatment of the various factors affecting J_i is presented in order that the interaction of these factors might be better understood.

Microwave Lab., Stanford U., Calif.
WALKER MODES IN LARGE FERRITE SAMPLES, by B. A. Auld. Scientific rept. no. 20 on Contract AF 19(604)1930. Apr 60, 20p. 6 refs. M. L. rept. no. 709; AFCRC-TN-60-383.
Order from LC mi$2.40, ph$3.30 PB 149 247

The modes of resonance for a ferrite strip and a ferrite post resonator between conducting planes are found by taking appropriate combinations of uniform plane wave solutions. It is shown that magnetostatic resonances (Walker modes) may exist even when the resonator dimensions are arbitrarily large, provided the mode indices satisfy certain restrictions. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
TRANSMISSION LINE FORMULATION FOR SEMICONDUCTORS, by Herbert Kurss. Quarterly rept. no. 12, 1 Apr-30 June 59, on Contract DA 36-039-sc-73052. 28 Sep 59, 26p. Rept. R-523.35-59; PIB-453.35; AD-228 468.
Order from LC mi$2.70, ph$4.80 PB 146 454

A calculation of two points in the band structure of Lithium is tabulated with the aid of the new formulae for structure constants. The problem of determining those crystal planes which possess an orthogonal basis is reduced to a set of diophantine equations and, in a sense, solved. A priori constraints for the network

aspect of a set of coupled transmission lines are analyzed. These constraints are that the network conserve an inner product of terminal quantities where this inner product is (a) bilinear or (b) Hermitian-bilinear. (Author) (See also PB 145 896)

Naval Ordnance Lab., White Oak, Md.
RESEARCH ON PHOTOCONDUCTIVE FILMS OF THE LEAD SALTS, by Richard L. Petritz and James N. Humphrey. 13 Nov 57, 44p. 75 refs. NAVORD rept. 6042; AD-159 799.
Order from LC mi$3.30, ph$7.80 PB 147 227

A review is given of recent research on the photoconductive process in lead salt films. The paper begins with a discussion of the basic models of photoconductivity. The majority carrier model is then analyzed in detail and formulae for the responsivity, noise, and noise-equivalent power are developed. Experimental studies of the sensitization process barrier modulation, noise, quantum efficiency, responsivity, and noise-equivalent power are then discussed in terms of the majority carrier model. (Author)

Northwestern Technological Inst., Evanston, Ill.
TEMPERATURE AND COMPOSITION DEPENDENCE OF THE STRENGTH OF Al BASE Zn ALLOY SINGLE CRYSTALS, by J. Dash and M. E. Fine. Rept. on Contract AF 49(638)524. May 60, 16p. 19 refs. AFOSR-TN-60-524.
Order from LC mi$2.40, ph$3.30 PB 149 537

The critical resolved shear stress, σ_c, of zone-hardened Al base Zn alloys was found to increase with $c_{Zn})^{1/2}$ at room temperature, suggesting that the stress necessary to shear the zones is larger than that necessary to overcome the Mott-Nabarro misfit stresses. On cooling to 4.2°K, σ_c of a particular alloy (e.g. 5.3 at .% Zn) increases considerably more than predicted. This is attributed in part to off-center cutting of zones and in part to cutting of mismatch dislocations presumed to be located in the region between the core of the zone and the depleted shell.

Notre Dame U., Ind.
ELECTRON EMISSION FROM A SINGLE CRYSTAL, by E. A. Coomes. Reprint series. Technical rept. on Contract Nonr-1623(01). 12 Oct 59, 26p. 23 refs. AD-229 451.
Order from LC mi$2.70, ph$4.80 PB 149 511

A model for electron emission is presented which parallels volume transport theory and allows the interpretation of a number of perplexing experimental surface effects in a simple consistent manner. Use of the model raises the question of validity of assigning a surface potential barrier to the face of a perfect crystal. (Author)

Ohio State U. Research Foundation, Columbus.
STUDY OF THE MECHANISM OF ENDOTHERMIC REACTIONS PHOTOSENSITIZED ON SOLID SURFACES, by Jack G. Calvert. Final rept. on Contract AF 19(604)4069. Dec 59, 28p. 11 refs. AFCRC-TR-60-222; AD-233 258.
Order from LC mi$2.70, ph$4.80 PB 149 260

Samples of CdS, CdSe, and CdTe were prepared in our laboratory and/or obtained from commercial suppliers. The light-absorbing properties of the solids were determined by reflectance measurements. This work proved that CdS(s) is not suitable for use as a light-to-chemical energy converter in aqueous suspensions containing oxygen. CdSe(s)-O_2-H_2O(1) system also shown to be unsuitable as an energy converter in oxygen-containing aqueous systems. CdTe(s)-O_2-H_2O(1) system appeared to be ideally suited for consideration as a solar-to-chemical energy converter.

Pennsylvania U., Philadelphia.
INVESTIGATION OF PHYSICAL PROPERTIES OF SEMICONDUCTORS, by Max E. Caspari. Rept. on Research on Physical Phenomena Affecting the Characteristics of Electronic Components, Contract AF 33(616)3376. Apr 60, 53p. 9 refs. WADC Technical rept. 59-549.
Order from OTS $1.50 PB 161 903

Part of the research effort described in this report was devoted to the investigation of materials which may have interesting semiconducting properties at high temperatures. In particular solid solutions and compounds of metals and tungsten trioxide have been investigated. It was found that lead forms solid solutions with tungsten trioxide over a wide composition range but has metallic electrical properties. Copper tungstate and a compound containing a small amount of silver in tungsten trioxide were found to have interesting semiconducting properties. Aluminum boride was found to be a semiconductor with a large activation energy. Coupled with the preparation, chemical analysis and determination of electrical properties of these compounds, a crystal structure determination of triclinic copper tungstate was initiated. A study of the Faraday effect at microwave frequencies on n- and p-type germanium and silicon was carried out over a wide temperature range as a function of the static magnetic field, leading to information regarding the effective masses, life-times and mobilities of the charge carriers. Optical investigations of iodine single crystals showed the latter to be a semiconductor with a large activation energy. A large electrostrictive effect was measured in rutile single crystals and surface rather than volume imperfections were shown to have an effect on the breakdown strength in Harshaw KCl crystals. (Author)

Purdue Research Foundation, Lafayette, Ind.
SILICON CRYSTAL PERFECTION STUDY, by H. U. Yearian. Quarterly rept. no. 3, 1 Dec 58-28 Feb 59, on Contract DA 36-039-sc-77991. [1959] 29p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 149 110

Single crystals of Si have been pulled from a quartz crucible heated by a regulated carbon resistance furnace in either a He or A atmosphere. A small dislocation free seed was used with <111> growth axis. Initially there was no physical separation of the gas flowing over the crucible and the radiation shielded heater. Under these conditions the dislocation density was in the neighborhood of a few tens to a few hundred per cm^2 and twinning not associated with known changes in growing conditions occurred frequently. By isolating

the crucible gas from the heater, reducing gas contamination by hydrocarbon vapors, and by careful preparation of the seed, the dislocation density was reduced to less than $10/cm^2$ in favorable cases of seeding and growth control. The only twins observed were associated with an irregularity in the temperature control which can be eliminated. The factors affecting plastic deformation during crystal growth and the optimum growing conditions were formulated. A regulated RF converter and puller were installed for experiments on extending the small seed technique to pulling from a molten zone supported by surface tension on the end of a silicon rod. Preliminary experiments with unregulated equipment gave some promise of success. (Author) (See also PB 142 703)

Rutgers State U., New Brunswick, N. J.
X-RAY STUDY OF LATTICE DEFECTS IN FATIGUED SINGLE CRYSTALS, by A. Shrier, S. Weissmann, and J. J. Slade, Jr. Technical note no. 2 on Contract AF 49(638)17. July 60, 58p. 37 refs. AFOSR-TN-60-519.
Order from LC mi$3.60, ph$9.30 PB 149 154

Annealed silver single crystals grown from the melt with a (111) orientation were subjected to cyclic bending and were studied below and above the fatigue limit (10^7 cycles). High resolution x-ray methods were employed which included the Schulz reflection topography method, the x-ray reflection microscopy method with continuous speciment rotation, the double-crystal diffractometer method supplemented by x-ray reflection microscopy and the divergent x-ray beam back-reflection method. The x-ray studies were carried out as functions of increased number of cycles and position of specimen areas and were also supplemented by microhardness investigations. It was possible to discern three distinct stages in low-stress fatigue: in high-stress fatigue the effects of all three stages were juxtaposed and the characteristic fatigue phenomena developed at a higher rate.

Stanford Electronics Labs., Stanford U., Calif.
STUDIES OF MICROPLASMAS AND HIGH-FIELD EFFECTS ON SILICON. Final rept. on Contract DA 36-039-sc-78272. 15 Feb 60, 33p; AD-236 849.
Order from LC mi$3.00, ph$6.30 PB 149 411

This study is concerned with producing a p-n junction device for obtaining high internal fields perpendicular to a silicon surface. This device will ultimately be used to study microplasmas and high field effects in silicon. The work has proceeded in three steps. The first step was to achieve a reproducible diffusion process. The next step was the construction of the device itself. Essentially, the device is a guard ring diode with a very shallow junction which under reverse bias will, hopefully, avalanche uniformly over the junction area. In the avalanche condition the device emits light in the region of breakdown, the glow being produced by hot hole-hot, electron recombination in the high fields present. The devices constructed experienced avalanche breakdown in isolated spots rather than uniform breakdown over the junction area. The attempt to correlate these breakdown spots with surface imperfections led to the discovery that surface imperfections introduced during the construction of the device were directly related to the breakdown phenomenon. Attempts to understand the nature of the surface imperfections constitute the present stage of the research. (See also PB 147 933)

Stanford U., Calif.
THE SPECIFIC HEAT OF THE EXCHANGE SYSTEM OF SOME FREE RADICALS BETWEEN 1.6° AND 4.2°K, by J. P. Goldsborough, M. Mandel, and G. E. Pake. Rept. on Paramagnetic Resonance, Contract AF 18(603)131. June 60, 9p. 7 refs. Technical note no. 131-6; AFOSR-TN-60-585.
Order from LC mi$1.80, ph$1.80 PB 148 552

Portions of this report will not reproduce well.

Technical Research Group, Syosset, N. Y.
DEVELOPMENT OF THE PERIODIC SHOCK WAVE TECHNIQUE AND ITS APPLICATION TO THE PREPARATION OF SEMICONDUCTOR SILICON CARBIDE, by J. Dharma Teja. Final rept. for 15 Aug 57-15 Oct 59 on Contract AF 19(604)2665. Jan 60, 165p. 77 refs. TRG-117-FR; AFCRC-TR-60-105.
Order from LC mi$7.80, ph$25.80 PB 149 789

The periodic shock tube has been investigated as a high temperature device for the pyrolytic decomposition of various organo-silicon compounds, into silicon carbide. Temperatures in the range 1100°F were produced in a periodic shock tube (gas driven jet resonance tube). Results of hundreds of experimental runs show that silicon carbide is obtained in a comparatively impure form in such a shock tube. Gram quantities of silicon carbide were thus prepared. X-ray diffraction analyses indicate that both α- and β-forms of silicon carbide are formed in the pyrolysis showing large temperature gradients in the shock tube. Since times of the order of one minute were employed in each experimental run, adequate time was not available for crystal growth, and hence only micro-crystalline silicon carbide is produced. (Author) (See also PB 138 704)

Watertown Arsenal Labs., Mass.
CRYSTALLOGRAPHIC AND MICROSTRUCTURAL CHANGES OCCURRING DURING THE GRAPHITIZATION OF A PETROLEUM COKE, by Aram Tarpinian. Jan 60, 46p. 25 refs. Technical rept. no. WAL TR 825.5/1; AD-234 186.
Order from LC mi$3.30, ph$7.80 PB 146 997

An analysis is made of the growth kinetics of carbon crystallites in a Gulf Coast crude petroleum coke. In the range of 2000° to 2500°C an activation energy of 90 - 120 K cal/mol was determined for growth parallel to the c-axis; from 2500° to 2800°C a lower activation energy of 20 - 30 K cal/mol was observed. Cathodic etching techniques were utilized to prepare powdered coke specimens for microstructural examination. Significant changes in microstructure were observed at approximately the same temperature range (2400° - 2500°C) in which the activation energy for crystallite growth changed to the lower value. (Author) (Several color photographs will not reproduce)

Theoretical Physics

Air Force Missile Development Center, Holloman AFB, N. Mex.
PHENOMENOLOGICAL THEORY OF THE ONE-DIMENSIONAL STATIONARY SHOCK WAVE, by Bruno Manz. July 60, 140p. 15 refs. AFMDC TR-60-12.
Order from LC mi$6.90, ph$21.30 PB 149 306

Known results from the physics of shock waves are combined here with new results. The main features, or results, are: (1) a more refined application of the Second Law of Thermodynamics; (2) a critical review of the concept of a shock thickness as a criterion for the applicability of ordinary thermodynamics: (3) its replacement by a new criterion which is based on a formula of Enskog for the specific entropy of a heat-conducting viscous gas which departs from external equilibrium; (4) a mathematical discussion of the non-linear second-order differential equation for the velocity with respect to the possibility of oscillations occurring inside the shock zone; (5) an iteration method leading to the approximation of the original second-order differential equation by a first-order differential equation which is integrable; (6) the conclusion that the initial Mach number generally cannot exceed a certain limit which depends on the Prandtl number and which is infinite for Prandtl numbers greater than 0.56 ($\gamma = 1.4$); (7) a closed-form solution for the velocity as an implicit function of x which holds for Prandtel numbers in the neighborhood of unity and for not-too-great initial Mach numbers. (Author)

Avco-Everett Research Lab., Mass.
COLLISION FREE MAGNETOHYDRODYNAMIC SHOCK WAVE, by A. Kantrowitz, R. M. Patrick, and H. E. Petschek. Rept. on Contracts AF 49(638)61 and Nonr-2524(00). Aug 59, 15p. 6 refs. Research rept. 63; [AFOSR TN-59-1190] AD-228 384.
Order from LC mi$2.40, ph$3.30 PB 148 187

It is assumed that the dissipation in a collision free shock produces a random distribution to magneto-hydrodynamic waves. These waves are then treated as the fundamental particles of the plasma. A rough kinetic theory is developed which estimates the heat conduction coefficient due to the waves. Using this heat conduction coefficient, the shock thickness is estimated to be about 4 times the characteristic ion Larmour radius. This prediction is in rough agreement with experimental results obtained in a MAST device. (Author)

Avco-[Everett] Research Lab., Mass.
SUPERSONIC TWO-DIMENSIONAL MAGNETOHYDRODYNAMIC FLOW, by F. Fishman, J. Lothrop and others. Rept. on Contracts AF 04(647)278 and AF 49(638)61. Feb 59, 50p. 7 refs. Research rept. 39; [AFOSR TN-59-290; AD-212 922]
Order from LC mi$3.30, ph$7.80 PB 147 199

The problem treated in this paper is the experimental and theoretical treatment of a two-dimensional supersonic flow problem. In order to emphasize the magnetohydrodynamic effects and minimize ordinary flow effects, a problem has been chosen in which there are virtually no solid bodies in the flow field, but only a magnetic field. This situation can be approximated by using the magnetic field of a loosely wound circular solenoid. A flow perpendicular to the axis of the solenoid will have only a weak interaction with the wire of the solenoid. For reasonable magnetic field strengths the interaction with the magnetic field of the solenoid can be much larger.

Centro di Studio per la Fisica Delle Microonde (Italy).
ON THE THEORY OF SOME CERENKOVIAN EFFECTS, by Giuliano Toraldo di Francia. Technical note no. 7 on Contract AF 61(052)67. Feb 60, 22p. 17 refs. AFCRC-TN-60-566.
Order from LC mi$2.70, ph$4.80 PB 149 583

The field generated by a charged particle in uniform straight motion is expanded into a set of evanescent waves. The expansion is valid in any half-space with no points in common with the path of the particle. The evanescent waves may impinge on the surface of an optical diffraction grating and be diffracted. Some of the diffracted waves turn out to be ordinary plane waves, which carry energy away from the grating. It is possible in this way to explain the Smith and Purcell effect and to derive some quantitative conclusions. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
MAGNETOHYDRODYNAMIC SIMPLE WAVES (SUPPLEMENT) by Y. M. Lynn. Rept. on Contract AF 49(638)476. May 60, 25p. AFOSR Technical note TN-59-1302, sup.
Order from LC mi$2.70, ph$4.80 PB 148 929

In this supplement an exact analytic solution of the simple wave problem is presented, as well as some further computations of integral curves for fast waves. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
ON A POSSIBLE NEW EXPERIMENTAL TEST OF GENERAL RELATIVITY THEORY, by L. I. Schiff. Technical note no. 12 on Contract AF 49(638)388. Feb 60, 10p. 8 refs. AFOSR-TN-60-199; AD-233 744.
Order from LC mi$1.80, ph$1.80 PB 147 616

An experiment is proposed that would provide a genuine test of the general theory of relativity. This consists of observation of the precession of the axis of a torque-free gyroscope that is either fixed in a laboratory (rotating with the earth), or located in a satellite. It is also suggested that a gyroscope made of a superconducting sphere supported by a static magnetic field might be used for this experiment, and possibly also for an experimental investigation of Mach's principle.

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
EXCITATION OF ALFVEN WAVES, by Roy W. Gould. Rept. on Advanced Propulsion Systems, Contract AF 04(647)309. 24 May 60, 26p. 7 refs. STL/TR-60-0000-09143.
Order from LC mi$2.70, ph$4.80 PB 149 896

This memorandum examines the nature of waves which can propagate in a cold plasma which is immersed in a strong magnetic field and surrounded by a perfectly conducting cylinder.

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
MAGNETIC PLASMA PROPULSION BY MEANS OF A TRAVELLING SINUSOIDAL FIELD, by Rudolf X. Meyer. Rept. on Contract AF 04(647)309. 30 Apr 60, 19p. 8 refs. STL/TR-60-0000-09114.
Order from LC mi$2.40, ph$3.30 PB 148 923

A theoretical model for electrodeless plasma propulsion by means of a time-dependent magnetic field is considered. The plasma is propelled by the peristaltic motion caused by an externally applied travelling magnetic field. The field is sinusoidal and purely transverse in the plane of symmetry. The model is based on the assumption of a fully ionized gas of finite conductivity. The conductivity is assumed to be sufficiently high to permit neglecting the kinetic energy associated with the leakage velocity of the plasma through the magnetic field. The plasma motion is therefore determined by the equilibrium of ponderomotive force and pressure gradient, and is somewhat analogous to the flow of a cold, viscous gas percolating through a porous medium. Temperature and conductivity can be shown to be approximately constant. The quantity of greatest interest is the pressure ratio sustained per half-wavelength of the applied magnetic field. An explicit expression for the case of zero magnetic Reynolds number is given in terms of an integral over the reciprocal of a Legendre elliptic integral. Numerical results are given. (Author)

Thermodynamics

AeroChem Research Labs., Inc., Princeton, N. J.
REACTION RATE DISTRIBUTIONS ON CATALYTIC SURFACES. II. COMPARISON OF EXACT AND APPROXIMATE FLAT PLATE SOLUTIONS FOR ASYMPTOTICALLY SMALL PRANDTL NUMBER, by Daniel E. Rosner. Rept. on Contracts AF 49(638)300 and AF 33(616)6216. Apr 60, 14p. 19 refs. Technical pub. no. 16; AFOSR-TN-60-690.
Order from LC mi$2.40, ph$3.30 PB 148 230

A chemical reaction rate distribution along a catalytic plate immersed in a uniform incompressible fluid stream containing a reactant in dilute amounts is shown to satisfy a familiar integral equation when the Prandtl number for diffusion ($Pr_D \equiv \nu/D$) asymptotically approaches zero. The closed form, exact solution to the catalytic plate problem provides a convenient standard against which two approximate methods, intended to span the entire range of Prandtl numbers, are compared. It is concluded from this comparison that global diffusion corrections η (= actual over-all conversion/chemically controlled conversion) computed assuming a constant (fictitious) reactant concentration along the catalytic surface probably represent exact solutions to the laminar diffusion layer equations (with first order chemical reaction) to within 4.8 percent over the entire range of Prandtl number $Pr_D = \nu/D$. (See also PB 140 809)

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
A STUDY OF FREE CONVECTION BOUNDARY LAYER OSCILLATIONS AND THEIR EFFECTS ON HEAT TRANSFER, by Jack P. Holman, Harold E. Gartrell, and Erich E. Soehgren. Dec 59, 42p. 7 refs. WADD Technical rept. 59-3.
Order from OTS $1.25 PB 161 941

Wave length, wave speed, and wave amplitudes of artificially induced oscillations in a free convection boundary layer on a vertical, isothermal, flat plate were measured with a Zehnder-Mach interferometer. It was found that, as the oscillations amplify in their movement up the plate, the wave energy increased more rapidly in the outer layers of the boundary layer than in the layers close to the wall. When the wave energy in the outer layers became sufficiently high transition to turbulence began. It was also observed that the time averaged heat transfer coefficient for the oscillating boundary layer was the same as the theoretical steady state value, within the range of the experimental error. (Author)

Avco-[Everett] Research Lab., Mass.
LAMINAR HEAT TRANSFER AROUND BLUNT BODIES IN DISSOCIATED AIR, by N. H. Kemp, P. H. Rose, and R. W. Detra. Rept. on Contract AF 04(645)18. May 58, 36p. 12 refs. Research rept. 15.
Order from LC mi$3.00, ph$6.30 PB 147 192

In the present work the local similarity differential equations are solved exactly, with variable external pressure gradient parameter, variable $\rho\mu$, and inclusion of the dissipation term. Lewis number effects are also discussed. This is accomplished numerically by an extension of the method which Fay and Riddel used at the stagnation point. The solutions which depend on the local external flow conditions, vary around the body, in contrast to the constant values used by Lees. Attention is restricted to bodies of revolution at zero angle of incidence. Results for two-dimensional bodies could be obtained by the same method.

Avco-[Everett] Research Lab., Mass.
A QUANTITATIVE RAPID RESPONSE ATOM DETECTOR, by Kurt L. Wray. Rept. on Contract AF 04(645)18. Mar 59, 16p. 5 refs. Research rept. 46.
Order from LC mi$2.40, ph$3.30 PB 146 659

A fine platinum wire resistance thermometer which serves as a rapid response atom detector is described. The platinum wire surface catalyzes the recombination of the atoms striking it and the liberated heat of recombination increases the temperature of the wire. In use, a constant electric current is passed through

the wire and the voltage drop across the wire is monitored as a function of time on an oscilloscope. Equations are developed which quantitatively relate the observed signal to the atom concentration when the detector is simultaneously subjected to atom flux and electrical heating. An electrical calibration technique is given for the detector which is independent of a known atomic concentration. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A METHOD OF DETERMINING THE HEAT CONDUCTIVITY COEFFICIENT OF A GAS WITH A SINGLE AC HEATED HOT WIRE, by Herbert J. Bomelburg. May 60, 19p. 3 refs. Rept. no. 1107.
Order from LC mi$2.40, ph$3.30 PB 149 238

A method is theoretically derived and experimentally verified for measuring the heat conductivity coefficient of a gas with a single ac heated hot wire. It is based on the determination of the phase lag between the heating current and the resulting temperature fluctuations of the wire. For temperatures up to about 300°C the experimental results were in good agreement with existing textbook data but at temperatures above 300°C systematic deviations are evident. This paper tries to give a possible explanation for this unexpected behavior. (Author)

Brown U. Div. of Engineering, Providence, R. I.
HEAT TRANSFER FROM SURFACES OF NON-UNIFORM TEMPERATURE DISTRIBUTION, FINAL REPORT. PART I. LOCAL RATES OF MASS TRANSFER FROM CYLINDERS IN CROSS FLOW, by H. H. Sogin, V. S. Subramanian, and R. J. Sogin. Rept. on Contract AF 49(638)46. May 60, 75p. 29 refs. AFOSR-TR-60-78.
Order from LC mi$4.50, ph$12.30 PB 149 597

This is an investigation of the distribution of the local rate of mass transfer from 4.2-in.-diameter naphthalene cylinders to air flowing normal to the axis. The air speeds, ranging from 58 to 166 ft/sec, are in the critical zone. The temperatures range from 73.6 to 84.7°F. The results in the laminar region have been compared with predictions based on the approximate boundary-layer calculations of H. Schuh and of H. J. Merk. Also, the results are compared with the heat transfer measurements of Schmidt and Wenner and of Zapp, and the mass transfer measurements of Winding and Cheney. The effect of changing the turbulence intensity of the main stream from 0.8 to 2.4 per cent by means of a wire grid is also presented. (Author) (See also PB 139 919)

Brown U. Div. of Engineering, Providence, R. I.
HEAT TRANSFER FROM SURFACES OF NON-UNIFORM TEMPERATURE DISTRIBUTION. FINAL REPORT, PART II. LOCAL SUBLIMATION FROM DISKS IN AXISYMMETRIC FLOW, by H. H. Sogin and V. Oskay. Rept. on Contract AF 49(638)46. July 60, 48p. 18 refs. AFOSR-TR-60-78.
Order from LC mi$3.30, ph$7.80 PB 149 598

The radial distribution of the local rate of mass transfer is measured on 4 in. naphthalene disks facing air streams in axisymmetric flow. The air speeds range from 71 to 128 ft/sec, and the temperature from 75 to 90°F. The results are compared with the solution by Merk. The effect of a change in turbulence intensity from 0.8 to 2.4 per cent is included. Experimental results on disks with inert central regions are compared with a wedge-type step function factor. (Author) (See also PB 149 597)

California Inst. of Tech., Pasadena.
GROWTH OF VAPOR BUBBLES IN A RAPIDLY HEATED LIQUID, by S. A. Zwick. Rept. on Contract Nonr-220(28). Sep 59, 21p. 7 refs. Engineering Div. rept. no. 85-13; AD-227 651.
Order from LC mi$2.70, ph$4.80 PB 148 895

The previous theory of the growth of vapor bubbles in superheated liquids is extended to the situation in which the rate of temperature rise of the liquid is large. Numerical solutions are presented for the early stages of bubble growth for various rates of liquid temperature rise. The asymptotic behavior of a bubble is found explicitly for a temperature rise of the liquid which is linear in the time. The asymptotic behavior consists of an early phase in which the radius increases like $t^{1/2}$ and a later phase in which the radius increases like $t^{3/2}$. These 2 phases are joined in a continuous manner. The $t^{3/2}$ solution occurs not only for rapid rates of temperature rise but also for moderate temperature rise rates provided the bubble growth is followed for a sufficiently long time. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
HEAT CONDUCTION IN A MELTING SLAB: AN EXACT SOLUTION, by R. W. Sanders. Technical note on Flight Sciences. July 60, 23p. 2 refs. LMSD-288274.
Order from LC mi$2.70, ph$4.80 PB 149 327

Transient heat conduction in melting finite solids is discussed. Solutions are determined for which the melting rate is inversely proportional to the amount of unmelted material. The solutions obtained demonstrate that a better measure of accuracy for any numerical procedure is its ability to predict the melting rate and not the grosser quantity — the total amount melted. (Author)

National Bureau of Standards, Washington, D. C.
THERMODYNAMIC FUNCTIONS FOR ATOMIC IONS, by Harold W. Woolley. Rept. on Contract SWR-53-1014. Apr 57, 114p. 28 refs. AFSWC-TR-56-34; AD-96 302.
Order from LC mi$6.00, ph$18.30 PB 150 099

This report released for sale to the public 30 Aug 60.

The calculation of equilibrium thermodynamics properties of a chemically reacting mixture of gases at such high temperatures that ionic forms are appreciably present is discussed with special consideration of cluster theory.

Ohio State U. Research Foundation, Columbus.
INFRARED EMISSION SPECTRUM OF GASEOUS HBO_2. THERMAL FUNCTIONS, by D. White, D. E. Mann and others. Technical rept. no. 3 on Contract Nonr-495(12). June 59, 22p. 11 refs. RF Proj. 691; AD-220 495.
Order from LC mi$2.70, ph$4.80 PB 149 259

The system $B_2O_3(l) + H_2O(g)$ at elevated temperatures has been investigated spectroscopically in the infrared region 700 to 4000 cm^{-1}. A vapor species, HBO_2, has been identified at partial pressures of water in the range 1 to 15 mm and three emission bands of this molecule observed, at approximately 3680, 2030 and 1420 cm^{-1}. Approximate B^{-10}-B^{-11} and H-D isotope shifts are given.

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
EXTENDED HYPERVELOCITY GAS DYNAMIC CHARTS FOR EQUILIBRIUM AIR, by Richard W. Ziemer. Rept. on Contract AF 04(647)309. 14 Apr 60, 43p. 3 refs. STL/TR-60-0000-09093.
Order from LC mi$3.30, ph$7.80 PB 149 218

The gas dynamic properties associated with a traveling normal shock, stationary normal shock, stagnation point, and reflected normal shock were computed for incident shock velocities of up to Mach 50. The computation, one of successive approximations and utilizing graphical thermodynamic data, has an estimated accuracy of 1 to 10 percent, with the major portion correct to within 5 percent. The properties of density, pressure, temperature, internal energy and enthalpy are plotted versus shock velocity for initial densities of 10^{-1} to 10^{-5} times atmospheric density and an initial temperature of 273.2°K. A Mollier diagram and an enthalpy-density cross-plot are included. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
ON NEAR-EQUILIBRIUM AND NEAR-FROZEN BEHAVIOR OF ONE-DIMENSIONAL FLOW, by Martin H. Bloom and Lu Ting. Rept. on Contract AF 40(600)732. July 60, 27p. 10 refs. AEDC TN-60-156; PIBAL R-525
Order from LC mi$2.70, ph$4.80 PB 149 747

Near-equilibrium and near-frozen one-dimensional inviscid flows downstream of an initial station at which the flow is in equilibrium have been examined by means of perturbation analyses. The near-equilibrium analysis requires the application of boundary layer techniques. The near-frozen analysis is of standard type. It is demonstrated that both types of flow behave in a frozen manner near the initial station. However the near-equilibrium flow quickly approaches the equilibrium behavior. Examples have been presented for both cases utilizing a dissociating model gas after Lighthill. Representative numerical results are included. (Author)

Princeton U., N. J.
ENTROPY PRODUCTION AND PRESSURE WAVES, by Gerald Rosen. Rept. on Project Squid, Contract Nonr-1858(25). June 59, 13p. 7 refs. Technical rept. PR-90-P.
Order from LC mi$2.40, ph$3.30 PB 146 538

Neglecting thermal conduction and viscous dissipation, the velocity-free equations of one-dimensional flow are derived with the inclusion of general fluid thermodynamics. The strength of finite amplitude pressure waves is introduced into the theory. This quantity is conserved if the entropy of each fluid particle remains constant with time. The growth or decay of the strength is examined for a perfect gas which produces entropy. (Author)

Stanford U., Calif.
THERMAL STRESS DUE TO DISTURBANCE OF UNIFORM HEAT FLOW BY CAVITIES AND INCLUSIONS, by J. N. Goodier and A. L. Florence. Rept. on Contract Nonr-225(29). 15 July 59. 101p. 3 refs. Div. of Engineering Mechanics technical rept. no. 120; AD-225 882.
Order from LC mi$5.70, ph$16.80 PB 147 799

Steady heat flow under a uniform temperature gradient in a linear isotropic homogeneous material does not induce thermal stress, if the body is free to expand. Thermal stress is induced, however, if the heat flow is distrubed by an inclusion of another material, or a cavity. Solutions are obtained of problems of this type concerning inclusions in thin plates, the special cases considered being the circular and elliptic inclusions and the insulated ovaloid hole. It was assumed that the surface of the plate is insulated. The problems are reduced to isothermal boundary load problems, and these are solved by the methods of N. I. Muskhelishvili, the regions of the inclusions being mapped conformally in the unit circle. Solutions are given of the 3-dimensional axi-symmetric problems of the spherical inclusion and the insulated prolate and oblate spheroidal cavities. Computations for the stress distribution around some prolate and oblate cavities are also presented. (Author)

Wave Propagation

Airborne Instruments Lab., Mineola, N. Y.
TIME-FREQUENCY VARIATION OF TROPOSPHERIC SCATTER PROPAGATION, by W. E. Landauer. Interim rept. no. 4, Feb-May 59, on Contract DA 36-039-sc-73276. 16 June 58, 16p. Rept. no. 4231-1-4.
Order from LC mi$2.40, ph$3.30 PB 149 020

Progress in the design and construction of the transmitter and receiver is discussed. (Author) (See also PB 149 019)

Airborne Instruments Lab., Mineola, N. Y.
TIME-FREQUENCY VARIATION OF TROPOSPHERIC SCATTER PROPAGATION, by W. E. Landauer. Interim rept. no. 5, June-12 Oct 58, on Contract DA 36-039-sc-73276. 31 Oct 58, 14p. Rept. no. 4231-1-5.
Order from LC mi$2.40, ph$3.30 PB 149 021

The receiver has been completed and is set up at the Département de Physique Appliquée of Compagnie Générale de Télégraphie Sans Fil at Orsay (Seine-et-Oise) France, for combined testing with the transmitter. As a result of these tests, a number of

changes are being made in the transmitter. Antennas for the proposed link have been mounted at link terminals. (Author) (See also PB 149 020)

Airborne Instruments Lab., Inc., Mineola, N. Y.
TIME-FREQUENCY VARIATION OF TROPOSPHERIC SCATTER PROPAGATION, by W. E. Landauer. Quarterly rept. no. 2, Aug-Oct 57, on Contract DA 36-039-sc-73276. 15 Nov 57, 23p. Rept. no. 4231-1-2; AD-161 432.
Order from LC mi$2.70, ph$4.80 PB 149 018

The desired frequency behavior of the carcinotron was obtained by means of 3 servo loops. The first loop slaves the carcinotron frequency to the 14th harmonic of a frequency modulator. The linearity sweep period and endpoints of the carcinotron sweep are determined by the properties of this modulator, differing only by errors of the servo loop. A second servo loop fixes the endpoints of the modulator sweep. Crystal filters are used to provide pulses that invert the sweep direction of the modulator. The third servo loop controls the slope of the input applied to the modulator (and to the carcinotron) to ensure that the modulator reaches the inflection points of its frequency sweep in time coincidence with the sync pulses. This is accomplished by varying the gain of the amplifier in accordance with the time difference between the sync pulses and a set of pulses (called frequency pulses) that are coincident with the sweep inflection points. An error in the timing of the inflection points may require several sweep cycles for correction. For the receiver system, a super-heterodyne receiver with a tracking local oscillator was the most suitable. Tests on a local oscillator for the receiver are in progress.

Airborne Instruments Lab., Inc., Mineola, N. Y.
TIME-FREQUENCY VARIATION OF TROPOSPHERIC SCATTER PROPAGATION, by W. E. Landauer. Quarterly rept. no. 3, Nov 57-Jan 58, on Contract DA 36-039-sc-73276. 17 Feb 58, 19p. Rept. no. 4231-1-3; AD-159 114.
Order from LC mi$2.40, ph$3.30 PB 149 019

The design of the transmitter was revised because of difficulties encountered in the servo loop that was utilized to align the frequency inflection pulses with the synchronizing pulses. Instead of fixing the endpoints of the frequency sweep by crystal filters and using the difference in time between the frequency and synchronizing pulses to control the slope of the sweep voltage, the frequency sweep will be inverted at fixed moments of time, as determined by the synchronizing pulses. A voltage-sensing circuit at the discriminator output was used to identify the location of the signal frequency within the IF amplifier pass band. The AFC level sensor permitted data display only when the discriminator output was within limits corresponding to intermediate frequency within about 1 or 2 db of the peak response of the IF pass band. The characteristic of the discriminator is such that the second range of frequencies corresponds to frequencies at which the IF gain is more tha 40 db below its center frequency gain. An oscilloscope type of frequency-time-intensity display was chosen. Preliminary measurements were performed on the integrator that provides the sweep voltage. The IF amplifier, limiter, and discriminator were constructed. (See also PB 149 018)

Airborne Instruments Lab., Mineola, N. Y.
TIME-FREQUENCY VARIATION OF TROPOSPHERIC SCATTER PROPAGATION, by W. E. Landauer and J. C. Greene. Annual rept. (Final) on Contract DA 36-039-sc-73276. Feb 59, 47p. 2 refs. Rept. no. 4231-1. Order from LC mi$3.30, ph$7.80 PB 149 022

A tropospheric scatter link has been established in France using a transmitter with a frequency that is swept in a triangular fashion between 3100 and 3600 Mc at a 10-cps sweep rate. A superheterodyne receiver, with a local-oscillator sweep synchronized with the transmitter sweep, is used to measure the amplitude of received signals as a simultaneous function of frequency and time. Preliminary data from this link show that there are many frequency bands within the swept-frequency range where the received signal level exceeds the median level by about 10 db. These privileged transmission bands are relatively stationary in frequency and time, being generally wider than 4 Mc (ofteh 10 to 20 Mc wide) and persisting for periods of from 5 to 20 seconds. These data suggest the possibility of a scatter link using a frequency-seeking system to exploit the privileged transmission frequencies, and are also of considerable interest in the theory of scatter propagation. (Author)

Columbia U. School of Engineering, New York.
THE SPECTRAL DENSITY OF A MULTIPLY SCATTERED ELECTROMAGNETIC FIELD, by Dimitri S. Bugnolo. Doctoral thesis. Final rept. on Contract AF 49(638)350. 31 May 60, 89p. 8 refs. CU-13-60-AF-350-EE; AFOSR-TR-60-10.
Order from LC mi$4.80, ph$13.80 PB 149 783

This dissertation is concerned with the derivation of a transport equation for the spectral distribution of the photon density function in positional velocity space. The general theory is applied in detail to the case of multiple scattering by random dielectric noise and is independent of any particular model. A method of solution is developed for the special case of forward scattering. The results are applied in detail to the earth's troposphere.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
SIGNALS REFLECTED FROM THE MOON, by H. D. Webb. Final rept. for 1 Feb 57-31 Dec 59 on Contract DA 36-039-sc-73163. 29 Feb 60, 75p. 25 refs. AD-236 064.
Order from LC mi$4.50, ph$12.30 PB 149 015

The modifications made in the antenna and receiving equipment, and the development of supplementary equipment are described. The reception of moon reflections at 151.11 mc, 413 mc, and 448 mc are summarized. Other types of signal reception include satellite signals, signals at 151.11 mc by scatter mechanism, and radio noise from the sun and radio stars. A history of refiction of radio waves from the moon is given. A development of an equation for Faraday rotation in mks units is given. Some data were analyzed for Faraday rotation and some for amplitude fading. The Faraday rotation was used to calculate the change in electron content following ionospheric sunrise and shortly before sunset. Changes of about 1.8×10^{15} electrons/sq m/min were

obtained. Fading rates were analyzed by autocorrelograms. Propagation path attenuation is given, but the values are in doubt because of lack of knowledge of transmitter characteristics. (Author)

Lincoln Lab., Mass. Inst. of Tech., Lexington, Mass.
RADIO REFRACTION IN A COOL EXPONENTIAL ATMOSPHERE, by J. R. Bauer, W. C. Mason, and F. A. Wilson. Rept. on Contract AF 19(122)458. 27 Aug 58, 32p. 9 refs. Technical rept. no. 186; AD-202 331.
Order from LC mi$3.00, ph$6.30 PB 147 347

Equations are derived for computing the height of a radar target or other radio scatterer as a function of observed (or virtual) slant range and elevation angle of arrival for the case of propagation through a spherically symmetric nondispersive atmosphere with an arbitrary refractive index distribution n(h). The method is applied to calculate propagation through the lower atmosphere when the refractive index of the troposphere obeys the exponential law $n(h) = 1 + \alpha \cdot \exp[-\beta h]$. When these results are compared with calculations based on the 4/3 earth's radius principle, serious discrepancies are found in the latter principle at ranges exceeding about 100 n. mi. Interpolated values of height vs range for the exponential model are tabulated in 10-n. mi. intervals of range to a maximum range of 360 n. mi., for elevation angles of 0^{o} to 90^{o}, to a maximum height of 100,000 feet.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
RELATION BETWEEN A CLASS OF TWO-DIMENSIONAL AND THREE-DIMENSIONAL DIFFRACTION PROBLEMS, by L. B. Felsen and S. N. Karp. Rept. on Contract AF 19(604)4143. 12 Jan 59, 26p. 7 refs. Scientific rept. no. R-694-58; PIB-622; AFCRC-TN-59-130; AD-210 493.
Order from LC mi$2.70, ph$4.80 PB 146 526

By means of a certain transformation, a relationship is demonstrated between a class of two-dimensional and three-dimensional scalar or electromagnetic diffraction problems. The basic three-dimensional configuration consists of a perfectly reflecting half plane excited by a ring source centered about the edge and having a variation $\exp(\pm i\phi/2)$, where ϕ is the azimuthal variable; in addition, a perfectly reflecting rotationally symmetric obstacle whose surface is defined by $f(\rho, z) = 0$ (ρ, z are cylindrical coordinates), may be superposed about the edge (z-axis). This problem is shown to be simply related to the two-dimensional one for the line source excited configuration $f(y, z) = 0$, where y and z are Cartesian coordinates. Various special obstacle configurations are treated in detail.

Motorola, Inc., Phoenix, Ariz.
ELECTROMAGNETIC PROPAGATION STUDY, by Robert J. Solem and John H. Thess. Semi-annual rept. for period ending 31 Mar 59 on Contract DA 36-039-sc-74841. [1959] 35p. 7 refs. AD-228 363.
Order from LC mi$3.00, ph$6.30 PB 149 371

Ducting (or trapping), a special case of tropospheric refraction, is shown to be a possible model of propagation of energy between two AN/PPN-13 equipments. This phenomena is described in terms of refractive modulus, and the mechanics of duct trapping are briefly presented from a qualitative ray-tracing aspect. Further, a background in meteorology, and those atmospheric conditions which lead to the formation of ducts, is presented. A study of the effects of multi-path propagation on AN/PPN-13 system distance-measuring accuracy is made. An equation for the envelope of the total response to two signals (a typical multi-path situation) is developed on the Appendix and applied to several examples of reflection percentages and time delays. These examples are illustrated and the indicated errors resulting from the various conditions imposed are tabulated. (Author) (See also PB 149 371)

Motorola, Inc., Phoenix, Ariz.
ELECTROMAGNETIC PROPAGATION STUDY, by J. H. Thess. Semi-annual rept. for period ending 30 Sep 59 on Contract DA 36-039-sc-74841. [1959] 5 refs. AD-234 964.
Order from LC mi$3.00, ph$6.30 PB 148 334

The effects of multi-path propagation on the AN/PPN-13 and Tellurometer systems of distance measurement are experimentally investigated. Errors for various single reflection amplitudes and delays are experimentally determined in a laboratory multi-path simulation. Actual field data is collected and analyzed for operation over line-of-sight land paths with low ground clearance. System accuracy is shown to be unaffected by ground-reflected waves over this type of path. (Author)

National Bureau of Standards, Boulder, Colo.
AMPLITUDE AND PHASE OF THE LOW- AND VERY-LOW-RADIO FREQUENCY GROUND WAVE, by J. R. Johler, L. C. Walters, and C. M. Lilley. 1 June 60, 43p. 4 refs. Technical note no. 60.
Order from OTS $0.75 PB 161 561

Graphs and tables of the low- and very low-radio-frequency ground wave are presented as a function of frequency, 100 c/s to 1000 kc. (Author)

National Bureau of Standards, Boulder, Colo.
PROCEEDINGS OF THE 1960 CONFERENCE ON THE PROPAGATION OF E. L. F. RADIO WAVES HELD 26 JANUARY 1960. 6 June 60, 27p. 3 refs. Technical note 61.
Order from OTS $0.75 PB 161 562

Abstracts are given of the following papers:
Frequency spectra of transient e.m. pulses in a conducting medium
Measurements of the spectrum of radio noise from 50 to 100 cycles per second
Natural electromagnetic energy in frequencies below slow tail sferics band
Studies of natural electric and magnetic fields
A proposed experiment to determine ELF propagation characteristics

Electrical resistivity studies on the Athabasca Glacier, Alberta, Canada
Half wave cylindrical antenna in a dissipative medium: current and impedance
A very-low frequency antenna for investigating the ionosphere with horizontally polarized radio waves
Sub-audio frequency (1 to 50 c/s) geomagnetic fluctuations at Denver, Colorado
Dipol radiation in a conducting half-space
Possible application of the system loss concept at ELF
Some ELF phenomena
Field strength measurements in fresh water
Slow tails from intra-cloud lightning discharges
Mode theory and the propagation of E.L.F. radio waves
ELF electric fields from thunderstorms
Useful radiation from an underground antenna

RCA Victor Co., Ltd. (Canada).
ELECTROMAGNETIC WAVE PROPAGATION OVER THE SURFACE OF THE EARTH (ELECTROMAGNETIC WAVE PROPAGATION OVER NATURAL OBSTACLES). Final rept. on Contract AF 19(604)3049. Mar 60, 104p. 30 refs. AFCRC-TR-60-138-1.
Order from LC mi$5.70, ph$16.80 PB 148 790

Scale model laboratory experiments have been utilized to simulate the propagation of electromagnetic waves over the surface of the earth. The major advantage of the scale model techniques has been the ease with which control can be exercised over the pertinent parameters. As a result, the influence of critical factors could be specifically ascertained. Two general aspects of propagation over the earth's surface have been of concern, namely, the effect of the shape of dominant obstacles, such as mountains, on wave propagation and secondly the effect of the location and nature of reflecting ground on the radio energy at the receiving site. This report deals with electromagnetic wave propagation over dominant obstacles.

Stanford Electronics Labs., Stanford U., Calif.
NIGHT-TIME EQUATORIAL PROPAGATION AT 50 Mc/s; FINAL RESULTS FROM AN IGY AMATEUR OBSERVING PROGRAM, by M. P. Southworth. Final rept. on Contract AF 19(604)5235. 31 May 60, 142p. 16 refs. [AFCRC] TR-60-281.
Order from LC mi$7.20, ph$22.80 PB 149 307

Transequatorial scatter or "TE" causes vhf signals to propagate over 5,000-10,000-km transequatorial paths during the evening hours. Diurnal and seasonal plots are presented for typical paths, and it is concluded that there are actually two kinds of evening transequatorial propagation. The first type provides steady signals and is best between 1800 and 1900 local time. The second gives signals a deep flutter fade and maximizes at 2000-2200 local time. Both types occur most often during the equinoxes. The optimum path for both is one symmetrical both geographically and magnetically to the magnetic dip equator, normal to the magnetic equator and about 6000 km long. Amateurs often make contacts over distances of 200-4000 km at the same time TE is present. Amateur work in South America is compared with results from 50- to 50-Mc backscatter soundings made at Puerto Rico. TE is shown to correlate negatively with magnetic activity and positively with spread F and with the height of the F-layer on the equator at 1900 local time. Either magnetic or h'F data for this hour can be used to predict spread F and TE a few hours later, especially at the equinoxes. The early type of TE is believed to involve the "billiard ball" mode in which there are two successive reflections from either side of the equatorial bulge in the ionosphere without any intermediate ground reflection. The type of TE with fluttery signals is believed to be F scatter from turbulence caused by the collapsing equatorial bulge.

Woods Hole Oceanographic Institution, Mass.
RADIATION OF WAVES FROM A POINT SOURCE, by Robert McKelvey. Technical rept. on Contract Nonr-891(00). May 59, 15p. 3 refs. Reference no. 59-23.
Order from LC mi$2.40, ph$3.30 PB 146 570

The object of this note is to obtain an expression for a radiation solution of the wave equation in medium which is in general inhomogeneous and non-isotropic. The form of solution obtained is identical with that found by the method of Hadamard. We give a direct verification which avoids many of the complications of that method but which preserves its spirit. The particular case of an isotropic continuously stratified medium is worked out in detail. (Author)

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Naval Ordnance Test Station, China Lake, Calif.
EXPERIMENTAL DESIGN AND USEFUL TECHNIQUES OF ANALYSIS, by R. L. Eidemiller. 2 Apr 59, 60p. 21 refs. NOTS TP 2186; NAVORD rept. 6466; AD-216 636.
Order from LC mi$3.60, ph$9.30 PB 147 608

The planning and conducting of statistically designed experiments and the selection of actual designs are discussed. Several techniques that are useful in the analysis of observed data of an experiment are included: (1) an IBM 704 program for computation and analysis, (2) two methods for estimating missing values, (3) Tukey's method for individual mean comparisons, (4) attribute analysis techniques including Fisher's "Exact Method" and Batson's proposed "Factorial Chi-Square Analysis," and (5) Box's technique for optimizing a response surface including a numerical example. The appendixes contain many fractional factorial designs that are ready for use, and a direct entry table for Fisher's exact method for analyzing a 2 x 2 contingency table. (Author)

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly rept. for Jan-Mar 60. June 60, 42p. 17 refs. NAVWEPS rept. 5996; NOLC rept. 503.
Order from LC mi$3.30, ph$7.80 PB 149 084

Contents:
Communication stochastics
Ferromagnetic resonance
High temperature polymer program
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(See also PB 147 512)

SOCIAL SCIENCES

Applied Mathematics and Statistics Labs., Stanford U., Calif.
COMPETITIVE STABILITY UNDER WEAK GROSS SUBSTITUTABILITY: NONLINEAR PRICE ADJUSTMENT AND ADAPTIVE EXPECTATIONS, by Kenneth J. Arrow and Leonid Hurwicz. Technical rept. no. 78 on Contract Nonr-225(50). 12 Oct 59, 33p. 17 refs.
Order from LC mi$3.00, ph$6.30 PB 149 487

McKenzie's dynamic system, which is the most general yet proposed, is considered, and it is demonstrated that if there exists at least one strictly positive equilibrium, then the path defined by the dynamic system from any starting point will converge to a limit which, of course, must be an equilibrium. This theorem is stronger than McKenzie's in the sense that the type of stability proved is somewhat stronger. The method of proof is somewhat novel. (See also PB 147 058)

California U., Los Angeles.
AN ECONOMIC ANALYSIS OF THE SHORT RUN EQUILIBRIUM OF A JOB SHOP--AN EXTENSION OF THE THEORY OF THE FIRM, by Yoshiro Kuratani. Rept. on Management Sciences Research Proj. [Contract Nonr-223(02)] 8 July 58, 11p. 1 ref. Discussion paper no. 71.
Order from LC mi$2.40, ph$3.30 PB 148 837

An economic analysis on the job shop's behavior heretofore unattempted in the traditional economic analysis. Attention has generally been focused on the type of the firm which produces for the market and not to customers' orders. The analysis of the present paper is aimed toward firms producing to fill orders already on hand. The presentation is general and applies to many subcontractor types of firms in whose operation delivery time plays a strategic role. (Author)

California U., Los Angeles.
PRICE-TEMPORAL EQUILIBRIUM -- AN EQUILIBRIUM ANALYSIS OF MARKETS UNDER CONTRACTS, by Yoshiro Kuratani. Rept. on Management Sciences Research Proj. [Contract Nonr-223(02)] 12 May 59, 16p. 4 refs. Discussion paper no. 72.
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A standard demand and supply analysis seldom goes beyond price and quantity dimensions and even in the case where a third factor, quality variations for example, is considered, the other independent variable namely, price, is treated as a parameter. While this approach has a great merit of simplicity, it is bound to become utterly inadequate when the parametric treatment of one factor grossly distorts the market behavior due to the wilful neglect of the interrelation among the factors. The analysis presented here aiming at the behavior of the market under contracts is the first step towards constructing a more general theory of the firm which considers eventually all the relevant factors simultaneously, including the traditional demand and supply analysis as a special case. (Author)

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Biology and Medicine

Semiannual report to The Atomic Energy Commission, by L. O. Jacobson and M. Doyle. Argonne Cancer Research Hospital, Chicago, Ill. Mar 60. Contract AT-(11-1)-69. 118p. Order from OTS. $2.75. ACRH-13

Metabolism of W^{185} in the rat, by J. E. Ballou. Hanford Atomic Products Operation, Richland, Wash. Mar 60. Contract AT(45-1)-1350. 12p. Order from OTS. 50 cents. HW-64112

Blast biology. Technical progress report, by C. S. White and D. R. Richmond. Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Sep 59. Contract AT (29-1)-1242. 89p. Order from OTS. $1.00. TID-5764

A trapezoidal-wave electromagnetic blood flowmeter, by H. M. Yanof and P. Salz. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 42p. Order from OTS. $1.00. UCRL-9204

Toxicology of beryllium: A bibliography, by E. D. Hutchinson and others. The University of Rochester, Rochester, N. Y. Mar 60. Contract W-7401-eng-49. 74p. Order from OTS. $2.00. UR-570

The accumulation of Po^{210} in the rat during multiple inhalant exposures, by H. L. Berke and A. C. Di Pasqua. The University of Rochester, Rochester, N. Y. July 60. Contract W-7401-eng-49. 35p. Order from OTS. 75 cents. UR-573

Biological effects of nuclear radiation on the monkey (Macaca Mulatta): Two-year evaluation, by J. E. Pickering and others. School of Aviation Medicine, U. S. Air Force, Brooks Air Force Base, Tex. June 59. 51p. Order from OTS. $1.25. WT-1542

Chemistry—General

Kinetics of dissolution of zirconium in molten uranium, by G. H. Golden. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 38p. Order from OTS. $1.00. ANL-6167

Counting individual alpha activities in mixtures, by J. Sadauskis. Argonne National Laboratory, Argonne, Ill. June 60. Contract W-31-109-eng-38. 20p. Order from OTS. 50 cents. ANL-6186

Nuclear magnetic resonance spectra of trialkyl phosphates and related compounds. I. Proton magnetic resonance spectra, by W. E. Shuler and R. C. Axtmann. E. I. du Pont de Nemours & Co. Explosives Department, Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. June 60. Contract AT(07-2)-1. 48p. Order from OTS. $1.50. DP-474

Thermodynamic and transport properties of helium, by M. P. Wilson, Jr. General Dynamics Corp., Electric Boat Div., San Diego, Calif. Jan 60. Contract AT(04-3)-187. 144p. Order from OTS. $2.75. GA-1355

Corrosion control of copper and steel by vacuum deaeration, by M. E. Tester. Goodyear Atomic Corp., Technical Div., Process Engineering Dept., Portsmouth, Ohio. May 60. Contract AT-(33-2)-1. 14p. Order from OTS. 50 cents. GAT-296

A versatile autoclave facility for aqueous corrosion research, by V. H. Troutner. Hanford Atomic Products Operation, Richland, Wash. Contract

AT(45-1)-1350. 30p. Order from OTS. 75 cents. HW-64111

Decomposition of nitrous oxide. Final report, by J. H. Zufall and H. S. Miller. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office, Idaho Falls, Idaho. July 60. Contract AT(10-1)-205. 19p. Order from OTS. 50 cents. IDO-14513

Transport numbers in pure fused zinc chloride, by A. Lunden. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. Apr 60. Contract W-7405-eng-82. 34p. Order from OTS. $1.00. IS-114

Improved U^{235} measurements at the Paducah Plant through refinements in the gravimetric oxide dilution procedure, by R. F. Smith, R. E. Eby, and C. W. Turok. Union Carbide Nuclear Co., Union Carbide Corp., Paducah Plant, Paducah, Ky. July 60. Contract W-7405-eng-26. 14p. Order from OTS. 50 cents. KY-349

Tabulated values of thermal diffusion column shape factors for the Lennard-Jones (12-6) potential, by B. B. McInteer and M. J. Reisfeld. The University of California, Los Alamos Scientific Lab., Los Alamos, N. Nex. Oct 59. Contract W-7405-ENG-36. 56p. Order from OTS. $1.75. LAMS-2413

Thermal conductivity and thermal expansion of B_eO at elevated temperatures, by R. E. Taylor. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Cnntract AT(11-1)-GEN-8. 19p. Order from OTS. 75 cents. NAA-SR-4905

P-V-T relationships of BF_3 gas, by C. R. F. Smith. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 31p. Order from OTS. 75 cents. NAA-SR-5286

The cadmium--cadmium halide systems, by L. E. Topol and A. L. Landis. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 15p. Order from OTS. 50 cents. NAA-SR-5310

Liquidus curves for molten alkali metaphosphate-sulfate systems, by S. W. Mayer and others. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 15p. Order from OTS. 50 cents. NAA-SR-5334

The thermostability of thorium tetraiodide, by A. L. Landis and A. J. Darnell. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 15p. Order from OTS. 50 cents. NAA-SR-5394

Green salt Pilot Plant final report, by R. Braddock and others. Mallinckrodt Chemical Works, St. Charles, Mo. Mar 43. Decl. July 12, 1960. 54p. Order from OTS. 50 cents. NYO-5029

Hydrides of metals and metalloids. A literature search. Tufts University, Medford, Mass. July 60. 164p. Order from OTS. $2.75. TID-3902

I. Beta-spectroscopic studies in the promethium region. II. The coriolis interaction in deformed nuclei. Thesis, by T. V. Marshall. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. 73p. Order from OTS. $1.75. UCRL-8740

Fission of gold with 112-Mev C^{12} ions: A yield-mass and charge-distribution study. Thesis, by H. M. Blann. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. OTS $1.75. UCRL-9190

Thermal ignition and response of materials, by K. P. Laughlin. Office of Civil and Defense Mobilization, Battle Creek, Mich. July 60. 58p. Order from OTS. $1.25. WT-1198

Preparation of dense, spheroidal UO_2, by R. P. Levey, Jr. Union Carbide Nuclear Co., Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Aug 60. Contract W-7405-eng-26. 25p. Order from OTS. 50 cents. Y-1299

Preparation of uranous oxalate, by L. R. Phillips and others. Union Carbide Nuclear Co., Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Aug 60. Contract W-7405-eng-26. 18p. Order from OTS. 50 cents. Y-1308

Chemistry—Radiation and Radiochemistry

Radiation processing report no. 1: Gamma irradiation experiments in the N_2-O_2 system, by M. Steinberg. Brookhaven National Laboratory, Associated Universities, Inc., Upton, N. Y. June 60. 17p. Order from OTS. 50 cents. BNL-612(T-182)

Radiation processing report no. 2: Irradiation of NH_3-H_2O solutions for formation of hydrazine, by M. Steinberg and others. Brookhaven National Laboratory, Upton, N. Y. June 60. 7p. Order from OTS. 50 cents. BNL-613(T-183)

Precipitation of radioruthenium, by F. E. Butler. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. June 60. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-494

The mass spectra of deuterated biphenyls: mechanisms of hydrogen and carbon loss processes, by J. C. Burr, J. M. Scarborough and R. H. Shudde. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 29p. Order from OTS. 75 cents. NAA-SR-4960

Some factors correlating the rates of gas formation in the radiolysis of aromatic hydrocarbons, by J. G. Burr and J. D. Strong. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 11p. Order from OTS. 50 cents. NAA-SR-4962

Chemistry—Separation Processes for Plutonium and Uranium

Chemical Engineering Division summary report for January, February, March, 1960, by S. Lawroski and others. Argonne National Laboratory, Argonne, Ill. 1960. Contract W-31-109-eng-38. 192p. Order from OTS. $2.75. ANL-6145

Reactor chemistry, by S. Peterson and R. W. Stoughton. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 54. Decl. July 8, 1960. 53p. Order from OTS. 50 cents. CF-54-4-198(Rev.)

Separation processes, by I. Perlman. Argonne National Laboratory, Argonne, Ill. Sep 46. Decl. Aug 2, 1960. Contract W-31-109-eng-38. 72p. Order from OTS. 55 cents. CN-3627

Shear development for the nonproduction fuel reprocessing program. Interim report, by V. P. Kelly. Hanford Atomic Products Operation, Richland, Wash. July 60. Contract AT(45-1)-1350. 42p. Order from OTS. $1.00. HW-62842

Reprocessing uranium-molybdenum alloy fuels - dissolution in concentrated nitric acid, by W. W. Schulz. Hanford Atomic Products Operation, Richland, Wash. Mar 60. Contract AT(45-1)-1350. 16p. Order from OTS. 75 cents. HW-64432

Idaho Chemical Processing Plant technical progress report for April through June 1956, by C. E. Stevenson. Phillips Petroleum Co., Idaho Falls, Idaho. Jan 57. Decl. July 6, 1960. Contract AT(10-1)-205. 54p. Order from OTS. 50 cents. IDO-14391

Tributyl phosphate extraction of uranium from ammonium nitrate solutions, by K. L. Rohde and R. A. Kent. Phillips Petroleum Co., Idaho Chemical Processing Plant, Idaho Falls, Idaho. July 60. Contract AT(10-1)-205. 16p. Order from OTS. 50 cents. IDO-14501

Idaho Chemical Processing Plant technical progress report for July through September, 1959, by C. E. Stevenson. Phillips Petroleum Co., Idaho Falls, Idaho. June 60. Contract AT(10-1)-205. 92p. Order from OTS. $2.25. IDO-14509

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Report of the Chemistry and Chemical Engineering Section for February, March, April, 1956, by D. H. Ahmann and others. General Electric Co., Knolls Atomic Power Laboratory, Schenectady, N. Y. July 56. Decl. July 8, 1960. Contract W-31-109-Eng-52. 98p. Order from OTS. 60 cents. KAPL-1536

Report of the Chemistry and Chemical Engineering Section for August, September, October, 1956, by D. H. Ahmann and others. General Electric Co., Knolls Atomic Power Laboratory, Schenectady, N. Y. Jan 57. Decl. July 8, 1960. Contract W-31-109-Eng-52. 105p. Order from OTS. 65 cents. KAPL-1620

Operation of the piqua OMR degasification system prototype, by G. W. Corporales and P. R. Benson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Aug 60. Contract AT(11-1)-GEN-8. 36p. Order from OTS. 75 cents. NAA-SR-4894

Corrosion data from the ORNL Purex Pilot Plant acid recovery equipment, by J. W. Landry and J. W. Ullmann. Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, Tenn. Mar 52. Decl. June 18, 1960. Contract W-7405-eng-26. 71p. Order from OTS. 55 cents. ORNL-1210

Dissolution of uranium-zirconium fuel elements in fused $NaF-ZrF_4$, by R. G. Wymer and J. F. Land. Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, Tenn. Feb 57. Decl. July 6, 1960. Contract W-7405-eng-26. 26p. Order from OTS. 35 cents. ORNL-2183

Controlled Thermonuclear Processes

Development of reliable 20 KV, size a ignitrons for thermonuclear research, by G. P. Boicourt, E. L. Kemp, and F. K. Tallmadge. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. Contract W-7405-ENG-36. 46p. Order from OTS. $1.00. LAMS-2416

Quarterly status report of the LASL Controlled Thermonuclear Research Program for period ending May 20, 1960, by S. Glasstone. The University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. Contract W-7405-ENG-36. 59p. Order from OTS. $1.50. LAMS-2444

A beam inflector, by F. C. Gilbert. University of California, Lawrence Radiation Laboratrry, Livermore, Calif. Nov 59. Contract W-7405-eng-48. 7p. Order from OTS. 50 cents. UCRL-5698

High-energy molecular ion injection into a mirror machine, by F. C. Gilbert and others. University of California, Lawrence Radiation Laboratory, Livermore, Calif. Feb 60. Contract W-7405-eng-48. 26p. Order from OTS. 75 cents. UCRL-5827

Tables of functions involved in linear pinch stability criteria, by J. Killeen, W. A. Newcomb, and J. S. Vandergraft. University of California, Lawrence Radiation Laboratory, Livermore, Calif. Mar 60. Contract W-7405-eng-48. 9p. Order from OTS. 50 cents. UCRL-5885

Controlled Thermonuclear Research quarterly report for December 1958, January, and February 1959. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Mar 59. Decl. February 15, 1960. Contract W-7405-eng-48. 81p. Order from LC. Mi $4.50, ph $12.30. UCRL-8682

Controlled Thermonuclear Research quarterly report for December 1959, January, February 1960. University of California. Lawrence Radiation Laboratory, Berkeley and Livermore, Calif. Mar 60. Contract W-7405-eng-48. 122p. Order from OTS. $2.75. UCRL-9106

Criticality Studies

Plutonium plexiglas assemblies, by C. L. Schuske and others. Dow Chemical Co., Rocky Flats Plant, Denver, Colo. Man 60. Decl. February p6, 1960. Contract AT(29-1)-1106. 20p. Order from LC. Mi $2.40, ph $3.30. RFP-178

Criticality studies of enriched uranium metal in $UO_2(NO_3)_2$ solutions, by A. Goodwin, Jr., G. H. Bidinger, and C. L. Schuske. The Dow Chemical Co., Rocky Flats Plant, Denver, Colo. July 60. Contract AT(29-1)-1106. 19p. Order from OTS. 50 cents. RFP-182

Plutonium plexiglas assemblies. Part II, by G. H. Bidinger, C. L. Schuske, and D. F. Smith. The Dow Chemical Company, Rocke Flats Plant, Denver, Colo. July 60. Contract AT(29-1)-1106. 22p. Order from OTS. 50 cents. RFP-190

Equipment, Methods and Techniques

A bibliography on gas lubricated bearings, revised, E. B Sciulli. Franklin Institute, Laboratories for Research and Development, Philadelphia, Pa. Sep 59. Contract Nonr-2342(00) Task NR 097-343. 104p. Order from OTS. $2.50. AECU-4440

Refinements of the theory of the infinitely-long, self-acting, gas-lubricated journal bearing. Interim report, by H. G. Elrod, Jr. and A. Burgdorfer. Franklin Institute, Laboratories for Research and Development, Philadelphia, Pa. Jan 60. Contract Nonr-2342(00. 48p. Order from LC. Mi $3.30, ph $7.80. AECU-4688

Isotopic method for age determinations of industrial products. Monthly progress letter for January 1960, by T. C. Gregson and L. B. Bangs. Goodyear Tire and Rubber Co., Akron, Ohio. Contract AT(11-1)-729. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4711

An analysis of several of the variables encountered in low cycle fatigue. Interim Technical report no. 4, by W. W. Gerberich. Syracuse University, Metallurgical Research Laboratories, Syracuse, N. Y. June 59. Contract AT(30-1)-2141. 45p. Order from LC. Mi $3.30, ph $7.80. AECU-4722

Isotopic method for age determination of industrial products. Quarterly progress report for October through December 1959. Goodyear Tire and Rubber Co., Akron, Ohio. 1959. Contract AT(11-1)-719. 52p. Order from LC. Mi $3.60, ph $9.30. AECU-4724

Parallel operation of welding generators, by B. H. Butler. E. I. du Pont de Nemours & Co., Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. June 60. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-482

Fabrication of the type "E" fluorine cell tank, by B. W. Clark. Union Carbide Nuclear Co., Div. of Union Carbide Corporation, Paducah, Ky. May 60. Contract W-7405-eng-26. 23p. Order from OTS. 75 cents. KY-326

OMR finned fuel plate, by R. R. Hargrove and C. R. Atomics International. Division of North American Aviation, Inc., Canoga Park, Calif. Jan 58. 10p. Order from LC. Mi $2.40, ph $3.30. NAA-SR-Memo-2354

Stresses in contoured nozzles when subjected to external loadings. Period covered October 16, 1958 to September 15, 1959, by D. E. Hardenbergh. Pennsylvania State University, University Park, Pa. Sep 59. Contract AT(30-1)-1874. 85p. Order from LC. Mi $4.80, ph $13.80. NYO-7565

A sampling device for molten-salt systems, by W. B. McDonald and J. L. Crowley. Oak Ridge National Laboratory, Reactor Projects Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 4p. Order from OTS. 50 cents. ORNL-2688

Design, development, and operation of metal-diaphragm reactor-service pumps, by E. C. Hise. Oak Ridge National Laboratory, Reactor Experimental Engineering Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 63p. Order from OTS. $2.00. ORNL-2841

An evaluation of solid moderating materials, by T. S. Lundy and E. E. Gross. Oak Ridge National Laboratory, Metallurgy Division and Reactor Projects Division, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 10p. Order from OTS. 50 cents. ORNL-2891

Surface temperatures of irradiated ORR fuel elements cooled in stagnant air, by J. F. Wetts, Jr. Oak Ridge National Laboratory, Operations Div., Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 13p. Order from OTS. 75 cents. ORNL-2892

Fission product distribution in ORR fuel elements, by A. L. Colomb. Oak Ridge National Laboratory, Operations Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 7p. Order from OTS. 50 cents. ORNL-2897

Photoneutrons and the control of a pool-type reactor, by A. L. Colomb. Oak Ridge National Laboratory, Operations Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 8p. Order from OTS. 50 cents. ORNL-2898

Development of an electrolytic cell for removal of nickel from HRT fuel solutions, by E. L. Youngblood. Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, Tenn. [nd]. Contract W-7405-eng-26. 21p. Order from OTS. 75 cents. ORNL-2923

Tolerances of position and form, including MMC, by Sandia Corporation, Albuquerque, N. Mex. Sep 55. 54p. Order from OTS. $1.25. SC-7016 (SP)

Environmental testing to 2000°F, by J. A. Barber. Sandia Corporation, Albuquerque, N. Mex. June 59. 16p. Order from OTS. 75 cents. SCR-96

How positional tolerancing clarifies design intent and reduces product cost, by E. S. Roth. Sandia Corporation, Albuquerque, N. Mex. Jan 60. 41p. Order from OTS. $1.25. SCR-154

The work ratio system, by C. J. McGarr. Sandia Corporation, Albuquerque, N. Mex. July 60. 14p. Order from OTS. 50 cents. SCT-220

An analysis of general stores investment, by R. M. Allan, and P. H. Arnold. Sandia Corporation, Albquerque, N. Mex. Mar 60. 51p. Order from OTS. $1.50. SCTM-72-60(34)

Crystal accelerometer response to mechanical shock impulses, by A. F. Lawrence. Sandia Corporation, Albuquerque, N. Mex. Aug 56. 10p. Order from OTS. 50 cents. SCTM-168-56-16

Application of thin printed wiring laminate in electronic packaging, by G. Voida. Sandia Corporation, Albuquerque, N. Mex. Jan 57. 38p. Order from LC. Mi $3.00, ph $6.30. SCTM-279-56-14

Geology and Mineralogy

A preliminary study of the potential to kinetic energy conversion process in the stratosphere, by R. M. White and G. F. Nolan. Massachusetts Institute of Technology, Cambridge, Mass. Sep 59. Contract AT(30-1)-2241. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4556

Operation PRE-gnome. Seismic data from natural phenomena and high-explosive tests near Carlsbad, New Mexico, by D. S. Carder and others. Coast and Geodetic Survey, Washington, D. C. Jan 60. Contract AT(29-2)-746. 45p. Order from LC. Mi $3.30, ph $7.80. AECU-4625

Comparison of seismic shock in salt and tuff, by P. E. Byerly. Geological Survey, Washington, D. C. Oct 59. 10p. Order from LC. Mi $1.80, ph $1.80. TEM-1034

Health and Safety

Sr^{90} Monitoring at the Savannah River Plant, by F. E. Butler. E. I. du Pont de Nemours & Co., Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Plant, Aiken, S. C. May 60. Contract AT(07-2)-1. 37p. Order from OTS. $1.00. DP-473

Surface dosage rate studies of Task III Feed Materials, by F. L. Helgeson. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Apr 54. Decl. March 15, 1960. Contract W-31-109-Eng-52. 25p. Order from LC. Mi $2.70, ph $4.80. HW-31522

Quarterly progress report Research and development activities in the field of radiological sciences October - December 1959, by Members of the Staff. Hanford Atomic Products Operation, Richland, Wash. Jan 60. Contract AT(45-1)-1350. 37p. Order from OTS. $1.25. HW-63643

Evaluation of radiological conditions in the vicinity of Hanford for 1959, by R. L. Junkins and others. Hanford Atomic Products Operation, Richland, Wash. May 60. Contract AT(45-1)-1350. 123p. Order from OTS. $2.50. HW-64371

Evaluation of radiological conditions in the vicinity of Hanford January through March - 1960, by E. C. Watson and others. Hanford Atomic Products Operation, Richland, Wash. May 60. Contract AT(4501)-1350. 45p. Order from OTS. $1.25. HW-65534

Neutron tissue dose survey for the little EVA critical assembly, by M. J. Engelke, B. B. Riebe, and J. A. Sayeg. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Aug 60. Contract W-7405-ENG-36. 14p. Order from OTS. 50 cents. LA-2425

A study of Nevada Test Site wind variability, by J. W. Reed. Sandia Corporation, Albuquerque, N. Mex. Mar 58. 51p. Order from OTS. $1.50. SC-4144(TR)

Comparison of fallout doses from Nevada Tests (Revised), by J. W. Reed. Sandia Corporation, Albuquerque, N. Mex. June 60. 46p. Order from OTS. $1.50. SC-4414(RR)

Factors influencing the biological fate and persistence of radioactive fall-out, by R. C. Lindberg and others. University of California of Los Angeles, School of Medicine, Department of Laboratories of Nuclear Medicine and Radiation Biology, Los Angeles, Calif. Jan 59. 78p. Order from OTS. $1.75. WT-1177

Measuring and monitoring training exercise: Foodstuffs, by H. J. McConnell and others. Food and Drug Administration, Department of Health, Education, and Welfare, Washington, D. C. Dec 59. 28p. Order from OTS. 50 cents. WT-1498

Instruments

Magnetic recorder for nuclear pulse application. Period covered: December 6, 1959 to February 5, 1960, by G. M. Burgwald and R. M. Norton. Illinois Institute of Technology, Armour Research Foundation, Chicago, Ill. Feb 60. Contract AT(11-1)-702. 8p. Order from LC. Mi $1.80, ph $1.80. ARF-1151-4

Development of a fuel-element leak-detection system based on the principle of isotopic exchange, by J. E. Howes, Jr., T. S. Elleman, and D. N. Sunderman. Battelle Memorial Institute, Columbus, Ohio. Aug 60. Contract W-7405-eng-92. 17p. Order from OTS. 50 cents. BMI-1432

Accurate micrometer for corrosion samples, by W. J. Woodward. E. I. du Pont de Nemours & Co., Explosives Dept., Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. June 60. Contract AT(07-2)-1. 10p. Order from OTS. 50 cents. DP-488

Medium-level continuous alpha air monitor, by M. O. Rankin. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 27p. Order from LC. Mi $2.70, ph $4.80. HW-56487(Rev.)

Stainless-inconel metal sorting device, by G. E. Martin. Knolls Atomic Power Laboratory, Schenectady, N. Y. Mar 59. Contract W-31-109-ENG-52. 6p. Order from LC. Mi $1.70, ph $1.80. KAPL-M-GEM-1

Development of temperature protective circuits for the HNPF fuel channel exit, by D. E. Brown. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 18p. Order from OTS. 50 cents. NAA-SR-5313

Interim report on investigation of dynamic characteristics of relays. This report covers the period 1 November to 31 December, 1959. Sandia Corporation, Albuquerque, N. Mex. June 60. 90p. Order from OTS. $2.25. SC-4422(RR)

Theoretical characteristics of several fluid- metering instruments, by M. D. Bennett. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 51p. Order from OTS. $1.50. SC-4446(RR)

Radar return from the vertical for ground and water surfaces, by C. S. Williams, Jr., C. H. Bidwell and D. M. Gragg. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 93p. Order from OTS. $2.25. SCR-107

Metallurgy and Ceramics

Progress letter no. 11 for January 1, 1960 through January 31, 1960, by E. H. Baron. Stevens Institute of Technology, Hoboken, N. J. Feb 60. Contract AT(30-1)-2258. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4695

Corrosion of plutonium alloys in NaK, by H. H. Hyman and J. J. Katz. Argonne National Laboratory, Lemont, Ill. July 53. Decl. March 15, 1960. Contract W-31-109-eng-38. 10p. Order from LC. Mi $1.80, ph $1.80. ANL-5090

The fabrication of a plutonium helix for a doppler experiment. Work completed September 1956, by R. J. Dunworth, H. V. Rhude and L. R. Kelman. Argonne National Laboratory, Lemont, Ill. Feb 58. Decl March 15, 1960. Contract W-31-109-eng-38. 15p. Order from LC. Mi $2.40, ph $3.30. ANL-5842

The transformation temperatures of high-purity uranium, by B. Blumenthal, J. E. Baumrucker, and L. T. Lloyd. Argonne National Laboratory, Argonne, Ill. June 60. Contract W-31-109-eng-38. 30p. Order from OTS. 75 cents. ANL-5957

Tests of defected thoria-urania fuel specimens in EBWR, by R. F. S. Robertson. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 87p. Order from OTS. $2.00. ANL-6022

Aqueous corrosion of magnesium alloys, by S. Greenberg and W. E. Ruther. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-108-eng-38. 18p. Order from OTS. 50 cents. ANL-6070

Metallography of aluminum and some aluminum-1 w/o nickel alloys, by R. K. Hart and M. J. Heyduk. Argonne National Laboratory, Argonne Ill. June 60. Contract W-31-109-eng-38. 26p. Order from OTS. 50 cents. ANL-6144

Characteristics of anodic and corrosion films on zirconium, by R. D. Misch. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 25p. Order from OTS. 50 cents. ANL-6149

Preparation of magnesium oxide refractories, by R. C. Lied. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 14p. Order from OTS. 50 cents. ANL-6164

Combustibility studies with nicrhome V (80 Ni - 20 Cr), by J. B. Conway and R. D. McLay. General Electric Co. Aircraft Nuclear Propulsinn Dept., Cincinnati, Ohio. Dec 54. Decl. November 20, 1959. 33p. Order from LC. Mi $3.00, ph $6.30. APEX-252

Effects of ternary additions on aluminum-35 w/o uranium alloys, by N. E. Daniel, E. L. Foster and R. F. Dickerson. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Decl. February 3, 1960. Contract W-7405-eng-92. 31p. Order from LC. Mi $3.00, ph $6.30. BMI-1388

Progress relating to civilian applications during May, 1960, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. July 60. 99p. Order from OTS. $2.25. BMI-1442 (Rev.)

Experiments to determine the radiation stability of UN dispersions in stainless steel, by J. E. Gates and others. Battelle Memorial Institute, Columbus, Ohio. June 60. Contract W-7405-eng-92. 29p. Order from OTS. 75 cents. BMI-1446

Progress relating to civiliam applications during June, 1960, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. July 60. Contract W-7405-eng-92. 104p. Order from OTS. $2.50. BMI-1448 (Rev.)

Factors affecting the ductility of iron-chromium-aluminum alloy sheet, by R. W. Endebrock, E. L. Foster, Jr., and R. F. Dickerson. Battelle Memorial Institute, Columbus, Ohio. July 60. 24p. Order from OTS. 75 cents. BMI-1450

The bonding of molybdenum- and niobium-clad fuel elements, by S. J. Paprocki, E. S. Hodge, P. J. Gripshover. Battelle Memorial Institute, Columbus, Ohio. July 60. Contract W-7405-eng-92. 61p. Order from OTS. $1.50. BMI-1451

Irradiation effects on massive uranium monocarbide, by A. W. Hare and F. A. Rough. Battelle Memorial Institute, Columbus, Ohio. July 60. Contract W-7405-eng-92. 28p. Order from OTS. 75 cents. BMI-1452

Apparatus for the study of fission-gas release from fuels during postirradiation heating at temperatures up to 1600 C, by R. H. Barnes and D. N. Sunderman. Battelle Memorial Institute, Columbus, Ohio. July 60. Contract W-7405-eng-92. 12p. Order from OTS. 50 cents. BMI-1453

Preparation and evaluation of aluminum-35 w/o uranium alloys containing up to 3 w/o tin or zirconium, by N. E. Daniel, E. L. Foster, Jr., and R. F. Dickerson. Battelle Memorial Institute, Columbus, Ohio. July 60. Contract W-7405-eng-92. 28p. Order from OTS. 75 cents. BMI-1454

The solution susceptibilities of refractory metals in molten plutonium, by F. W. Schonfeld. Los Alamos Scientific Laboratory, N. Mex. June 52. Decl. March 15, 1960. 9p. Order from LC. Mi $1.80, ph $1.80. CMR-5-1365

A sonic test for preferred orientation in Hanford fuel element cores, by A. A. Ferguson and E. C. Wood. General Electric Co. Hanford Atomic Co., Hanford Atomic Products Operation, Richland, Wash. Jan 55. Decl. December 3, 1959, Contract W-31-109-Eng-52. 22p. Order from LC. Mi $2.70, ph $4.80. HW-33024

Calcium uranium (IV) fluoride: Precipitation and reduction to metal, by W. B. Tolley. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Mar 55. Decl. January 12, 1960. Contract W-31-109-Eng-52. 14p, Order from LC. Mi $2.40, ph $3.30. HW-35815

The effect of oxidation on the compression strength of CS-GBF graphite, by B. Griggs. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Apr 56. Decl. January 8, 1960; 12p. Order from LC. Mi $2.70, ph $4.80. HW-42498(Del.)

The irradiation of thin evaporated films of uranium dioxide. Interim report, by T. K. Bierlein and B. Mastel. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 17p. Order from LC. Mi $2.40, pn $3.30. HW-61656

A report of results of tests on impervious graphite and discussions by: L. N. Johanson, R. J. Campbell, and E. E. Mueller. University of Washington, Seattle, Wash. Mar 58. 47p. Order from LC. Mi $3.30, ph $7.80. HW-61820

Some metallographic observations on thorium metal, by D. T. Peterson. Ames Laboratory, Iowa State University of Science and Technology, Ames, Iowa. June 60. Contract W-7405-eng-82. 11p. Order from OTS. 50 cents. IS-155

Improved welding techniques for SER fuel element assembly closures, by S. Elchyshyn. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 30p. Order from OTS. 75 cents. NAA-SR-4909

Direct observation of fast neutron damage in gold films, by A. Grenall. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 18p. Order from OTS. 75 cents. NAA-SR-5062

Fuel element development for Piqua OMR, by M. H. Binstock. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 52p. Order from OTS. $1.25. NAA-SR-5119

Hot pressure bonding of OMR tubular fuel elements, E. E. Garrett, G. V. Alm and M. H. Binstock. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 47p. Order from OTS. $1.00. NAA-SR-5120

A heat transfer control device for irradiation experiments, by W. K. McCarty and R. C. Noyes. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 10p. Order from OTS. 50 cents. NAA-SR-5141

Process development of uranium carbide fuel slugs for HNPF, by D. H. Turner. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 26p. Order from OTS. 50 cents. NAA-SR-5346

Development of pass schedule for rolling narrow uranium strip, by J. F. Schiltz and J. W. Magoun. National Lead Company, Cincinnati, Ohio. June 58. Decl. November 30, 1959. Contract AT(30-1)-1156. 23p. Order from LC. Mi $2.70, ph $4.80. NLCO-756

The development and testing of the UO_2 fuel element system. Progress report for period September 1 through December 31, 1959, by B. E. Murtha. Combustion Engineering, Inc. Nuclear Division, Windsor, Conn. 1959. Contract AT(30-1)-2379. 157p. Order from OTS. $2.75. NYO-9006

High energy storage ceramic capacitor. Final report, by P. H. Klein and others. General Electric Co., Electronics Laboratory, Syracuse, N. Y. and General Electric Co., Missile and Space Vehicle Department, Philadelphia, Pa. Feb 60. Contract AT(30-1)-1963. 96p. Order from OTS. $2.25. NYO-9076

Metallurgy Division semiannual progress report for period ending April 10, 1954, by W. H. Bridges. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 54. Decl. with deletions December 1, 1959. Contract W-7405-eng-26. 120p. Order from LC. Mi $6.30, ph $19.80. ORNL-1727(Del. 2)

Relaxation characteristics of inconel at elevated temperatures, by C. R. Kennedy and D. A. Douglas. Oak Ridge National Laboratory, Oak Ridge, Tenn. Feb 60. Contract W-7405-eng-26. 28p. Order from LC. Mi $2.70, ph $4.80. ORNL-2407

Metallurgy Division annual progress report for period ending September 1, 1959. Oak Ridge National Laboratory, Oak Ridge, Tenn. Dec 59. Contract W-7405-eng-26. 352p. Order from LC. Mi $11.10, ph $37.80. ORNL-2839

Columbium clad uranium carbide fuel element contract. Monthly letter report for September 1 through September 30, 1959. Union Carbide Metals Co., Niagara Falls, N. Y. Sep 59. Contract AT(40-1)-2559. 2p. Order from LC. Mi $1.80, ph $1.80. ORO-229

Research on piezoelectric materials and phenomena. Final report for February 1, 1959 through January 31, 1960, by D. A. Berlincourt. Sandia Corporation, Albuquerque, N. Mex. July 60. 164p. Order from OTS. $3.00. SC-4443(RR)

Quarterly technical progress report for period ending March 31, 1960, by J. L. Zambrow. Sylvania-Corning Nuclear Corporation, Bayside Long Island, N. Y. May 60. Contract AT-30-1-GEN-366. 42p. Order from OTS. $1.00. SCNC-309

Metallurgy information meeting, Ames Laboratory, Iowa State College, May 2, 3, and 4, 1956. Ames Laboratory, Ames, Iowa. 1956. Decl. October 7, 1959. 18p. Order from LC. Mi $2.40, ph $3.30. TID-7526(Pt. 7)

Corrosion of D loop, by H. K. Lembersky and P. Cohen. Westinghouse Electric Corporation, Atomic Power Division, Pittsburgh, Pa. Oct 55. Decl. with deletions November 20, 1957. 15p. Order from LC. Mi $2.40, ph $3.30. WAPD-CP-715(Del.)

Heat transfer effects on the corrosion of zirconium and some alloys, by L. A. Waldman and P. Cohen. Westinghouse Electric Corporation, Atomic Power Division, Pittsburgh, Pa. May 54. Decl. with deletions March 14, 1957. Contract 11-1-GEN-14. 32p. Order from LC. Mi $3.00. ph $6.30. WAPD-MDM-8(Del.)

Back extrusion of Zircaloy-2 lower extension brackets, by J. G. Seton. Westinghouse Electric Company, Bettis Plant, Pittsburgh, Pa. Dec 55. 19p. Order from LC. Mi $2.40, ph $3.30. WAPD-SFR-Fe-355

A method for hot-pressing large diameter beryllium oxide rings, by L. M. McLaughlin and A. H. Ballard. Union Carbide Nuclear Company, Division of Union Carbide Corporation, Y-12 Plant, Oak Ridge, Tenn. Aug 60. Contract W-7405-eng-26. 15p. Order from OTS. 50 cents. Y-1302

Nuclear Explosions—Peaceful Applications

Blanca--A study of the maximum vertical earth motion of the Mesa slope, by D. Barnes and S. Finos. Edgerton, Germeshausen & Grier, Inc., Las Vegas, Nev. Feb 60. 16p. Order from OTS. 75 cents. AECU-4681

Nuclear explosives and landslide dams, by R. H. Carlson. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 95p. Order from OTS. $2.25. SC-4403(RR)

Geologic studies of underground nuclear explosions Rainier and Neptune. Final report, by T. L. Thompson and J. B. Misz. University ot California, Lawrence Radiation Laboratory, Livermore, Calif. Oct 59. Contract W-7405-eng-48. 58p. Order from OTS. $1.75. UCRL-5757

The Neptune event a nuclear explosive cratering experiment, by A. V. Shelton, M. D. Nordyke, and R. H. Goeckermann. University of California, Lawrence Radiation Laboratory, Livermore, Calif. Apr 60. Contract W-7405-eng-48. 32p. Order from OTS. $1.00. UCRL-5766

Industrial and scientific applications of nuclear explosions, by G. W. Johnson. University of California. Lawrence Radiation Laboratory, Livermore, Calif. Jan 60. Contract W-7405-eng-48. 33p. Order from OTS. $1.00. UCRL-5840

The Soviet program for industrial applications of explosions, by G. W. Johnson. University of California, Lawrence Radiation Laboratory, Livermore, Calif. Mar 60. Contract W-7405-eng-48. 15p. Order from OTS. 50 cents. UCRL-5932

An application of nuclear explosives to block caving mining, by W. G. Flangas and L. E. Shaffer. University of California, Lawrence Radiation Laboratory, Livermore, Calif. June 60. Contract W-7405-eng-48. 23p. Order from OTS. 75 cents. UCRL-5949

Particle Accelerators and High-Voltage Machines

A study of some coherent electromagnetic effects in high-current particle accelerators. Thesis, by V. K. Neil. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Apr 60. Contract W-7405-eng-48. 141p. Order from OTS. $2.50. UCRL-9124

Bevatron operation and development. XXIV November, December 1959, and January 1960, by W. D. Hartsough. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. 13p. Order from OTS. 50 cents. UCRL-9220

Bevatron operation and development. XXV February, March, and April 1960, by W. D. Hartsough. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 10p. Order from OTS. 50 cents. UCRL-9221

Physics and Mathematics

General reactor analysis computer program for the IBM 704, program George, by T. A. Hoffman and W. B. Henderson. General Electric Co., Atomic Products Division, Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Oct 59. Contracts AT(11-1)-171 and AF 33(600)-38062. 361p. Order from OTS. $5.00. APEX-543

Liquid metal fuel reactor experiment: Operation and testing of a nonnuclear liquid-metal system, by the Babcock and Wilcox Company, Lynchburg, Va. May 60. Contract AT(30-1)-1940. 145p. Order from OTS. $3.00. BAW-1192

Tilting capsule tests in LMFRE fuel solution. Final report, by E. J. Rozic. The Babcock and Wilcox Company, Lynchburg, Va. Apr 60. Contract AT(30-1)-1940. 75p. Order from OTS. $2.25. BAW-1252

Nuclear physics research quarterly report for October, November, and December 1959, by J. E. Faulkner and others. Hanford Atomic Products Operation, Richland, Wash. Jan 60. Contract AT(45-1)-1350. 76p. Order from OTS. $2.25. HW-63576

Quarterly technical report, SPERT project for April, May, June 1959, by S. G. Forbes and others. Phillips Petroleum Company, Idaho Operations Office, Idaho Falls, Idaho. Apr 60. Contract AT(10-1)-205. 36p. Order from OTS. $1.25. IDO-16584

The SPERT III reactor nuclear startup, by F. Schroeder, and others. Phillips Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho. Mar 60. Contract AT(10-1)-205. 54p. Order from OTS. $1.50. IDO-16586

Distributions of neutron density and neutron flux, by W. B. Lewis and G. D. Marshall. Phillips Petroleum Company, Atomic Energy Division, Idaho Falls, Idaho. July 60. Contract AT(10-1)-205. 15p. Order from OTS. 50 cents. IDO-16614

UFO: A three-dimensional neutron diffusion code for the IBM 704, by E. H. Auerbach, J. P. Jewett, and M. A. Ketchum. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Mar 59. Contract W-31-109-Eng-52. 59p. Order from OTS. $1.75. KAPL-1999

Reactor technology report no. 12: Metallurgy, by B. H. Caldwell and others. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Mar 60. Contract W-31-109-Eng-52. 94p. Order from OTS. $2.50. KAPL-2000-9

Plasma propulsion studies--summer, 1959, by M. E. Ebel and others. The University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Aug 60. Contract W-7405-ENG-36. 143p. Order from OTS. $2.50. LA-2408

Ideal gas treatment of the equilibrium composition, enthalpy function, and heat capacity of cesium vapor and cesium plasma, by D. G. Clifton. The University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Aug 60. Contract W-7405-ENG-36. 33p. Order from OTS. 75 cents. LA-2419

Field emission of electrons. A bibliography of abstracts, by H. Hanson and G. Riese. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. Contract W-7405-ENG-36. 115p. Order from OTS. $2.25. LAMS-2385

The penetration of radiation with constant driving temperature, by A. G. Petschek and others. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. 43p. Order from LC. $1.00. LAMS-2421

Annihilation radiation counting for neutron activation determination, by J. P. Conner and R. T. Wagner. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. Contract W-7405-ENG-36. 19p. Order from OTS. 50 cents. LAMS-2428

The determination of lattice parameters by means of measurements on a single fuel element, by J. W. Zink and G. W. Roderback. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 33p. Order from OTS. 75 cents. NAA-SR-5392

A method for computing expected damage from a single bomb, by Sandia Corporation, Albuquerque, N. Mex. Jan 53. 37p. Order from OTS. $1.25. SC-2663(TR)

A confidence-limit computer, by J. O. Muench. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 11p. Order from OTS. $1.25. SCR-159

Multiple-source schlieren system (Transonic wind tunnel), by H. R. Spahr and R. E. Kyrlach. Sandia Corporation, Albuquerque, N. Mex. Apr 60. 9p. Order from OTS. 50 cents. SCR-177

A system of standard atmospheres, by B. N. Charles. Sandia Corporation, Albuquerque, N. Mex. May 60. 37p. Order from OTS. $1.00. SCR-183

On the algebra of boundary-value problems, by O. Wyler. Sandia Corporation, Albuquerque, N. Mex. May 60. Contract 51-6543. 27p. Order from OTS. $1.00. SCR-185

IBM problem M curves, by C. D. Broyles. Sandia Corporation, Albuquerque, N. Mex. June 60. 57p. Order from OTS. $1.75. SCTM-268-56-51

Energy-absorbing characteristics of several materials, by V. Parfitt. Jandia Corporation, Albuquerque, N. Mex. Oct 59. Contract AT(29-1)-789. 75p. Order from OTS. $2.00. SCTM-284-57(51)

The production of antinucleons by pions, by O. C. Eldridge, Jr. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 92p. Order from OTS. $2.00. UCRL-9128

Photopion production from deuterium near threshold, Thesis by W. P. Swanson. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Apr 60. Contract W-7405-eng-48. 134p. Order from OTS. $2.50. UCRL-9194

Low-energy photopion production from pions and neutral-pion decay. Thesis, by How-sen Wong. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 37p. Order from OTS. $1.00. UCRL-9251

A general least-squares program for the IBM 650 computer, by L. K. Goodwin. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 22p. Order from OTS. 75 cents. UCRL-9263

Double dispersion relations and unitarity as the basis for a dynamical theory of strong interactions, by G. F. Chew. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 103p. Order from OTS. $2.25. UCRL-9289

A P-9 multigroup method for solution of the transport equation in slab geometry, by R. C. Gast. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. May 60. Contract AT-11-1-GEN-14. 39p. Order from OTS. $1.25. WAPD-232

Technical progress report: reactor physics and mathematics for the period March 1 to June 1, 1960, by P. N. Ross. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. 1960. Contract AT-11-1-GEN-14. 122p. Order from OTS. $2.50. WAPD-MRJ-10

STDY-3, a program for the thermal analysis of a pressurized water nuclear reactor during steady state operation, by R. S. Pyle. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. June 60. Contract AT-11-1-GEN-14. 42p. Order from OTS. $1.00. WAPD-TM-213

Radiation Effects on Materials

Irradiation of an aluminum alloy-clad ceramic pellet-fueled plate, by A. P. Gavin. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 44p. Order from OTS. $1.00. ANL-6143

Shearing irradiated uranium plates, by W. Scott and others. E. I. du Pont de Nemours & Co. Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. C. Nov 56. Contract AT(07-2)-1. Decl. July 27, 1960. 20p. Order from OTS. 30 cents. DP-185

Shearing irradiated uranium plates - Part II, by R. B. Olcott. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. C. July 57. Decl. July 27, 1960. Contract AT(07-2)-1. 16p. Order from OTS. 30 cents. DP-224

Flux monitoring for radiation damage studies, by H. H. Yoshikawa. Hanford Atomic Products Operation, Richland, Wash. Mar 60. Contract AT(45-1)-1350. 19p. Order from OTS. 75 cents. HW-64251

Radioactive Waste

Zeolitic extraction of cesium from aqueous solutions, by L. L. Ames, Jr. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 23p. Order from OTS. 75 cents. HW-62607

Quarterly progress report research and development activities fixation of radioactive residues, October through December, 1959, by D. W. Pearce. Hanford Atomic Products Operation, Richland, Wash. Jan 60. Contract AT(45-1)-1350. 20p. Order from OTS. 75 cents. HW-63949

Study of real gas and heat transfer effects on the design of hotshot wind tunnels, by J. R. Stalder, M. W. Rubesin, and D. K. Eberly. Sandia Corp., Albuquerque, N. Mex. Mar 60. 77p. Order from OTS. $2.25. SCR-166

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Studies of reactor containment. Monthly technical progress report no. 29 for September 1, 1959 through September 30, 1959, by T. A. Zaker. Illinois Institute of Technology, Armour Research Foundation, Chicago, Ill. Oct 59. Contract AT(11-1)-528. 4p. Order from LC. Mi $1.80, ph $1.80. AECU-4599

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Thorium uranium physics experiments. Final report, by N. L. Snidow and others. Babcock and Wilcox Co., Lynchburg, Va. May 60. Contract AT(11-1)-766. 174p. Order from OTS. $3.50. BAW-1191

Radiation effects on boron-containing compounds, by D. J. Hamman and P. Schall. Battelle Memorial Institute, Columbus, Ohio. Jan 60. Decl. March 4, 1960. Contract W-7405-eng-92. 24p. Order from LC. Mi $2.70, ph $4.80. BMI-1406

Effect of non-thermal capture on Californium production in the HFIR, by H. C. Claiborne. Oak Ridge National Laboratory, Oak Ridge, Tenn. Dec 59. 12p. Order from LC. Mi $2.40, ph $3.30. CF-59-12-16

Molten-salt breeder reactors, by H. G. MacPherson. Oak Ridge National Laboratory, Oak Ridge, Tenn. Jan 60. 25p. Order from LC. Mi $2.70, ph $4.80. CF-59-12-64(Rev.)

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Proposal for an advanced engineering test reactor-ETR II, by D. R. deBoisblanc et al. Phillips Petroleum Company, Atomic Energy Division, Idaho Falls, Idaho. Mar 60. Contract AT(10-1)-205. 223p. Order from OTS. $3.50. IDO-16666

Reactor technology report no. 13; Engineering, by B. H. Caldwell and others. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. June 60. Contract W-31-109-Eng-52. 207p. Order from OTS. $3.00. KAPL-2000-10

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Reactor safety quarterly progress report for August to October 1954, by N. E. Huston, North American Aviation, Inc, Downey, Calif. Apr 55. Decl. July 20, 1959. Contract AT-11-1-GEN-8. 43p. Order from LC. Mi $3.30, ph $7.80. NAA-SR-1190

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Multigroup-multiregion kinetics of the AETR (Formulation), by E. R. Cohen. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 59. 27p. Order from LC. Mi $2.70, ph $4.80. NAA-SR-Memo-4394

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Metallurgy Division annual progress report for period ending October 10, 1957, Oak Ridge National Laboratory, Oak Ridge, Tenn. Dec 57. Decl. with deletions October 29, 1959. Contract W-7405-eng-26. 247p. Order from LC. Mi $11.10, ph $39.60. ORNL-2422

A transistorized reactivity measurement system, by L. Ehrman. Sandia Corporation, Albuquerque, N. Mex. July 60. 28p. Order from OTS. 75 cents. SCTM-190-60(14)

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Periodic intercalibration of temperature sensing elements. Section I. Second performance. Nov 59. 28p. Order from LC. Mi $2.70, ph $4.80. AECU-4515

Dynamic response of reactor plant to load changes. Section I. First performance. Core I. Seed I. Duquesne Light Co., Shippingport, Pa. Nov 59. 27p. Order from LC. Mi $2.70, ph $4.80. AECU-4516

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Nuclear instrumentation operation during plant operation. Section I. First performance, Core I, Seed I. Duquesne Light Co., Shippingport, Pa. Dec 59. 4p. Order from LC. Mi $1.80, ph $1.80. AECU-4584

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Basic slurry investigations, by The Chemistry Section, Research Center, Alliance, Ohio. The Babcock and Wilcox Company, Lynchburg, Va. June 60. Contract AT(30-1)-1940. 276p. Order from OTS. $3.50. BAW-1254

Heavy water moderated power reactors. Progress report for January 1960, by D. F. Babcock and others. E. I. du Pont de Nemours & Co. Explosives Department, Atomic Energy Division, Technical Division, Wilmington, Del. Mar 60. Contract AT(07-2)-1. 41p. Order from OTS. $1.25. DP-465

Heavy water moderated power reactors. Progress report for February 1960, by D. F. Babcock and others. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Wilmington, Del. Apr 60. Contract AT(07-2)-1. 39p. Order from OTS. $1.25. DP-475

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Maritime gas-cooled reactor program: Quarterly progress report for the period ending September 30, 1959, by K. A. Trickett and others. General Dynamics Corporation, General Atomic and Electric Boat Division, San Diego, Calif. 1959. Contract AT(04-3)-187. 187p. Order from OTS. $3.50. GA-1183

Experimental PRTR moderator flow distribution results, by M. R. Kreiter. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Jan 59. 13p. Order from LC. Mi $2.40, ph $3.30. HW-58743

PRTR gas-cooled loop, hazards survey of preliminary scope design, by N. G. Wittenbrock. General Electric Company, Hanford Atomic Products Operation, Richland, Wash. Apr 59. Contract W-31-109-Eng-52. 24p. Order from LC. Mi $2.70, ph $4.80. HW-59638

A calculation of the reactivity worth of plutonium and uranium-235 as enrichment in thermal reactors, by D. P. Granquist. General Electric Company, Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 34p. Order from LC. Mi $3.00, ph $6.30. HW-59758 (Rev.)

New production reactor thermal shielding studies, by S. J. Friesenhahn. General Electric Company, Hanford Atomic Products Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 9p. Order from LC. Mi $1.80, ph $1.80. HW-61761

Army gas-cooled reactor systems program: Inpile loop tests of GCRE elements (I-1T and I-1'T), by S. Nakazato, P. M. Williams and W. D. Wilson. Aerojet-General Nucleonics, San Ramon, Calif. July 59. Contract AT(10-1)-880. 81p. Order from OTS. $2.25. IDO-28539

Fabrication of modified GCRE fuel plates using spherical UO_2 dispersions, by G. A. Linenberger.and others. Aerojet-General Nucleonics, Military Projects Division, San Ramon, Calif. Mar 60. Contract AT(10-1)-880. 13p. Order from OTS. 35 cents. IDO-28547

The ML-1 design report, by G. A. Linenberger. Aerojet-General Nucleonics, Military Projects Division, San Ramon, Calif. May 60. Contract AT(10-1)-880. 119p. Order from OTS. $2.75. IDO-28550

Appraisal of organic coolant reactor cycle. Knolls Atomic Power Laboratory, Schenectady, N. Y. Dec 56. Decl. June 25, 1959. Contract W-31-109-Eng-52. 22p. Order from LC. Mi $2.70, ph $4.80. KAPL-1738

Quarterly status report on LAMPRE program for period ending May 20, 1960, by S. Glasstone. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. Contract W-7405-ENG-36. 64p. Order from OTS. $1.50. LAMS-2438

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Evaluation of calandria, thimble, and canned-moderator concepts for sodium graphite reactors, by G. L. Reed. Atomics International. A Division of North American Aviation, Inc., Cnnoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 64p. Order from OTS. $1.50. NAA-SR-3573

Fuel burnup studies for a 255 Mwe advanced sodium graphite reactor, by A. L. Aronson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 69p. Order from OTS. $1.75. NAA-SR-4529

Heating transformer performance, by R. S. Baker and I. Villalva. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 24p. Order from OTS. 50 cents. NAA-SR-4532

Stress analysis of HNPF loading-face shield, by R. D. Chipman, M. D. Lynch and R. M. Peterson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. June 60. Contract AT(11-1)-GEN-8. 50 p. Order from OTS. $1.00. NAA-SR-4535

Piqua OMR waste gas disposal, by H. M. Gilroy and J. H. Wilson. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 67p. Order from OTS. $2.00. NAA-SR-4576

300,000-KWE SGR nuclear power plant of current technology, by J. Renard, C. L. Peckinpaugh and R. E. Aronstein. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Aug 60. Contract AT(11-1)-GEN-8. 148p. Order from OTS. $2.50. NAA-SR-4873

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Hydraulic characteristics of HNPF 19-rod fuel element, J. A. Hagel. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. July 60. Contract AT(11-1)-GEN-8. 32p. Order from OTS. $1.00. NAA-SR-5340

Preliminary safety analysis of the sodium-deuterium reactor (SDR), by C. C. Beusman. Nuclear Development Corporation of America, White Plains, New York. May 59. Contract AT(30-3) 256. 127p. Order from OTS. $2.50. NDA-84-14

10 MW_e sodium deuterium reactor design report, by E. Bernsohn and P. J. Davis. Nuclear Development Corporation of America, White Plains, N. Y. Feb 59 and Mar 59. Contract AT(30-3)-256. 340p. Order from OTS. $4.50. NDA-84-16 (Vols. I & II)

Selected reactors of the power reactor demonstration program. A literature search, by J. M. Jacobs. Office of Technical Information Extension, Oak Ridge, Tenn. June 60. 34p. Order from OTS. 75 cents. TID-3556

New production reactor power plant economic feasibility study, by Federal Power Commission, Burequ of Power, San Francisco Regional Office, Calif. Feb 60. 138p. Order from OTS. $2.50. TID-5762(Vol. I)

State regulation and the future of nuclear power, by R. E. Untereiner. Office of Technical Service Information, Oak Ridge, Tenn. June 60. 11p. Order from OTS. 50 cents. TID-8208

Advanced pressurized water reactor study. Phase II-A report, by Stone and Webster Engineering Corporation and Combustion Engineering, Inc., for Divison of Reactor Development, U. S. Atomic Energy Commission. July 60. Contract AT(10-1)-1010. 405p. Order from OTS. $2.50. TID-8502(Pt. 1) (Supplement)

Heavy water moderated power reactor plants. Design study, by Sargent & Lundy, Engineers and Nuclear Development Corporation of America for Division of Reactor Development, U. S. Atomic Energy Commission. June 59. Contract AT(38-1)-193 Mod. 1. 415p. Order from OTS. $4.50. TID-8503(Pt. 3)

Complete results of the preliminary design and hazards study for the Boiling Nuclear Superheater (BONUS) Power Station are reported in four volumes:
Volume 1: Reference Design - 238p.
Volume 2: Technical and Economic Evaluation of Reference Design - 154p.
Volume 3: Alternate Design Studies - 137p.
Volume 4: Preliminary Hazards Summary Report - 361p.
The Puerto Rico Water Resources Authority and General Nuclear Engineering Corporation, Dunedin, Fla. June 60. 4 volumes (bound separately but priced as a unit). Order from OTS. $9.50. TID-8524

Small size pressurized water reactor specifications, by Gibbs and Hill, Inc. Internuclear Company. Nov 59. 72p. Order from OTS. $1.00. TID-8525

Small size pressurized water reactor conceptual design, by Gibbs and Hill, Inc. Internuclear Company. Apr 60. Contract AT(40-1)-2589. 81p. Order from OTS. $1.75. TID-8526

Bettis Technical Review, by B. F. Langer and others. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. Apr 60. Contract AT-11-1-GEN-14. 134p. Order from OTS. $2.75. WAPD-BT-18

Pressurized water reactor (PWR) project. Technical progress report for the period April 24, 1960 to June 23, 1960, by P. N. Ross and others. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. 1960. Contract AT-11-1-GEN-14. 149p. Order from OTS. $2.50. WAPD-MRP-186

PWR hazards summary supplement, by R. Atherson. and others. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. Oct 59. Contract AT-11-1-GEN-14. 11p. Order from OTS. 50 cents. WAPD-PWR(RD-1)-596

Stable Isotope Separation

Possible large-scale uses of separated fission products. Presented at November 1959 meeting of the Atomic Industrial Forum. Technical Information Service Extension, Oak Ridge, Tenn. 5p. Order from OTS. 50 cents. TID-8521

Technology—Feed Materials

New beta heat-treating salt baths for reducing hydrogen pickup by uranium rods, by L. L. Lortscher, K. A. Sense, and R. B. Filbert, Jr. Battelle Memorial Institute, Columbus, Ohio. June 57. Decl. March 27, 1960. Contract W-7405-eng-92. 31p. Order from OTS. 40 cents. BMI-1195

Densification of uranium tetrafluoride by sintering, by R. A. Carter. Union Carbide Nuclear Company, Union Carbide and Carbon Corporation, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Mar 57. Decl. June 27, 1960. Contract W-7405-eng-26. 15p. Order from OTS. 30 cents. K-1299

Process developments in the manufacture of uranium hexafluoride for period July 1957 through June 1959. Union Carbide Nuclear Company, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. July 60. Contract W-7405-eng-26. 41p. Order from OTS. $1.00. K-1437

Process development quarterly report, Part I, by N. E. Berry and others. Mallinckrodt Chemical Works, St. Louis, Mo. Oct 55. Decl. June 27, 1960. Contract W-14-108-eng-8. 142p. Order from OTS. $2.50. MCW-1380

Process development quarterly report. Part I-Laboratory work, by N. Kuhlman and others. Mallindkrodt Chemical Works, St. Louis, Mo. Jan 57. Decl. May 31-60. Contract W-14-108-eng-8. 151p. Order from OTS. $2.75. MCW-1399

Process development quarterly report. Part I. Laboratory work, by N. Kuhlman and others. Mallinckrodt Chemical Works, St. Louis, Mo. Apr 57. Decl. July 15, 1960. 144p. Order from OTS. $2.50. MCW-1401

The utilization of the HF-H_2O azeotrope in the manufacture of uranium tetrafluoride, by L. G. Weber. Mallinckrodt Chemical Works, Uranium Weldon Spring, Mo. July 60. Contract W-14-108-eng-8. 13p. Order from OTS. 50 cents. MCW-1450

Process development quarterly progress report for April through June 1960, by J. H. Yeager and others. Mallinckrodt Chemical Works, Uranium Division, Weldon Spring, Mo. Aug 60. Contract W-14-108-Eng-8. 68p. Order from OYS. $1.75. MCW-1451

Laboratory evaluation of South Australian Radium Hill uranium concentrates, (Ammonium precipitate and Magnesium precipitate), by B. G. Ryle. and others. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Jan 57. Decl. June 2, 1960. Contract AT(30-1)-1156. 21p. Order from OTS. 35 cents. NLCO-665

Laboratory and pilot plant evaluation of synthetic carnotite uranium concentrate, by B. G. Ryle and others. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Feb 57. Decl. June 6, 1960. Contract AT(30-1)-1156. 27p. Order from OTS. 35 cents. NLCO-669

A summary report of all pilot plant work done in developing a continuous process for the production of UF_4, by E. K. Teter. Mallinckrodt Chemical Works, St. Louis, Mo. Dec 50. Decl. August 5, 1960. 22p. Order from OTS. 35 cents. NYO-1316

Reprocessing of uranium bearing barium sulfate cake produced in the M. C.W. refinery, by A. M. Kirby. Mallinckrodt Chemical Works, Uranium roject lants, St. Louis, Mo. May 53. Decl. July 14, 1960. Contract W-14-108-Eng-8. 31p. Order from OTS. 40 cents. NYO-1351

A study of continuous extraction methods, by S. H. Anonsen. Mallinckrodt Chemical Works, St. Louis, Mo. May 45. July 12, 1960. Contract W-7405-eng-1. 178p. Order from OTS. $1.10. NYO-5077

The use of poro carbon tubes for dust removal, by H. Yeager and K. Eckberg. Mallinckrodt Chemical Works, St. Louis, Mo. May 50. Decl. August 9, 1960. 7p. Order from OTS. 25 cents. NYO-5234

A report on the filtration of TBP slurrex raffinate, by A. M. Kirby and others. Mallinckrodt Chemical Works, St. Louis, Mo. [nd]. Decl. August 10, 1960. 27p. Order from OTS. 35 cents. NYO-5254

Application of the pulse column for uranium recovery from K-25 wastes, by E. Lieberman and A. C. Jealous. Oak Ridge National Laboratory, Oak Ridge, Tenn. Nov 53. Decl. August 8, 1960. Contract W-7405-eng-26. 22p. Order from OTS. 35 cents. ORNL-1543

Fluorox moving-bed process for producing UO_3, UF_4, and UF_6: A bibliography, by J. E. Moore. Oak Ridge National Laboratory, Oak Ridge, Tenn. Aug 56. Decl. July 6, 1960. Contract W-7405-eng-26. 20p. Order from OTS. 35 cents. ORNL-2117

Laboratory development of the fluorox process: II. Thermogravimetric study of the chemical kinetics for the reaction of UF_4 with dry oxygen, by I. M. Ferris and E. G. Carter. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 57. Decl. June 2, 1960. Contract W-7405-eng-26. 26p. Order from OTS. 35 cents. ORNL-2216

Technology—Raw Materials

Energy from uranium and coal reserves, by R. D. Nininger, C. I. Gardner, M. F. Searl and D. W. Kuhn. Office of Operations Analysis and Forecasting and Division of Raw Materials, United States Atomic Energy Commission. May 60. 7p. Order from OTS. 50 cents. TID-8207

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AGRICULTURE

Plant Cultivation

Wisconsin U., Madison.
COASTAL PIONEER PLANTS OF THE CARIBBEAN AND GULF OF MEXICO, by Jonathan D. Sauer. Final rept. on Contract Nonr-1202(08). 12 Oct 59, 92p. 212 refs. AD-228 002.
Order from LC mi$5.40, ph$15.30 PB 149 860

Contents:
Sites studied and species encountered
The coastal flora in general
Inland vs. littoral species
Primarily inland species
Ambivalent species
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Plant dispersal by ocean currents
Primarily littoral species
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The flora of different shore types
Salt flats, marsh and estuary margins
Artificial shores
Natural sand, gravel, and limestone shores
Microdistribution patterns
Irregularities unrelated to habitat
Zonation parallel to the shore

Naval Photographic Interpretation Center, Washington, D. C.
AERIAL PHOTOGRAPHIC INTERPRETATION OF DISEASED AND HEALTHY CEREAL CROPS, by L. W. Keith. 30 Jan 53, 13p. PIC rept. 102-53.
Order from LC mi$2.40, ph$3.30 PB 150 785

This report released for sale to the public 11 Oct 60.

ASTRONOMY

Aeronautical Research Labs., Air Force Research Div., Wright-Patterson AFB, Ohio.
THE LIMITATIONS FOR NIGHTTIME DETECTION OF CELESTIAL BODIES EMPLOYING THE IMAGE ORTHICON AND THE INTENSIFIER IMAGE ORTHICON, by Radames K. H. Gebel. Rept. on Research on the Quantum Nature of Light. June 60, 46p. 9 refs. WADC Technical note 59-131.
Order from OTS $1.25 PB 161 951

This paper concludes that it is theoretically possible, by using the intensifier image orthicon, to exceed by ten magnitudes the faintest star ever recorded. Generally, the final limit of detectability of faint stars is determined by the randomness in the radiation of the sky background. Further limitations are imposed by the statistical fluctuations in the conversion of photons into electrons at the photocathode and the statistical fluctuations of the photocathode dark current emission. When using the image orthicon without intensifiers, these fluctuations become small with respect to the scanning beam fluctuations. Part I deals with the conventional image orthicon, with the scanning beam fluctuations usually being the prime factor in limiting detectability. An equation is derived which permits calculation of the apparent star magnitude which can be recorded under the made assumption with the image orthicon without intensifier stages. Part II deals mainly with the intensifier image orthicon. Formulas are derived for the intensifier image orthicon for threshold star magnitude number, as determined by the fluctuations in the emission due to sky radiation and photocathode dark current emission. (Author)

Astrophysics

Astrophysical Observatory, Smithsonian Institution, Cambridge, Mass.
STUDY OF ATMOSPHERIC ENTRY AND IMPACT OF HIGH VELOCITY METEORITES, by Fred L. Whipple. Quarterly status rept. no. 18, 1 Apr-30 June 60, on Contract AF 18(600)1596. 31 Aug 60, 5p.
Order from LC mi$1.80, ph$1.80 PB 150 382

See also PB 148 019

Brandeis U., Waltham, Mass.
ELECTRON SCREENING IN DENSE DEGENERATE GASES, by Jack S. Goldstein. Final rept. on Contract AF 19(604)5563. 30 May 60, 24p. 12 refs. AFCRC-TR-60-275.
Order from LC mi$2.70, ph$4.80 PB 149 596

An investigation is made of the screening properties of a degenerate electron gas, with principal attention placed on the physical conditions to be found in white dwarf stars. In particular, the effect on nuclear reaction rates is considered. We find that although the method of approach differs, the result is not significantly different from that obtained by previous authors except in a very narrow range of densities. (Author)

California U., Los Angeles.
THE "ASTRONOMICAL UNIT" AND THE SOLAR PARALLAX, by Samuel Herrick, George Westrom, and Maud W. Makemson. Rept. on Contract AF 49(638)498. 30 Sep 59, 26p. 24 refs. Astrodynamical rept. no. 5; AFOSR-TN-59-1044; AD-234 711.
Order from LC mi$2.70, ph$4.80 PB 148 266

A plan for the exploration of the world of planets has developed divergencies of usage on the navigation of interplanetary vehicles, of which one of the most significant and interesting concerns the unit of distance and associated trajectory constants. On the one hand there are those, steeped in laboratory concepts and units and in thrust and drag, who prefer to bring the planets into line by expressing their coordinates in laboratory units. On the other hand there are those who point out that the positions of the planets and the gravitational constant have accuracies up to 8 or 9 significant figures when the unit of distance is the astronomical unit (approximately the mean distance of the earth from the sun) and only to 3 or 4 in any laboratory unit. The pros and cons of these 2 schools of thought, and the 2 ways of handling the trajectory calculations, are explored in connection with specific orbit problems. (Author)

Free U. of Berlin (Germany).
REMARKS ON THE VALIDITY OF A TEST FOR EVOLUTION, by K. Just and R. Wielen. Technical note no. 1 on Contract AF 61(052)335. 3 May 60, 9p. 4 refs. AFOSR-TN-60-916.
Order from LC mi$1.80, ph$1.80 PB 150 348

The former test against a steady state of the universe (Just: Ap. J. 129 (1959) 268-270) holds even when the used clusters of galaxies are catalogued (Abell: Ap. J. Suppl. 3 (1958) 211 - 288) with certain systematic errors. (Author)

Harvard Coll. Observatory, Cambridge, Mass.
EVAPOROGRAPHY WITH SPECIAL APPLICATION TO THE MOON, by Hector C. Ingrao and Donald H. Menzel. Scientific rept. no. 4 on Contract AF 19(604)3074. 15 June 60, 44p. 31 refs. AFCRC-TN-60-469.
Order from LC mi$3.30, ph$7.80 PB 149 806

The methods of evaporography and condensography are discussed with special application to the Moon. Measurements of the droplets, resolving power and detectivity are given. On July 30, 1958, a condensograph of the Moon was obtained with integrated radiation and an evaporograph through a germanium filter; both photographs were made with a reflector of 8-inch aperature and effective focal ratio F/1.85. The feasibility of this technique for a study of some properties of the surface of the Moon is discussed. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
EXTRATERRESTRIAL RADIATION OF NONTHERMAL ORIGIN, by S. Kownacki. Technical note on Physical Electronics. June 60, 31p. 27 refs. LMSD-703032.
Order from LC mi$3.00, ph$6.30 PB 149 594

A type of radiation where spectral energy distribution does not conform with Planck's radiation law is discussed. Various possible mechanisms of its generation are considered with particular emphasis on the "synchrotron mechanism," radiation of electromagnetic waves from fast, charged particles subjected to the centripetal acceleration by magnetic fields. An analysis of the more convincing aspects of the theory as well as its inadequacies is given with description of relevant experimental evidence. The need for further experimental and theoretical work in connection with both the synchrotron mechanism and other alternatives is presented. In particular, additional work is discussed in some detail as related to the investigation of the spectral distribution of radiation, polarization, evaluation of magnetic fields, and to the number and energies of radiating particles. Finally, possible fields of inquiry are mentioned as well as methods of approach to the problems of developing models of alternative mechanisms. (Author)

Maryland U., College Park.
DISTRIBUTION OF DENSITY IN A PLANETARY EXOSPHERE, PART II, by E. J. Opik and S. F. Singer. Rept. on Contract AF 19(604)3861. 20 June 60, 28p. 6 refs. GRD-TN-60-606.
Order from LC mi$2.70, ph$4.80 PB 149 952

In an isolated neutral exosphere three components are distinguished: (1) elliptic-ballistic; (2) hyperbolic-ballistic; (3) bound-elliptic. Component (2) forms the escape flux which cannot be defined simply. Numerical results are given for neutral hydrogen and oxygen, applicable to the terrestrial exosphere. (See also PB 142 711)

Maryland U., College Park.
SOME CONSIDERATIONS OF EXPECTED RADIATION BELTS OF PLANETS MARS AND VENUS, by S. F. Singer. Scientific rept. no. 4 on Contract AF 19(604)5575. Jan 60, 23p. 50 refs. ERD-TN-60-573.
Order from LC mi$2.70, ph$4.80 PB 149 887

The historical development of the ideas which led to the prediction of geomagnetically trapped radiation are briefly traced out. Direct observations are then summarized, and various theories concerning the origin of the radiation belts are discussed. The neutron albedo-plus-solar injection theory (which predicts existence of two belts) is then applied to calculate the expected distribution of trapped particles near Mars and Venus. The "sweeping" effect of the Martian satellite Phobos is calculated; it should provide a radiation-free base near Mars. (Author)

Maryland U., College Park.
STRUCTURE OF THE EARTH'S EXOSPHERE, by S. F. Singer. Rept. on Contract AF 19(604)3861. 27 June 60, 10p. 10 refs. GRD-TN-60-607.
Order from LC mi$1.80, ph$1.80 PB 149 953

The main components of the earth's exosphere are neutral oxygen, neutral hydrogen atoms, ionized oxygen. The position of the base of the exosphere is established at an altitude of 530 km from an analysis of density data obtained from satellite drag observations. The relative distribution of both neutral oxygen and neutral hydrogen is derived from a theory of the exosphere. The normalization of oxygen is accomplished by means of satellite drag data. The normalization of hydrogen is accomplished by the use of the Lyman-alpha technique of Johnson, Friedman and Tousey. The distribution of ionized oxygen can be established jointly from the rocket measurements of Berning and from an analysis of radiation belt data obtained from satellites. They give a consistent picture of ionized oxygen becoming the most important constituent of the atmosphere at about 1500 km. The distribution of ionized hydrogen is only imperfectly known at the present time. (Author).

Oklahoma State U. Research Foundation, Stillwater.
AN ANALYSIS OF ROCKET AND EARTH SATELLITE MEASUREMENTS OF MICROMETEORIC INFLUX, by Curtis W. McCracken. Master's thesis. Final rept. vol. II, appendix B on Acoustic Detection of Meteoric Particles, Contract AF 19(604)1908. 14 Apr 60, 128p. 52 refs. AFCRC TR-60-272, vol. 2, app. B; AD-240 260.
Order from LC mi$6.30, ph$19.80 PB 150 381

The micrometeor data and some of the other available data on meteoric influx are plotted together as particle influx versus particle momentum to get a tentatively revised mass distribution curve. An equation is fitted to the tentatively revised mass distribution curve in order to obtain the corresponding tentatively revised mass distribution function. The new mass distribution function allows a significant extension of the known mass distribution function for meteoric particles. Some of the implications of the tentatively revised mass distribution function are discussed in a quite qualitative manner. (Author) (See also PB 149 099)

Palomar Observatory, San Diego, Calif.
A THEORY OF THE ROLE OF MAGNETIC ACTIVITY DURING STAR FORMATION, by Evry Schatzman. Special technical rept. no. 3 (Pre-print) on Contract AF 49(638)21. 14 Jan 60, 27p. 14 refs. AFOSR-TN-60-214; AD-234 150.
Order from LC mi$2.40, ph$3.30 PB 147 618

BEHAVIORAL SCIENCES

Human Engineering

Aeronautical Instruments Lab., Naval Air Development Center, Johnsville, Pa.
EXPERIMENTAL DESIGN FOR HUMAN ENGINEERING EVALUATION OF DV-10/A2F DISPLAYS, by William A. Bradley. Rept. on Proj. TED ADC AV-73011. 30 June 59, 21p. Rept. no. NADC-AI-5958.
Order from LC mi$2.70, ph$4.80 PB 149 526

The purpose of this experiment is to determine the optimum scale factors of certain variables in an electronic contact analog display on the basis of minimum errors obtained in this experiment. These optimum scale factors will then be utilized in the experimental cockpit of the R4Y in real flight and the results compared with those obtained in the simulator.

California U., Los Angeles.
STUDIES OF EFFECTIVENESS OF ELIMINATION OF DISPLAYED INFORMATION WITH OBSERVER PRACTICE INCREASE. Annual summary rept. for Nov 58-Sep 59 on Contract Nonr-233(49). Oct 59, 28p. Dept. of Engineering rept. 58-62; AD-229 418.
Order from LC mi$2.70, ph$4.80 PB 149 507

A review of research accomplishments during the year 1958-1959 is presented. Activities fell into broad categories as follows: (1) development and check-out of an electronically controlled display and control panel and necessary recording apparatus for the study of specified display variables in a perceptual-motor task; (2) development of methodology and actual construction of a versatile paper-and-pencil test for the evaluation of redundancy in dial reading tasks; and (3) initial experimental investigations and subsequent statistical analyses for the evaluation of probability distribution and the performance effects of additional signal cues on the apparatus task, and the evaluation of performance effects as a function of both type and amount of redundancy on a simulated dial reading task. (Author)

Control Systems Lab., U. of Illinois, Urbana.
HUMAN PERFORMANCE IN INFORMATION TRANSMISSION. PART VI. EVIDENCES OF PERIODICITY IN INFORMATION PROCESSING, by L. G. Augenstine. Rept. on Contract DA 36-039-sc-56695. Dec 58, 38p. 7 refs. Rept. R-75; AD-209 278.
Order from LC mi$3.00, ph$6.30 PB 149 398

In the present study an attempt has been made to specify some of the properties associated with data processing.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
TRANSFER OF TRAINING AMONG COMPONENTS OF A COMPLEX VELOCITY CONTROL TASK, by Randall M. Chambers. Rept. no. 3 on BuMed Proj. MR 005.15-1003.1. 28 Dec 59, 24p. 12 refs. NADC-MA-5920; AD-233 756.
Order from LC mi$2.70, ph$4.80 PB 148 273

The principle of transfer of training among task components states that practice on one part within a total task will result in increments in performance proficiency on the other parts as well as in the total task, provided that the parts are similar to one another. Results of tests conducted on 9 groups of airmen who were given specific practice on parts of a complex multidimensional compensatory rate control task showed that skill proficiency on certain unpracticed components within the total-skill complex was changed as a function of practice on certain components. Practice on the originally difficult component singly, and practice on this component simultaneously with other components, resulted in major reorganization of the skill complex, and in significant increments in total task performance over that of controls, whereas practice on the originally easiest component or combinations involving the easiest component, were generally less effective, even though marked transfer of training occurred. More transfer of training to the total-task occurred following practice on the originally difficult component and/or combinations involving it than following practice on the originally easy component and/or its combinations. Within the task, transfer of training was more effective than the practice itself for raising the proficiency level of originally easy components. However, in situations involving originally difficult components, transfer of training was slightly less effective than practice itself for raising the proficiency level of that component. (Author)

Educational Research Corp., Cambridge, Mass.
A TRAINING ANALYSIS OF THE PILOT'S TASK IN TRANSITIONING TO JET VTOL AIRCRAFT, by Phillip J. Rulon and Milton W. Horowitz. Rept. on Contract N61339-74. Sep 59, 57p. 6 refs. Technical rept. NAVTRADEVCEN 74-1; AD-231 477.
Order from LC mi$3.60, ph$9.30 PB 148 271

An analysis of Vertical Take-off and Landing (VTOL) flight training problems was undertaken. The study consisted primarily of discussions with technical and pilot personnel, examination of test flight reports, and observation of VTOL aircraft from the human engineering viewpoint. Since VTOL aircraft were still in the development stage, the study was necessarily anticipatory and opportunistic. However, an attempt was made to provide data most relevant to horizontal attitude VTOL. A number of factors were found to make the task of flying VTOL aircraft exceptionally difficult. The more important of these were: (1) need for great precision in controlling aircraft, especially during transition from the hovering to the aerodynamic mode; (2) poor visibility from the cockpit during certain flight modes; (3) variations in display-control relationships and instrument responsiveness and sensitivity as a function of flight mode; and (4) inadequate instrumentation for determining whether aircraft is sustained by thrust or aerodynamic control. Solutions of these problems are considered in terms of better instrumented and human engineering VTOL aircraft; previous helicopter training; the use of 2-place VTOL training aircraft; and selected training devices. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
LEADERSHIP IN ARMY INFANTRY PLATOONS: STUDY II, by Carl J. Lange and T. O. Jacobs. Rept. on Contract DA 49-106-qm-1. July 60, 42p. 4 refs. Research rept. 5.
Order from LC mi$3.30, ph$7.80 PB 149 966

A Leader Activities Questionnaire (LAQ) was developed to measure leader behavior variables found in an earlier study to be associated with judgments of leader effectiveness. The LAQ was planned for use as a measure of the effectiveness of experimental platoon leader training based on the leader behavior variables identified earlier. Results of the tryout indicated that most of the LAQ scoring categories were satisfactory as to internal consistencies and the extent to which platoon members agreed in describing behavior of their platoon leaders. Validities of parallel variables from the earlier and the present study were in substantial agreement. This was interpreted as evidence that the LAQ measured acceptably well those variables it was designed to measure. The close agreement between the two sets of results increases the confidence with which the findings of the earlier study can be used as a basis for training platoon leaders. (Author) (See also PB 142 579)

Illinois U., Urbana.
PART- VERSUS WHOLE-TASK LEARNING OF A FLIGHT MANEUVER, by Jack A. Adams, Lyle E. Hufford, and James M. Dunlop. Rept. on Contract N61339-297. 21 June 60, 58p. 13 refs. Technical rept. NAVTRADEVCEN-297-1.
Order from LC mi$3.60, ph$9.30 PB 150 180

Two matched groups of pilots were trained in a hypothetical toss-bomb maneuver to be performed in the SNJ Operational Flight Trainer. One group had separate training in flight control and procedural tasks; the contrasted group had concurrent training in the two classes of tasks. After equal amounts of training, both groups were asked to perform the maneuver in the whole-task version (i.e. criterion task). Analysis of the whole-task performance of the two contrasted groups revealed that only on the first trial was the part-task group less proficient than the group that learned the two types of tasks concurrently. And even then, this inferiority was shown only on the procedural aspects of the whole task. As for the flight control tasks, they were performed equally well by both groups on the very first whole-task trial.

Naval Personnel Research Field Activity, Washington D. C.
COMPARISON OF PERFORMANCE AND UTILIZATION OF FTs WITH DIFFERENT TRAINING AND ASSIGNMENT BACKGROUNDS, by Norman Labbe and Bert T. King. Mar 60, 27p. 3 refs. Technical Bulletin 60-2.
Order from LC mi$2.70, ph$4.80 PB 150 007

Data were collected aboard ships of the Atlantic Fleet dealing with the reenlistment intentions, professional and technical performance, and shipboard training and utilization of 265 Fire Control Technicians (FT). It was found that: (1) The incidence of reenlistment intentions was not associated with pay-grade level, GCT+ARI score, "A"-School attendance, or size of FT complement. (2) Better professional and military performance were associated with "A"-School attendance, petty-officer status, and higher GCT+ARI scores. (3) Speed of advancement was related to "A"-School attendance but not to GCT+ARI or size of FT complement. (4) Assignment to more difficult equipments was more frequent for men in larger complements. However, assignment to more difficult tasks characterized men in smaller complements, petty officers, and graduates of Class "A" FT School. (5) About one-half of these technicians were considered by their supervisors to have critical training needs.

Naval Personnel Research Field Activity, Washington, D. C.
SPEED FACTORS IN OFFICER SELECTION MEASURES, by Leonard Wollack and Isaiah Guttman. Feb 60, 31p. 18 refs. Technical Bulletin 60-5.
Order from LC mi$3.00, ph$6.30 PB 150 191

This research sought to find out if certain speed factors could account for the improvement that had been obtained in the prediction of success at Officer Candidate School when the experimental Verbal-Numerical Test (VNT) was used along with the operational Officer Qualification Test (OQT). The analyses offered no support to the hypothesis that "speed" accounted for the unique covariance in question. Rather, it appeared that quantitative reasoning components of the VNT best explained the improvement in prediction. Consequently, in the development of new forms (7, 8, and 9) of the OQT a greater number and variety of mathematics items are being included. (Author)

New York U., N. Y.
AUTOMATED TEACHING: A REVIEW OF THEORY AND RESEARCH, by Robert E. Silverman. Rept. on Contract N61339-507. 8 June 60, 49p. 56 refs. Technical rept. NAVTRADEVCEN-507-2.
Order from LC mi$3.30, ph$7.80 PB 150 179

The present state of research in the area of automated teaching and the application of automated teaching devices were reviewed in terms of issues relating to programming, to machine variables, and to studies comparing conventional instruction with automated instruction. Some basic issues were singled out for consideration. Such problems as prompting, confirmation, reinforcement, size-of-step, and branching were considered. The design and construction of machines were judged to be a secondary issue; the question of programming takes precedence. The problem of measuring the effects of automated teaching was considered to be crucial, since it is bound to the question of what is to be learned. It was also pointed out that job analyses of learning tasks must be done and measurement problems solved before valid comparisons between automated and conventional instruction can be made. (Author) (See also PB 148 755)

Pennsylvania State U., University Park.
THE EFFECTIVENESS, ACCEPTABILITY, AND FEASIBILITY OF TECHNICAL TRAINING COURSES RECORDED ON SOUND MOTION PICTURES AND SLIDES PLUS TAPES, by D. P. Duvall, L. P. Greenhill and others. Rept. on Contract N61339-364. June 60, 26p. Technical rept. NAVTRADEVCEN-364-1.
Order from LC mi$2.70, ph$4.80 PB 150 178

The purpose of this study was to develop and evaluate economical and effective means for recording existing courses of instruction in technical areas for subsequent use on shore or in the fleet. The techniques for attempting to do this included the use of minimum cost sound motion pictures, and 2" x 2" slides with audio tape. Specifically, comparisons were to be made between: (a) instruction recorded on 16mm sound motion pictures and face-to-face instruction, and (b) instruction recorded on 2" x 2" slides plus audio tape and face-to-face instruction. The comparisons were to be in terms of (1) the relative effectiveness of the methods as measured by the performance of trainees following the courses, (2) the acceptability of the methods, and (3) the feasibility of the methods. (Author)

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.
A REGRESSION ANALYSIS OF ONE SET OF AIRMAN PROFICIENCY TEST SCORES, by Chester J. Judy. June 60, 14p. 7 refs. WADD-TN-60-139.
Order from LC mi$2.40, ph$3.30 PB 150 076

One criterion for airman skill upgrading in the Air Force is met by attaining a qualifying score on an applicable Airman Proficiency Test (APT). This note reports an analysis which shows the proportion of variance one such test has in common with selected measures of training, experience, education, aptitude, supervisory opinion, and airman attitudes for a sample of 384 aircraft mechanics tested in 1956 and 1957. Each of these categories of information, excepting airman attitudes, could be used to predict the APT criterion at some level of effectiveness; but only the training variables and the aptitude variables added significantly to the prediction attainable by using all other available information. Other research was cited in which various APT correlates are reported. Results show the utility of APT scores in defining one important aspect of airman proficiency. (Author)

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.
CHARACTERISTICS OF OFFICERS GRADUATING IN 1954 FROM AIR FORCE INSTITUTE OF TECHNOLOGY PROGRAMS, by David K. Trites and Robert N. Cyzmoure. Apr 60, 40p. WADD TN-60-46; AD-237 212.
Order from LC mi$3.00, ph$6.30 PB 148 246

The results of a survey of 360 officers who remained in the Air Force and of 151 officers who left the Air Force subsequent to graduation from training programs sponsored by the Air Force Institute of Technology are reported. Background information was collected and questionnaires were mailed to each group of officers. It was found that officers remaining on active duty are generally older, have more rank, have spent more time in service, and more frequently are rated than were officers leaving service. A number of possible methods of improving retainability are identified and discussed. The most important of these are: (1) require a period of active duty service prior to assignment to AFIT programs; (2) increase the length of obligated service following AFIT graduation; (3) following AFIT graduation, insure that officers have sufficient time and opportunity to meet requirements for continued flying status; (4) in no way jeopardize an officer's promotion list status as a result of AFIT training; (5) continue to offer Distinguished Military Graduates of AFROTC regular commissions upon entering active duty in the Air Force; (6) increase the length of assignments following AFIT graduation; and (7) provide proficiency pay to reduce the gap between Air Force and civilian salaries for the same jobs. (Author)

Personnel Lab., Wright Air Development [Div.] Lackland AFB, Tex.
CONSTRUCTION AND VALIDATION OF THE INSTRUCTOR APTITUDE TEST, by Cecil J. Mullins and John A. Cox. Dec 59, 9p. 2 refs. WADC TN-59-203; AD-230 968.
Order from LC mi$1.80, ph$1.80 PB 150 590

This report released for sale to the public 11 Oct 60.

A test was constructed for predicting success in Technical Instructor Schools, using items previously proved valid for General Instructor School success and for Pilot Instructor School success. It consists of four parts: a verbal section, an arithmetic reasoning section, a social insight section, and an interest section. The test was normed for instructors now performing on the job. Validation coefficients were obtained between test scores and course grades in Technical Instructor Schools at six Air Force bases. Validities ranged from .06 to .63, with five of the six highly significant. These compare favorably with validities of the General Aptitude Index of the Airman Classification Battery for the final school grade criterion. Test scores identified eliminees from Technical Instructor Schools with considerable accuracy.

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.
CONVERSION OF APTITUDE INDEXES BETWEEN FORMS AC-1B AND AC-2A OF THE AIRMAN CLASSIFICATION BATTERY, by Bart B. Cobb. Feb 60, 9p. 4 refs. WADD TN-60-39; AD-237 210.
Order from LC mi$1.80, ph$1.80 PB 148 245

This study represents an empirical approach by which scales have been developed to facilitate conversion of aptitude indexes derived from the Airman Classification Battery AC-1B to equivalents of corresponding aptitude indexes for the Airman Classification Battery AC-2A. There has been a continuing need, both in test development and in operational situations, for a reliable means of converting the stanine-type aptitude indexes to the modified percentile-type indexes of Battery AC-2A. The Armed Forces Qualification Test score was used as a reference variable to select and equate an AC-1B sample. Frequency distributions were obtained for each of four sets of corresponding indexes and conversion tables were derived by the equipercentile technique. These tables are appropriate for use when comparing qualifications of individuals tested by different forms of the Airman Classification Battery. (Author)

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.
IMPACT OF A NEGATIVELY WEIGHTED VARIABLE ON THE VALIDITY OF AN APTITUDE INDEX, by Leland D. Brokaw and Helen Tomlinson. Jan 60, 8p. 4 refs. WADD TN-60-38; AD-237 209.
Order from LC mi$1.80, ph$1.80 PB 148 244

Evaluation of the impact of a negatively weighted variable as a part of a composite score is made by comparison between the characteristics of such composites and the characteristics of the composites with that variable removed. The validity of the aptitude indexes was increased, but not significantly, by eliminating the negatively weighted element; the correlation between the aptitude indexes was strongly affected. The aptitude indexes, containing the negatively weighted elements, were not appreciable correlated with each other; but the composites, within the negatively weighted elements, were positively intercorrelated. The results strongly support the use of negatively weighted elements in the aptitude indexes of differential classification batteries; they indicate that other purposes are best served by batteries involving only positively weighted elements. This conclusion is pertinent only to aptitude composite whose components all have positive validity. (Author)

Personnel Research and Development Corp., Cleveland, Ohio.
SPATIAL TESTS AS PREDICTORS OF SUCCESS IN AIR FORCE TRAINING, by Erwin W. Taylor and James W. Parker. Rept. on Contract AF 41(657)125. Dec 59, 43p. 2 refs. WADC TR 59-361.
Order from LC mi$3.30, ph$7.80 PB 149 625

The Airman Classification Battery includes two measures of spatial ability. In a search for possible improvement of coverage, 20 spatial tests were investigated to determine their validity for predicting success in Air Force training courses in five career fields representing the five aptitude indexes used in airman classification and assignment. Factor analysis indicated that a heterogeneous test was a better measure of spatial ability than were tests composed of homogeneous items. Of the final school grades as criteria, those for Aircraft Mechanic were most predictable both from Airman Classification Battery tests and from the spatial tests. Those for Organizational Supply Specialist were least predictable. Of the spatial battery tests, the most promising for a place in a differential classification battery is the heterogeneous subtest, Space Survey I. This had high individual validity for mechanical training but generally lower validity for other training. The authors suggest, as a general predictor of success in technical school, a composite which would include measures of academic ability, verbal facility, and ability to handle abstractions. (Author)

Psychology

Air Force Command and Control Development Div., Bedford, Mass.
A SIMULATION FACILITY FOR THE EXPERIMENTAL STUDY OF DECISION MAKING IN COMPLEX MILITARY SYSTEMS, by Joseph M. Doughty. July 60, 27p. 1 ref. AFCCDD-TN-60-32.
Order from LC mi$2.70, ph$4.80 PB 149 979

A system simulation facility and methodology for the study of human decision-making in military air surveillance systems is described. Contemplated experimental studies of decision-making at various levels of command and in various functions is outlined. Results of preliminary development of procedures and measures of performance are given. (Author)

Harvard Graduate School of Education, Cambridge, Mass.
TALK ABOUT SELE: THE RESULTS OF A PILOT SERIES OF INTERVIEWS IN RELATION TO GINZBERG'S THEORY OF OCCUPATIONAL CHOICE, by Robert P. O'Hara (Boston Coll.) Rept. no. 14 on Harvard Studies in Career Development, and Technical rept. no. 10 on Contract Nonr-1866(31). Oct 59, 17p. 2 refs. AD-227 532.
Order from LC mi$2.40, ph$3.30 PB 149 854

The nature of evolving conceptions of self was explored. Fifteen boys in the first, third, fifth, seventh, and ninth grades were interviewed. A boy of high, average, and relatively low intelligence was chosen for each level. The interview covered the following areas: (1) what sort of boy are you; (2) things you like to do; (3) present occupational choice and reasons for it; (4) past choices and reasons for changing them; and (5) role models. Results indicated a predominance of relatives as role models. The boys considered themselves as objective entities and began to evaluate themselves as early as the first grade. Reality testing, objective appraisal, entered the career development earlier than Ginzberg and his associates (An Approach to a General Theory, Columbia University Press, N. Y. 1951) suggested. Evidence of the need for compromise appeared to occur by the age of 12 and 13. A rational connection was indicated between the choices and the bases for choice during the fantasy period. Rejection of the former choices also appeared reasonable. The basis for choice appeared to be largely interest, but values and aptitude appeared as bases 4 to 6 grade-levels below those suggested by Ginzberg.

Institute for Research in Social Science, U. of North Carolina, Chapel Hill.
ANNUAL TECHNICAL REPORT. Rept. for 1 Nov 58-31 Oct 59 on Contract Nonr-855(04). [1959] 10p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 149 516

The various studies summarized are grouped under the following headings: Studies of Social Perception, Studies Related to the recent book by Thibaut and Kelley, Other Experimental Studies, and A Field Study. (See also PB 143 471)

[Institute for Social Research, U. of Michigan, Ann Arbor]
REFERENCE GROUP PROCESSES IN A FORMAL ORGANIZATION, by Jay M. Jackson. (U. of Kansas). Doctoral thesis. Rept. on Contract N6onr-232(02). [1959] 33p. 31 refs. AD-218 325.
Order from LC mi$3.00, ph$6.30 PB 147 897

Research is reported which was directed toward increasing understanding of some of the reference group processes. The following hypothesis were formulated and tested: (1) in any group or organization, a person's attraction to membership will be directly related to the magnitude of his social worth; (2) the magnitude of the positive relationship hypothesized above will vary directly with the volume of interaction the person has with other members of the group or organization under consideration; (3) where alternative group orientations are possible for a person, his relative attraction to membership in one or another group will be directly related to his relative social worth in the group considered; and (4) the magnitude of the positive relationship hypothesized in (3) will vary directly with the volume of interaction the person has with the members of the groups under consideration. Questionnaire data were obtained from 72 staff members of a child welfare agency. The sample consisted of 46 professional and 26 nonprofessional men and women. Hypotheses were tested by computing Pearson product-moment correlations between measures of attraction and social worth. Results indicated that the hypotheses and the assumptions from which they were drawn are supported. The findings point more specifically to the populations, conditions, and context in which the generalizations may hold true. Correlations were computed for high and low contact groups, for professionals and nonprofessionals, supervisory and nonsupervisory personnel, and for work-groups relative to the rest of the organization. None of the relationships approached statistical significance.

Institute of Psychiatry, Maudsley Hospital, London (Gt. Brit.)
RATE OF TEMPORAL AND SPATIAL INHIBITION IN HYSTERIA AND BRAIN DAMAGE IN NORMAL, NEUROTIC, AND BRAIN-DAMAGE SUBJECTS. Final technical rept. for 1 May 59-30 Apr 60 on Contract DA 91-591-EUC-1136. [1960[69p. 33 refs.
Order from LC mi$3.90, ph$10.80 PB 149 422

This report has three sections. In the first of these the experimental investigation has been completed. A battery of tests was administered to 16 hysterics, 16 dysthymics, 16 schizophrenics and 16 normal subjects. The second part is made up of three experiments on reminiscence. The third part consists of a report on sedation threshold as a measure of extraversion and inhibition. This report gives findings on hysterics and dysthymics. (See also PB 143 837).

Link Div., General Precision, Inc., Binghamton, N. Y.
A DEVICE AND TESTS FOR MEASURING INTELLECTUAL FUNCTIONS DURING ACCELERATION, by Irwin Miller, George B. Simon, and Edwin Cohen. Rept on Biophysics of Flight, Contract AF 33(616)6467. May 60, 39p. 28 refs. WADD Technical rept. 60-366.
Order from OTS $1.25 PB 171 019

In manned space flights, a vehicle operator will be expected to perform control functions or act as a systems monitor under high levels of acceleration. To determine the extent to which man's intellectual functions might be impaired under high G, a device was designed for use with the WADD human centrifuge. This device, the Link Intellectual Functions Tester (LIFT), can be operated up to 14 G, and features automatic scoring, tabulation of responses, and automatic pacing of stimulus presentation. Three test batteries of 14 one-minute tests were used to evaluate verbal, reasoning, mathematical, and perceptual abilities under the limitations of high G on the centrifuge. The median reliability of the one-minute tests was 0.27; the estimated reliability of the 14-test battery was 0.83. Until new data actually gathered during acceleration are made available, the reliability of all the tests remains undetermined for any values above 1 G. (Author)

Lockheed Aircraft Corp., Marietta, Ga.
HUMAN PERFORMANCE AS A FUNCTION OF THE WORK-REST CYCLE, by Oscar S. Adams and W. Dean Chiles (Aerospace Medical Div.). Rept. on Human Performance in Advanced Systems, Contract AF 33(616)6050. Mar 60, 21p. 11 refs. WADD Technical rept. 60-248.
Order from OTS $0.75 PB 161 958

This study was designed to investigate the effect on performance of four different work-rest period schedules (2 on and 2 off, 4 on and 4 off, 6 on and 6 off, 8 on and 8 off) followed over a period of 96 hours. The subject sample consisted of 16 male college students with 4 subjects being assigned to each of the four work-rest period schedules. Performance was measured by means of a battery of psychomotor tasks involving arithmetic computation, pattern discrimination, monitoring, and vigilance. Additional data were obtained from information recorded in an experimenter's logbook and from responses to a subject questionnaire administered at the end of the testing. Although the performance tasks failed to differentiate among the four experimental groups, the observational evidence suggested that the subjects in the 2-hour and 4-hour groups achieved a more favorable adjustment than those in the other two groups. (Author)

Maryland U., College Park.
A TEST OF UNDERWOOD'S LAW WITH CONNECTED MEANINGFUL MATERIALS, by Charles N. Cofer and Jean C. Holroyd. Technical rept. no. 22 on Learning, Retention and Recovery of Meaningful Material, Contract Nonr-595(04). Apr 59, 6p. 6 refs. AD-220 228.
Order from LC mi$1.80, ph$1.80 PB 148 272

The data offer no support for Underwood's law which, for the recall of discrete syllables, words or pairs, suggests that recall will be inversely related to the number of previous lists which have been learned.

Psychophysical Research Unit, Mount Holyoke Coll., South Hadley, Mass.
EXPERIMENTS ON VISUAL RESEARCH 1956-57, by H. Corbin, J. Carter and others. Final rept. Tasks I and II, on Contract AF 19(604)1713. July 58, 26p. 3 refs. AFCRC-TR-57-59.
Order from LC mi$2.70, ph$4.80 PB 149 541

About six experiments are summarized relating to two research programs: (1) the discrimination of groups of objects (targets) in searching cluttered visual displays; the research emphasized the use of visual aids to increase the efficiency of the discrimination of groups; (2) the speed and accuracy of search and discrimination of near-threshold and above-threshold visual targets in a horizontal array.

Utah U., Salt Lake City.
VARIABLES RELATED TO ACCURACY IN INTERPERSONAL PERCEPTION, by Victor B. Cline and James M. Richards, Jr. Annual rept. no. 1 on Contract [Nonr-1288(04)]. 15 Nov 58, 27p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 148 793

This project is concerned with the problem of generality of judging ability, to be followed by the study of the personality characteristics, life history experiences, etc., of judges who appear to excell in a general or specific manner in evaluating, assessing and predicting the behavior of fellow human beings. A preliminary study of these external correlates of judging ability is reported.

Washington U., Seattle. Div. of Counseling and Testing Services.
TWO IBM TYPE 650 PROGRAMS TO CORRECT CORRELATION MATRICES FOR ATTENUATION, by Calvin E. Wright. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). June 59, 7p. 4 refs. AD-227 961.
Order from LC mi$1.80, ph$1.80 PB 147 891

Two IBM Type 650 programs are reported which were found to be useful in multivariate psychological analyses. The first of these corrects symmetric correlation matrix elements for attenuation. For 1 to 50 variables, the program performs its function when the row and column identifications of the correlation coefficients refer to the variables of a symmetric correlation matrix. The second program is useful for up to a 50 by 50 non-symmetric correlation matrix where the row and column identifications of the correlations refer to 2 distinct sets of 50 variables. The input cards for both programs can be the output cards of the correlation matrix programs reported by Dvorak and Wright, where 4 decimal values are obtained. The output cards of the correction for attenuation programs are also of the correlation matrix programs output form. The location of the decimal can be controlled if desired. (Author)

Yale U., New Haven, Conn.
AUTOTELIC FOLK-MODELS, by Alan Ross Anderson and Omar Khayyam Moore. Technical rept. no. 8 on Contract Nonr-609(16). Nov 59, 19p. 32 refs.
Order from LC mi$2.40, ph$3.30 PB 148 962

This paper is concerned with cultural products which we call autotelic, i.e., cultural products such as puzzles, games of chance, games of strategy, and aesthetic objects, all of which contain their own goals and sources of motivation. Such activities are "cut off" in a sense, from serious and immediate problems of survival and welfare, and are protected by autotelic norms which dictate that participation must not impinge on serious problems. As a heuristic principle for the application of formal methods in sociology, it is suggested that autotelic cultural products may be viewed as folk-models, i.e., models in the prescientific culture, with the help of which members of a society learn about and "play at" the workings of their society.

BIOLOGICAL SCIENCES

California U., Los Angeles. School of Medicine.
NERVOUS CONTROL OF SHIVERING. IX. A REVIEW, by Allan Hemingway. Rept. on Contract AF 18(600)358. July 57, 12p. 9 refs. Technical note AAL-TN-57-40.
Order from LC mi$2.40, ph$3.30 PB 146 618

The research has endeavored to investigate details of nervous control. According to current concepts the nervous control of thermoregulation is under "dual control". One is a "reflex" control resulting from stimulation of thermoreceptors in the skin, i.e. the cold and warmth temperature receptors. The other is a "central" control operated by a rising or falling brain temperature. These experiments, and others not mentioned here, support the dual control theory of temperature regulation. The location of the controlling center in the brain is believed to be in the hypothalamus, the exact position in the hypothalamus with any ramifications and interrelations being unknown.

Naval Research Lab., Washington, D. C.
ELECTROPHORETIC STUDIES ON BACTERIA. PART I. DESIGN AND PERFORMANCE OF AN IMPROVED APPARATUS FOR ELECTROPHORESIS BY THE MICROSCOPE METHOD, by R. A. Neihof. Interim rept. 15 Aug 60, 11p. 16 refs. NRL rept. 5495.
Order from LC mi$2.40, ph$3.30 PB 146 393

An improved apparatus for studying the electrophoresis of bacteria or other particulate matter by the microscope method is described. A simplified and convenient design is permitted by the use of electrodes consisting of palladium foil charged with atomic hydrogen. In contrast to electrodes previously used, this system permits high current densities to be passed without danger of gassing or the use of convection barriers to prevent contamination of the experimental material with heavy metal ions. Temperature control and heat dissipation are facilitated by immersing the apparatus in a water thermostat. The performance of the apparatus is evaluated with gelatin-coated glass particles, bacteria, and human erythrocytes. Mobility measurements which are sufficiently precise and accurate for the intended studies can be readily obtained. (Author)

Anatomy and Physiology

Aerospace Medical [Div.] Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
DESIGN PARAMETERS FOR THE ENGINEERING OF CLOSED RESPIRATORY SYSTEMS, by Donald A. Keating. Rept. on Equipment for Life Support in Flight Operations. Dec 59, 18p. 21 refs. WADC Technical rept. 59-766.
Order from OTS $0.50 PB 161 963

Design data essential to the engineer engaged in the design of closed respiratory systems have been compiled in a compact form for ready engineering reference. The data presented can be considered as design guide lines since man is an ever changing mechanism and each is different within his species. Such data have been presented from an engineering viewpoint to form a foundation of design requirements for closed ecological systems of increasing complexity. (Author)

Aerospace Medical Div., Wright Air Development Div., Wright-Patterson AFB, Ohio.
VARIATIONS IN ABSOLUTE VISUAL THRESHOLDS DURING ACCELERATION STRESS, by William J. White. Rept. on Biophysics of Acceleration. Apr 60, 18p. 7 refs. WADD Technical rept. 60-34.
Order from OTS $0.50 PB 171 009

Measurements are reported on the effects of moderate acceleration upon the absolute thresholds of foveal (cone) and peripheral (rod) vision. This experiment shows that accelerative stress has a consistent and progressive effect on visual performance, this effect being proportional to the magnitude of the positive acceleration. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
BEHAVIORAL MEASUREMENTS ON ANIMALS PARTICIPATING IN SPACE FLIGHT, by Frederick H. Rohles, Jr. Mar 60, 12p. 3 refs. AFMDC-TN-60-5.
Order from LC mi$2.40, ph$3.30 PB 146 972

This report presents the historical background and events leading up to the establishment of the Comparative Psychology Branch at the Aeromedical Field Laboratory. The work being accomplished by this branch is discussed together with problems associated with obtaining behavioral measures on animals participating in space flight. (Author).

Air Force Missile Development Center, Holloman AFB, N. Mex.
PHYSIOLOGICAL BASE-LINE STUDIES OF ZOOLOGICAL SPECIMENS. PHASE I: HEMATOLOGICAL VALUES OF IMMATURE CHIMPANZEES, by James E. Cook, Jerry Fineg and Eldon D. Miksch. July 60, 19p. 7 refs. AFMDC-TN-60-9.
Order from LC mi$2.40, ph$3.30 PB 150 235

The hematological findings for 17 immature chimpanzees are presented. These findings are compared with human and other chimpanzee hematological values in published literature. The blood cellular morphology and hematological values are similar to those of humans of comparable age. The major dissimilarities are discussed. (Author)

Army Medical Research Lab., Fort Knox, Ky.
A REPRESENTATIVE BIBLIOGRAPHY OF RESEARCH IN LOW-FREQUENCY MECHANICAL VIBRATION, by V. H. Schaefer and R. G. Ulmer. Rept. on Psychophysiological Studies. 12 Nov 59, 30p. 188 refs. Rept. no. 405; AD-228 941.
Order from LC mi$2.70, ph$4.80 PB 149 768

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE PHYSIOLOGY OF TEMPERATURE REGULATION, by James D. Hardy. Rept. no. 22 on Task MR005.15-2002.1. 9 June 60, 299p. 851 refs. NADC-MA-6015.
Order from LC mi$11.10, ph$45.60 PB 150 139

The present report is restricted to the narrower considerations of the temperature responses of the homoiotherms and, more particularly, of the usual laboratory animals and of man. Even within this limited field there is an enormous current literature and more than three thousand references were reviewed in preparation of the material presented below. The attempt has been to give principal attention to the literature since 1952 although reference is made to much of the older work for purposes of continuity and clarity. It is not believed practical to separate temperature regulation from the physiological responses to heat and to cold and for this reason the present review is divided into: (a) physiological responses to cold, (b) physiological responses to heat, and (c) the physiology of temperature regulation.

Buffalo U., School of Medicine, N. Y.
STUDIES IN PULMONARY PHYSIOLOGY: CHEMISTRY, MECHANICS, AND CIRCULATION OF THE LUNG, by Hermann Rahn. Rept. on High-Altitude Physiology, Contracts AF 33(616)3834 and AF 33(616)5606. Apr 60, 162p. 5 refs. WADD Technical rept. 60-1.
Order from OTS $3.00 PB 161 984

The scientific papers compiled in this report on various aspects of pulmonary gas exchange have been divided into the following groups: Cardiovascular-Pulmonary Reactions to Pressure Breathing, Carbon-Dioxide Stores of the Body, Gas Tension in Tissues and Biological Fluids, Alveolar-Arterial Oxygen Difference and Theoretical Considerations of Pulmonary Ventilation, Perfusion and Diffusion. (Author).

California U., Los Angeles.
REPETITION AND CONFIRMATION OF MESSAGES RECEIVED BY EAR AND BY EYE, by Edward C. Carterette and Michael Cole. Technical rept. no. 3 on Contract Nonr-233(58). 29 June 59, 29p. 14 refs. AD-220 404.
Order from LC mi$2.70, ph$4.80 PB 147 888

An attempt was made to determine how the auditory and visual modes of reception compare over successive repetitions of a message. The rating method was used to obtain operating characteristics for 60 heterogeneous words, and to make specific comparisons of the visual and auditory modes of reception. The comparisons made showed that over successive repetitions, accuracy of reception is a direct function of the confidence rating and is relatively independent of the intelligibility level. Neither do the accuracy of reception or the distributions of rating categories change markedly over trials. Both visual and auditory data are fitted reasonably well by predictions made from a simple stochastic model based on the assumptions that (1) intelligibility, (2) probability of a correct acceptance, and (3) probability of an incorrect acceptance remain constant over successive repetitions. Results showed that the concept of operating characteristic as used in the reception of messages in noise may be extended to include vision.

Eye Research Foundation, Bethesda, Md.
RETINAL SENSITIVITY DURING PHOTOPIC ADAPTATION, by R. H. Peckham and W. M. Hart. Technical rept. no. 1 on Contract Nonr-2750(00). 12 Oct 59, 20p. 8 refs. AD-228 069.
Order from LC mi$2.40, ph$3.30 PB 149 859

Retinal responses to measured levels of luminance are reported. The stimulus was that of repetitive short alternations of equal duration, above and below a constant background luminance. The use of this stimulus permitted an estimate of retinal sensitivity by recording the frequency of the perception of scintillation in the stimulus area.

Florida U. Coll. of Medicine, Gainesville.
INTERACTION OF ADRENAL AND THYROID HORMONES IN MAINTENANCE OF BODY TEMPERATURE OF RATS EXPOSED TO COLD, by Melvin J. Fregly. May 60, 16p. 33 refs. AFSAM rept. 60-47; AD-239 977.
Order from LC mi$2.40, ph$3.30 PB 149 245

The effects of cortisone acetate and thyroxine, administered separately or in combination, on colonic cooling rate (CCR) were studied in restrained, adrenalectomized rats subjected to cold air (5°C.). Thyroxine alone at 5.0 μg./day reduced the rapid CCR of adrenalectomized rats but failed to return it to that of sham-operated rats. Cortisone acetate alone at 1.0 mg./day also reduced CCR but failed to return it to that of sham-operated rats. Administration of 5.0 μg. thyroxine per day simultaneously with 2.0 to 2.5 mg. cortisone acetate returned CCR to that of sham-operated rats. However, CCR of rats given 2.5 μg. thyroxine and cortisone daily failed to return to that of sham-operated rats. Simultaneous administration of cortisone acetate with graded doses of thyroid-stimulating hormone (TSH) resulted in a greater reduction of CCR than with either treatment alone. With respect to CCR, cortisone acetate did not appear to interfere either with thyroid gland response to TSH administration or to tissue utilization of thyroxine. (Author).

Jefferson Medical Coll., Philadelphia, Pa.
HORMONAL AND NERVOUS FACTORS IN THE RAT'S TOLERANCE TO REDUCED BAROMETRIC PRESSURE, by D. A. DeBias and K. E. Paschkis. May 60, 11p. 11 refs. AFSAM Rept. no. 60-58.
Order from LC mi$2.40, ph$3.30 PB 150 206

The effects of neuropharmacologic agents on the tolerance of adrenalectomized rats to a barometric pressure of 249 mm. Hg (equivalent to an altitude of 27,800 feet) for a period of 6 hours were studied. Dibenamine, antrenyl, pendiomide ditartrate, thorazine, and amphetamine did not improve the animals' tolerance. The survival time of adrenalectomized-thyroidectomized rats was significantly increased (from 2.7 hours to 5.7 hours) by a dose of cortisol sodium succinate which fails to prolong survival of the adrenalectomized animal. Some of the neuropharmacologic agents used have previously been found effective in other forms of stress. (Author)

Life Support Systems Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
CLOSED CIRCUIT RESPIRATORY SYSTEMS SYMPOSIUM. Rept. on Equipment for Life Support on Astronautical Operation. Aug 60, 470p. 164 refs. WADD Technical rept. 60-574.
Order from OTS $6.00 PB 161 988

This report presents various papers concerning Closed Circuit Respiratory Systems. Papers include those presented or submitted by various contractors, and Governmental Agencies. The specific areas which are presented include (a) concentration of expired carbon dioxide gas (b) concentration of expired water vapor (c) decomposition of carbon dioxide recovering all useful fractions, especially all useable oxygen for breathing purposes (d) decomposition of water yielding breathing oxygen and useful hydrogen (e) complete and continuous miniaturized instrumentation for a closed circuit breathing system. The papers represent the most advanced state of the art which is known to this Division in the related fields as determined by the representation and participation of such a universal group of representatives in the field of closed circuit breathing system. (Author)

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D. C.
AN EVALUATION OF THE EQUIVALENT AIR DEPTH THEORY, by J. A. Logan. 28 July 60, 16p. 9 refs. Research rept. 1-61.
Order from LC mi$2.40, ph$3.30 PB 150 274

U. S. Navy divers performed working dives on air and on nitrogen-oxygen mixtures other than air with equivalent partial pressures of nitrogen. Results of these dives were then scored in three manners. Inspection of the data revealed a difference in the scores, the dives on the nitrogen-oxygen mixtures appearing to produce higher scores than those on air. Statistical analysis, however, failed to demonstrate any significant differences between the scores of the various comparable dives. It was concluded that the mixed gas decompression system now in use is adequate for decompression. This experiment supports the view that oxygen does have some effect on the decompression problem, however, it is slight and statistical significance could not be demonstrated. (Author).

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D C.
PERFORMANCE IMPAIRMENT AS A FUNCTION OF NITROGEN NARCOSIS, by R. J. Kiessling and C. H. Maag. 1 June 60, 25p. 25 refs. Research rept. 3-30.
Order from LC mi$2.70, ph$4.80 PB 150 273

Navy divers individually performed air dives in a high pressure chamber for 40 minutes at a simulated depth of 100 feet. Each experimental session consisted of three phases: a measure of performance on choice reaction time, motor coordination, and conceptual reasoning at sea level in the chamber; three 12 minute periods at a pressure equivalent of 100 feet of sea water, during which equal time was allocated to each of the three tests; and a final measure during the decompression stop at 10 feet. All subjects had been trained to plateau level of performance before the experiment proper had begun. Statistically significant decreases in performance for all subjects on all tests were found, with the greatest decrement occurring on the reasoning test, least on motor coordination. Decreased performance occurred as the pressure increased and remained relatively constant with duration of exposure. (Author).

School of Aviation Medicine, Brooks AFB, Tex.
EXTENDING THE RANGE OF THE CARTESIAN DIVER, by Harold L. Bitter, W. O. Baentsch, and Bruce E. Jacobson. Aug 60, 5p. 3 refs. Rept. no. 60-67.
Order from LC mi$1.80, ph$1.80 PB 150 203

A modified Cartesian diver was designed and fabricated in an effort to obtain accurate tissue respiration results in an area not previously covered by the Cartesian diver technic. The resulting apparatus allows greater range in biologic sample size, is easier to load, and requires less accessory equipment — resulting in less chance for sample contamination. (Author)

Biochemistry

Arctic Aeromedical Lab., Ladd AFB, Alaska.
OBSERVATIONS ON THE BIOCHEMICAL BASIS OF CHEMICAL THERMOGENESIS IN THE COLD-ACCLIMATED RAT, by Robert E. Beyer (Tufts U School of Medicine). Apr 60, 10p. 26 refs. AAL-TN-60-6.
Order from LC mi$1.80, ph$1.80 PB 150 026

Several mechanisms concerning the increased thermogenesis resulting from exposure of the laboratory rat to a cold environment are discussed. It is postulated that adrenal medullary hormones mediate an increase in the efficiency of mitochondrial oxidative phosphorylation, and thus provide adequate adenosine triphosphate for accelerated muscular activity during the initial stage of cold acclimation. The second, or chemical, phase of increased thermogenesis may be accounted for by a lowering of mitochondrial respiratory control in the electron transport chain. The possible meditation thyroid hormone is also discussed. (Author)

Army Medical Research Lab., Fort Knox, Ky.
CARBOHYDRATES OF HUMAN AND BOVINE PLATELETS, by E. E. Woodside and W. Kocholaty. Rept. on Biological and Medical Aspects of Ionizing Radiation. 1 Sep 59, 19p. 39 refs. Rept. no. 395; AD-228 935.
Order from LC mi$2.40, ph$3.30 PB 149 767

Average values for the total carbohydrate content of human and bovine platelets were 8.4% and 8.77% of the dry weight, respectively. On a dry weight basis, human platelets were calculated to be approximately one-third larger than bovine platelets. By chemical and chromatographic analysis, glucose, galactose, mannose, fucose, ribose, glucosamine, galactosamine, glucuronic acid, and sialic acid were detected in both human and bovine platelets. Glucose and ribose were found to be the only monomers present in the 5% trichloroacetic acid (TCA) soluble fractions of both human and bovine platelets. The TCA insoluble residue contained glucose, galactose, mannose, fucose, ribose, glucuronic acid, glucosamine, galactosamine, and sialic acid. The acid mucopolysaccharide fraction of both human and bovine platelets contained galactosamine and glucuronic acid monomers as well as galactose, glucose and ribose. Glycogen was found in both human and bovine platelets. Total glycogen was extracted by 5% TCA from sonorated human and bovine platelets; however, subsequent ethanol precipitation of the glycogen was incomplete. In contrast, 30% potassium hydroxide extraction followed by ethanol precipitation resulted in complete recoveries of the glycogen. Variations in both total hexose and glycogen contents existed in both human and bovine platelets. These variations were partially dependent on the length of storage of the platelets in whole blood or in 0.85% sodium chloride after separation from whole blood. (Author)

Liege U. (Belgium).
ISOTOPE STUDIES ON BONE SALTS, by Marcel J. Dallemagne and Leon Richelle. June 60, 18p. 54 refs. Aeromedical Reviews 1-60.
Order from LC mi$2.40, ph$3.30 PB 150 204

The principal purpose of this study is to define bone and tooth salts. The main conclusions drawn are as follows: Bone and dentin mineral isolated from the organic matrix and studied by means of isotope method behave just as hydrated synthetic phosphates. Synthetically, compounds closely approximating bone, dentin, or cementum may be precipitated under well-defined conditions. However, the chemical composition of the biologic and the synthetic compounds is not absolutely the same, since these phosphates do not arise in a liquid phase with the same composition as fluids circulating in bone.

Naval Radiological Defense Lab., San Francisco, Calif.
INHIBITION OF DNA SYNTHESIS BY SODIUM IONS, by E. R. Walwick and R. K. Main. 12 May 59, 8p. 12 refs. Research and development technical rept. USNRDL-TR-319; AD-218 929.
Order from LC mi$1.80, ph$1.80 PB 147 613

Studies concerning the synthesis of DNA in a readily available and controllable in vitro system were initiated. A reliable method of measuring tritiated thymidine incorporation into DNA, as detected by a liquid scintillation counting technique, was devised and tested. It was found that sodium ions at concentrations within physiological limits and in the presence of optimal amounts of Mg^{++} ions markedly inhibit DNA synthesis.

University of Southern California. School of Medicine, Los Angeles.
STORAGE AND METABOLISM OF FED CARBOHYDRATE, by Douglas R. Drury. Rept. on Contract AF 18(600)567. Nov 57, 32p. 6 refs. Technical note AAL-TN-57-46.
Order from LC mi$3.00, ph$6.30 PB 150 023

The 24-hour-fed rats had, on the average, the equivalent of 2.5 grams glucose deposited as body fat. However, each gram of glucose converted to fat requires the expenditure of an additional 0.27 grams glucose to effect the conversion. In other words the fat that contains the amount of carbon that is in one gram of glucose is isocaloric with 1.27 grams glucose. The 2.5 grams of glucose deposited as body fat represents the amount of energy contained in 3.1 grams glucose. This is equivalent to 12.8 calories. The expected caloric requirement for these rats would be about 21 calories per day. Carcass fat therefore accounts for about 60% of stored carbohydrate. (Author).

Uppsala U. (Sweden).
INVESTIGATION OF THE METHODS FOR SEPARATING BIOLOGICALLY AND MEDICALLY IMPORTANT SUBSTANCES OF LARGE MOLECULAR WEIGHT, by A. Tiselius. Final technical rept. no. 2 on Contract DA 91-591-EUC-1025. 30 May 60, 61p. 21 refs.
Order from LC mi$3.90, ph$10.80 PB 149 428

Contents:
Development of zone electrophoresis
Zone electrophoresis in packed vertical columns and in gels
Zone electrophoresis in gel suspensions
Free zone electrophoresis in a revolving tube
Fractionation of particles and macromolecules of biological origin using liquid two-phase systems
Fractionation of particles utilizing stratification by density in packed semi-solid centrifugal sediments
Methodological studies of protein chromatography

Botany

California Forest and Range Experiment Station, Berkeley.
CROWN CHARACTERISTICS OF SEVERAL CONIFEROUS TREE SPECIES: RELATIONS BETWEEN WEIGHT OF CROWN, BRANCHWOOD AND FOLIAGE, AND STEM DIAMETER, by Theordore G. Storey, W. L. Fons, and F. M. Sauer. Interim technical rept. Aug 55, 91p. 26 refs. AFSWP-416.
Order from LC mi$5.40, ph$15.30 PB 150 675

This report released for sale to the public 11 Oct 60.

Prediction of wind breakage and uprooting in tree stands requires information on weight of dry crown, branchwood, and foliage. An experimental program started in 1951 has led to a number of generalized relations by which these crown characteristics can be determined with good accuracy over a wide range of tree diameters, species, and species groups.

University Coll., Galway (Eire).
THE STRUCTURE OF THE PHYCOBILINS. Final rept. for 1 Mar 59-29 Feb 60 on Contract DA 91-591-EUC-1071. [1960] 16p.
Order from LC mi$2.40, ph$3.30 PB 149 434

A chemical study of the algal chromoproteins, phycoerythrins and phycocyanins was undertaken. Representatives of the various types of chromoproteins were isolated from red algae, blue-green algae and cryptomonads. The water-soluble chromoproteins were purified by ammonium sulphate fractionation and/or by column chromatography. Paper chromatographic analyses of hydrolysed chromoproteins revealed the presence of all the common amino acids. A feature of all the proteins examined was the preponderance of dicarboxylic over basic amino acids and their high alanine and leucine contents. N- and C-terminal groups of the chromoproteins were determined quantitatively, using a variety of methods. Approximately 20 terminal groups of both types per molecular weight unit of phycoerythrins and phycocyanins were found. The chromophores (phycobilins) of these chromoproteins are related to the bile pigments. The chromophore-protein attachment was investigated in a number of cases. Previous evidence indicated that a peptide linkage joined the chromophore to the protein, but that a second labile bond was also involved. The ϵ-amino group of lysine does not appear to participate in peptide-bond formation in R-phycoerythrin, as all those groups were found to be free.

Medical Specialties and Equipment

Arctic Aeromedical Lab., Ladd AFB, Alaska.
DROPPABLE, AUSTERE MEDICAL FACILITY, by Norman C. Van Tassel. July 57, 36p. Technical note AAL-TN-57-22.
Order from LC mi$3.00, ph$6.30 PB 150 021

This report describes an Austere Medical Facility developed to furnish paramedical personnel with air-droppable supplies and equipment to care for and maintain 10 casualties for 10 days under Arctic and subarctic field conditions. In the severe environment of these regions, it is usually not feasible to render definitive medical treatment in the field, and the facility is intended only to aid in maintaining life and to minimize suffering until evacuation can be accomplished. Most of the supplies and equipment used are standard Air Force items. The facility is packaged to allow air-drop from cargo type aircraft and designed so that it can be operational within approximately 1 hour after arrival over the drop zone. It has been tested and found to be satisfactory for use on snow covered terrain and on sea ice. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
PACKAGING FREEZABLE EMERGENCY KIT ITEMS, by John D. Fulton and Jack D. Douglas. Mar 60, 15p. 2 refs. Technical note AAL-TN-60-2.
Order from LC mi$2.40, ph$3.30 PB 150 025

It is considered that the most practical approach for providing suitable insulated containers would be to procure molded styrene foam shells, with a suitable inside volume, which would fit into a standard, medical kit chest. Proper containers could be provided at minimum cost by this method. Based upon lists of the various emergency kit items provided by representative hospitals within the AAC, the required number and size of the containers recommended for each type of kit are shown.

Pathology

Army Chemical Corps., Fort Detrick, Md.
GRAPHIC SUMMARY OF SELECTED INFECTIOUS DISEASES, by Phebe W. Summers. Second edition, 1960, 65p. [Pub. 132]
Order from LC mi$3.90, ph$10.80 PB 150 236

The purpose of the Graphic Summary is to tabulate for quick reference salient points about selected diseases which may be of significance to the health of the public in the event of biological warfare attack either directly on man or indirectly on his animal protein food supply. This second edition brings information more up-to-date and presents data more completely and, it is hoped, more logically.

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PRIMARY PULMONARY NEOPLASM IN THE GOAT, by Erwin G. Pearson. May 60, 15p. 13 refs. CWLR-2397; AD-239 306.
Order from LC mi$2.40, ph$3.30 PB 149 906

A type of pulmonary tumor found occasionally in Angora goats is reported. The tumor is composed of nests of squamous cells growing in a small amount of connective tissue stroma. The tumor arises from metaplastic bronchial epithelium. The neoplasm shows no definite signs of malignancy, and is considered to be a benign papilloma. (Author)

Chemisches Institut, Marburg (West Germany).
SEROLOGY OF DNA, by H. Witzel. Final rept. for 15 Jan 59-15 Jan 60 on Contract DA 91-591-EUC-1043. [1960] 14p.
Order from LC mi$2.40, ph$3.30 PB 149 338

The purpose of this program was: (1) to define more closely the anti-DNA (desoxyribonucleic-acid) reactions which can be detected in about two thirds of the patients suffering from systemic lupus erythematosus; (2) to study clinically and serologically patients suffering from systemic lupus erythematosus.

School of Aviation Medicine, Brooks AFB, Tex.
HUMAN CARDIOACCELERATIVE RESPONSES TO HYPOXIA IN COMBINATION WITH HEAT, by Henry B. Hale. Sep 59, 14p. 7 refs. Rept. 60-14; AD-229 899.
Order from LC mi$2.40, ph$3.30 PB 150 283

The effects of high ambient temperature on heart rate responses to moderate reductions in oxygen pressure were determined in healthy human males. With air temperature approximating 50° C., and hypoxia equivalent to that at 14,000 or 18,000 feet altitude, most of the subjects showed intensified responses; but several experienced marked bradycardia and syncope (or near syncope). Both kinds of response indicate that special precautions should be taken in flying operations to avoid the occurrence of even mild degrees of hypoxia when ambient temperature is relatively high. (Author).

Pharmacology and Toxicology

Army Chemical Research and Development Labs., Army Chemical Center, Md.
THE PROTECTIVE ACTION OF THE OXIMES P2S AND 2-PAM LACTATE ALONE OR AS ADJUNCTS AGAINST GB VAPOR IN DOGS, by James W. Crook, Alvin I. Goodman and others. July 60, 15p. 6 refs. CRDLR-3021.
Order from LC mi$2.40, ph$3.30 PB 150 223

P2S and 2-PAM lactate administered orally in doses of 30 to 75 mg/kg 2.5 to 4 hours prior to lethal exposures to GB vapor (6 to 9 LCt50's) offer effective protection to dogs when supported by an intramuscular dose of atropine (5 mg/kg) within 1 minute after exposure. Neither of the oximes is effective treatment when given alone. 2-PAM lactate and atropine mixtures given intravenously to dogs 1 minute after a lethal exposure to GB vapor also offer adequate protection. Intramuscular administration of this mixture is ineffective.

Army Chemical Warfare Labs., Army Chemical Center, Md.
LIST OF REPORTS PUBLISHED UNDER THE HEALTH HAZARDS OF MILITARY CHEMICALS PROGRAM TO 1 MAY 1957. 30 July 57, 15p. 146 refs. CWL Special pub. 2-1.
Order from LC mi$2.40, ph$3.30 PB 150 546

This report released for sale to the public 11 Oct 60.

Reports are listed under: Acetylene derivatives; ammonia; aniline; boron compounds; cleaning agents; clothing impregnating agents; epoxides; fluorine compounds; furfuryl alcohol; halogenated hydrocarbons (fire extinguishants); hydraulic and lubricating fluids; hydrazine and derivatives; hydrogen peroxide; mercaptans; nitric acid; nitro compounds, nitrites and nitrates; perchlorates; tetrazoles; general.

Army Chemical Warfare Labs., Army Chemical Center, Md.
PULMONARY AND CARDIOVASCULAR EFFECTS OF SARIN IN TREATED DOGS, by Glenn D. Lubash, Irwin Gribetz, and Rudolph P. Johnson. June 60, 19p. 20 refs. CWLR-2389; AD-239 153.
Order from LC mi$2.40, ph$3.30 PB 149 970

Peripheral vascular collapse is an important cause of death, despite therapy with atropine and artificial respiration, after enormous doses of ChE inhibitors. Sarin was used to induce hypotension in dogs. Blood pressure was maintained despite injections as large as 500 LD50's when artificial respiration and atropine were used. Intravenous atropine reversed elevated tracheal pressures and heartblock. Metaraminol, norepinephrine, and molar sodium lactate administered after atropine and artificial respiration produced no satisfactory responses in hypotensive (and hypoxic) animals. Normotensive animals given metaraminol had significant complications with rise in blood pressure. The value of treatment with atropine and artificial respiration is re-emphasized. (Author)

[Army] Chemical [Warfare] Labs., Army Chemical Center, Md.
THE RABBIT AND RAT AS TEST ANIMALS FOR SCREENING CANDIDATE FOR TREATING NERVE GAS POISONING, by J. H. Wills, G. E. Groblewski, and L. M. Somers. June 54, declassified 9 June 60, 12p. Medical Labs. Research rept. no. 289.
Order from LC mi$2.40, ph$3.30 PB 150 123

Parallel assays of the comparative prophylactic potencies in GB poisoning of a series of 9 atropine-mimetic compounds in the rabbit and the rat yielded a coefficient of rank correlation of +0.71. A similar comparison of 7 bis-quaternary, ganglionic-blocking drugs, administered as adjuncts to atropine, yielded a coefficient of rank correlation of +0.11.

Ohio State U. Research Foundation, Columbus.
CARDIO-RESPIRATORY RESPONSES TO ENVIRONMENTAL STRESS, by Fred A. Hitchcock. Final rept. on Contract DA 49-007-MD-189. June 59, 81p. 62 refs. Rept. no. 479; AD-226 852.
Order from LC mi$4.80, ph$13.80 PB 149 999

The first two portions of this report deal with the cardio-respiratory effects of carbon monoxide inhalation in the anesthetized dog. Section one involves a study of the adaptive responses to sublethal concentrations of carbon monoxide. Here emphasis was placed on the pulmonary ventilation and its regulation and related changes in blood gas tensions and acid-base balance. Section two deals with the cardio-respiratory events preceding death due to inhalation of lethal concentrations of carbon monoxide. In this phase major interest was with respect to cardiac output, blood pressure, peripheral resistance, and pulmonary ventilation. A characteristic pattern of peripheral collapse, hypotension, and decline in cardiac output preceded by irregular respiration was observed. The abruptness of the final hemodynamic collapse was striking. The third and last section of this report describes preliminary investigation into the problem of distribution of inspired air among the pulmonary alveoli. A theoretical equation is derived describing the decline in alveolar nitrogen concentration following inhalation of oxygen where the oxygen mixed homogeneously with the functional residual air. An "efficiency index" based on the ratio of the observed decrement in alveolar nitrogen concentration to the theoretical decrement was then developed. Data obtained on normal human subjects indicated considerable variation in pulmonary "mixing efficiency" from breath to breath. (Author)

Radiobiology

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 6. Monthly rept. Sep 60, 61p. 2 refs.
Order from OTS $0.50, $3.00/6 mos. PB 161 371-6

Contents:
Sect. 1. Milk: Public Health Service milk monitoring network; stronium-90 in Canadian dried milk products
Sect. 2. Air: Public Health Service radiation surveillance network; data on radioactivity in air (May 60)
Sect. 3. Water: Public Health Service national water quality network; monitoring of water supplies around the Nevada Test Site (Jan-Feb 60, and Mar-Apr 60)
Sect. 4. Other data: external gamma; food; analytical reference service
(See also PB 161 371-5)

Radiobiological Lab., U. of Texas, Austin.
LIQUID SCINTILLATOR BETA COUNTING OF IRON-59 IN CLEAR AND COLORED SYSTEMS, by Thomas P. Leffingwell, Robert W. Reiss, and George S. Melville. Mar 60, 11p. 14 refs. AFSAM rept. 60-15.
Order from LC mi$2.40, ph$3.30 PB 148 081

National Bureau of Standards $Fe^{59}Cl_3$ was employed in model systems to quantitate liquid scintillator beta counting of Fe^{59}. In systems which contain a colored iron-orthophenanthroline chelate, decline in counting efficiency is a linear function of color density for the concentration gradient investigated. However, presence of the colored chelate causes an increased photon yield relative to the corresponding visibly colorless sample. The enhanced photon yield elevates the entire coincidence counting efficiency curve by approximately 6 percent. The enhancement phenomenon is (1) chelate concentration dependent, (2) beta particle energy dependent, (3) at its maximum at the emission peak of the scintillators in the counting system employed, (4) effected only in the presence of the scintillators, and (5) gamma ray independent. (Author) (See also PB 138 120)

School of Aviation Medicine, Brooks AFB, Tex.
THE EFFECTS FROM MASSIVE DOSES OF HIGH DOSE RATE GAMMA RADIATION ON MONKEYS, by John E. Pickering, Wright H. Langham, and Walter A. Rambach. [1959] 415p. 132 refs. Rept. 60-57.
Order from LC mi$11.10, ph$62.10 PB 150 220

Twenty-eight thousand curies of an equilibrium mixture of Ba-La^{140} were used to expose groups of Macaca rhesus to radiation doses of from 880 to 40,000 r at a dose rate of 1,000 r/min. Survival time varied inversely with the total delivered dose, although there is a dose range in which survival time is independent of total dose. Cinematography shows alternating periods of almost complete incapacitation and partial recovery. Measurable hematological changes can be produced as early as 5 min after the start of radiation at 1,000 r/min, maximal effects can be reached within 10 to 20 min, and some recovery can occur even while additional radiation exposure is continued. Rhesus monkeys demonstrate (a) accelerated respiration rate at all radiation doses except the 1,000-r, (b) increased tidal volume with 1,000-r and 2,500-r doses and a decrease with larger doses, (c) no significant changes in the respiratory minute volume with 1,000 r, a marked increase with 2,500 r, and a progressive decrease with dose with larger radiation doses, and (d) a slightly elevated oxygen consumption rate with 1,000 r, no significant change with 2,500 r and a suppression with the larger doses. Blood lactate levels increase immediately following exposures, and blood pyruvate increases at the higher doses. Ocular changes occur only if the eyes have been irradiated directly. Acute cytologic effects were less conspicuous in monkeys exposed to mixed neutron and gamma irradiation than in animals receiving comparable doses of irradiation from a pure gamma source. There is a reversal in the degree of biologic response within a fixed time interval, as judged by the extent of cellular destruction.

Tracerlab, Inc., Waltham, Mass.
[TABLE OF CARBON-14 RADIOACTIVITY MEASUREMENTS ON SAMPLES OF PLANT EXTRACTS]. Final rept. for 1 Sep-31 Dec 57. AD-213 157.
Order from LC mi$1.80, ph$1.80 PB 150 124

The results are tabulated of carbon-14 radioactivity measurements on samples of plant extracts obtained from plants treated with carbon-14 labeled compounds. Analysis of each sample was performed by combustion of all or a portion of the plant material to $C^{14}O_2$, distillation and purification of the gas before its introduction into an ionization chamber, and counting of the gas using a Lindemann-Ryerson electrometer. (Author)

Walter Reed Army Inst. of Research, Washington, D. C.
THE DETERMINATION OF INTERNALLY DEPOSITED RADIOACTIVE ISOTOPES IN THE MARSHALLESE PEOPLE BY EXCRETION ANALYSIS, by Kent T. Woodward, Ariel G. Schrodt and others. [1960] 19p. 11 refs. DASA-1180.
Order from OTS $0.50 PB 161 950

Since resettlement of the Marshallese people on Rongelap atoll in July 1957, the urinary excretion level of cesium^{137} has increased about 140 fold and about 20 fold for strontium^{90}. Zinc^{65} was readily detected in samples from the March 1958 medical survey. The estimated mean body burden at equilibrium for cesium^{137} is about 1.5 microcuries or about 1/6 of the tolerance recommended by the International Commission for Radiological Protection for non-industrial populations. For strontium^{90} the mean body burden of the exposed Rongelap group in March 1958 was estimated to be two millimicrocuries. This is about nine percent of the expected equilibrium value of 23 millimicrocuries. The equilibrated strontium^{90} burden is about 1/5 of tolerance. The estimated mean body burden of zinc^{65} for Rongelap subjects in March 195? is about 85 percent of the equilibration value of 0.6 microcuries and the equilibration value is 1/70 of tolerance. (Author)

CHEMISTRY

Inorganic Chemistry

North Carolina U., Chapel Hill.
THE DONOR PROPERTIES OF TRIPHENYLARSINE OXIDE, by David J. Phillips and S. Y. Tyree. Technical rept. no. 5 on The Synthesis of New Inorganic Molecules, Contract Nonr-855(05). 1 Sep 59, 19p. 25 refs. AD-230 255.
Order from LC mi$2.40, ph$3.30 PB 148 861

The coordination chemistry of triphenylarsine oxide with a variety of acceptors has been investigated. New substances have been isolated and characterized by molecular conductance measurements in nitrobenzene, cryoscopic molecular weight measurements in freezing nitrobenzene, magnetic susceptibility measurements, and infrared spectra. Most of the halides appear to be non-electrolytes, whereas the nitrate and perchlorates appear to be saltlike.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
THE COMPOSITION AND PROPERTIES OF ZIRKLOR, by F. L. Scott, H. Q. Smith, and I. Mockrin. Technical rept. no. 7 on Contract Nonr-2687(00). 10 Sep 59, 9p. AD-227 024.
Order from LC mi$1.80, ph$1.80 PB 148 863

The Zirklor sample was an inert material, stable towards water and a gamut of organic solvents, but it was attacked by aqueous bases. No intrinsic reaction was noted between Zirklor and sodium methylate in ether. After 6 hr refluxing of Zirklor with sodium ethoxide in ethanol, 13% of the theoretical quantity of available chloride ion was released; 52% was released after 146.5 hr at 78°C. The product was heterogenous and amorphous. An attempt to react Zirklor with benzene in a Friedel-Crafts reaction produced no evidence of any HCl evolution and no appreciable formation of any phenylated zirconium compound.

Organic Chemistry

[Hammersmith Hospital] London (Gt. Brit.)
OPTICAL ROTATORY DISPERSION OF ORGANIC COMPOUNDS, by W. Klyne. Final technical rept. no. 2, 1 May 59-30 Apr 60, on Contract DA 91-591-EUC-1095. 30 May 60, 48p. 12 refs.
Order from LC mi$3.30, ph$7.80 PB 149 429

Contents:
Monosubstituted steroids, carrying substituents at positions 1,2,3,4,6,7,17 and 20.
Disubstituted steroids, with substituents at 3, 17 or 3,20 or other positions
Steroid ketones.
Effect of remote and near substituents
Δ^6-3-ketones
D-Homo-17a-ketones
Benzylidene ketones
Sulphoxides
Lignans
Tetrahydroisoquinolines and emetine alkaloids

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
PERFLUOROVINYLBORON COMPOUNDS [AND] DIALKYLBIS (PENTAFLUOROETHYL) TIN COMPOUNDS, by F. G. A. Stone, S. L. Stafford and P. M. Treichel. Rept. on Contract AF 49(638)518. June 60, 12p. 17 refs. AFOSR-TN-60-552; AFOSR-TN-60-478, AD-242 310.
Order from LC mi$2.40, ph$3.30 PB 150 339

Ohio State U. Research Foundation, Columbus.
SYNTHESIS OF HETEROCYCLIC COMPOUNDS, by Michael P. Cava. Final rept. for 1 June 55-30 Nov 57. 1 Dec 57, 29p. AD-156 963.
Order from LC mi$2.70, ph$4.80 PB 150 125

It is well known that derivatives of phenoxyacetic acid, especially those bearing halogen substituents in the ring, may show marked plant hormonal activity. The objective of the work described here was to prepare a number of heterocyclic analogs of such compounds.

The basic series chosen for intensive study was the pyridine series; more specifically, the synthesis of substitution products and analogs of 2-pyridoxyacetic acid were given primary consideration. (Author)

Purdue U., Lafayette, Ind.
ATTEMPTED VIOLATIONS OF THE RULE OF TRANS-NUCLEOPHILIC ADDITION, by W. E. Truce, W. Bannister and others. Rept. on Contract AF 49(638)531 and National Science Foundation Grant G9929. 15 June 60, 5p. 9 refs. [AFOSR]TN-60-726.
Order from LC mi$1.80, ph$1.80 PB 149 322

Physical Chemistry

Aerojet-General Corp., Azusa, Calif.
A TEMPERATURE-CONTROL METHOD FOR USE BETWEEN 4.2 AND 77°K, by John M. Flournoy, Lillian H. Baum, and Seymour Siegel. Rept. on Contract AF 18(603)110. Aug 60, 12p. 3 refs. Aerojet rept. TN-37; AFOSR-TN-60-760.
Order from LC mi$2.40, ph$3.30 PB 150 164

Avco-Everett Research Lab., Mass.
OXYGEN VIBRATION AND DISSOCIATION RATES IN OXYGEN-ARGON MIXTURES, by M. Camac and A. Vaughan. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. Dec 59, 86p. 30 refs. Research rept. 84; AFBMD-TR-60-22; AD-234 035.
Order from LC mi$4.80, ph$13.80 PB 147 830

Experimental measurements of vibration and dissociation relaxation of O_2 in O_2-Ar mixtures were obtained from 1200° K to 8000° K. The vibration and dissociation relaxation rates become comparable at about 8000°K temperature. The experimental data indicates that there is at least a factor of 2 decrease in the dissociation rate at high temperatures (above 8000°K) where the vibration is not in equilibrium. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
ON AUTOMATIC CHEMICAL KINETICS ANALYZER, by Freeman W. Cope. Rept. no. 8 on Task MR005.15-0002.7. 8 Aug 60, 21p. 4 refs. NADC MA-6024; TED Proj. ADC RS-7045-5915M.
Order from LC mi$2.40, ph$4.80 PB 150 222

This paper describes equipment that automatically produces a graph of the mass-action differential equation of a chemical reaction while the reaction is taking place. From a spectrophotometer or other instrument, this apparatus accepts a voltage that is proportional to the concentration (x) of one of the reactants. It computes $\frac{dx}{dt}$ continuously and automatically and plots a graph of $\frac{dx}{dt}$ vs. x. Inspection of this graph immediately shows whether zero, first, or higher order kinetics are involved. Zero and first order rate constants can be directly measured from the graph. Electrical filtering usually must be used to reduce the high frequency noise which is amplified by the differentiator circuit. The effects of the filtering on the mass-action differential equation plot are described in detail. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
NON-AQUEOUS SOAP BUBBLES FOR FLAME STUDIES, by F. Kaufman and H. J. Cook. Jan 52, 8p. 4 refs. Technical note no. 575.
Order from LC mi$1.80, ph$1.80 PB 149 671

Entirely non-aqueous and non-volatile detergent solutions were developed for use in flame velocity measurement work. Chemical compatibility with various gases, diffusion effects, and vapor pressure determinations are described. (Author)

California U., Berkeley.
KINETICS OF FAST HOMOGENEOUS GAS REACTIONS, by Harold S. Johnston and Henry J. Bertin, Jr., Doctoral thesis (Stanford U.) Technical rept. on Contract Nonr-222(56). [1957] 44p. 26 refs. AD-226 150.
Order from LC mi$3.30, ph$7.80 PB 147 577

Heat of formation of nitrosyl fluoride: The absorption spectrum of nitrosyl fluoride was obtained in the near UV, and the 3 fundamental frequencies of the excited electronic state were determined. A rough estimate of the dissociation energy of the excited electronic state was obtained from the observed progressions. The dissociation energy of the ground electronic state was obtained indirectly by the thermochemical determination of the heat of the nitric oxide-fluorine reaction. The emission spectrum of the nitric oxide-fluorine flame was photographed. Absorption and emission spectra of nitrosyl fluoride: The absorption spectrum of nitrosyl fluoride in the near UV was studied, and 18 electronic-vibrational bands were found. The reaction of nitric oxide and fluorine is chemiluminescent, even with low temperature reaction conditions. The flame spectrum was continuous and was assigned to a radiative 2-body combination of NO and F.

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
LIGHT-SCATTERING AND VISCOSITY STUDY OF POLY(n-LAURYL METHACRYLATE) IN AN IDEAL SOLVENT, by Hsueh T. Lee and David W. Levi. Aug 60, 56p. 7 refs. Technical rept. FRL TR-1.
Order from LC mi$3.60, ph$9.30 PB 148 303

Poly(n-lauryl methacrylate) was fractionated from benzene solution using isopropanol as the nonsolvent. Phase separation studies were used to estimate the θ temperature in n-amyl alcohol and in isoamyl alcohol. Light-scattering and viscosity measurements were carried out on dilute solutions of the polymers in n-amyl alcohol at 29.5°C (θ temperature). The relation between molecular weight and intrinsic viscosity is compared with that determined in another theta solvent. Studies of the chain dimensions in solution have clarified anomalies that were observed earlier. Unperturbed chain extension of methacrylate ester polymers is discussed. (Author)

Florida State U., Tallahassee.
THE SOLVATION OF ELECTROLYTES IN DIOXANE-WATER MIXTURES, AS DEDUCED FROM THE EFFECT OF SOLVENT CHANGE ON THE STANDARD CHEMICAL POTENTIAL, by George Baughman, Ernest Grunwald, and George Kohnstam. Rept. on [Contract Nonr-988(02)]. [1959] 33p. 29 refs. AD-226 964.
Order from LC mi$3.00, ph$6.30 PB 150 108

The rate of change of the standard chemical potential with changing mole fraction of water, dF^o/dZ_1, was measured in 50.00 wt-% dioxane-water for a variety of electrolytes. Values obtained at 25.00° for $2dF^o_f/dZ_1$ were (in kcal per formula weight): NaOH, -17.6; NaCl, -13.8; KCl, -13.8; $(CH_3)_4NCl$, -13.5; RbCl, -13.2; CsCl, -12.5; LiCl, -11.5; KBr, -11.3; $NaNO_3$, -9.8; KI, -8.5; HCl, -7.9; sodium naphthalenesulfonate (β), -4.5; $NaClO_4$, -4.0; $(C_6H_5)_4PCl$, +0.2; $HClO_4$, +0.6; $NaB(C_6H_5)_4$, +15.4. Qualitatively, the positive values mean that these electrolytes are stabilized by addition of dioxane, in spite of the decreasing dielectric constant. Thermodynamic expressions were derived which relate the formal, experimental quantities, F^o and dF^o/aZ_1, for a dissolved substance to the corresponding quantities for the actual equilibrium mixture of solvated species. Then, assuming that the Born equation applies to each of the species in the equilibrium mixture, it was shown that these electrolytes are not solvated exclusively by water. More accurate theoretical treatments confirmed this result. Minimum values of the average dioxanation number were estimated for each electrolyte. The values tended to increase in the same order as the experimental values of $2dF^o_f/dZ_1$. Results indicate that dioxane can compete on fairly equal terms with water for the solvation of electrolytes. (Author)

Hull U. (Gt. Brit.).
THE INHIBITION OF THE HYDROGEN-OXYGEN REACTION BY METHANE, by R. R. Baldwin, D. Booth and others. Rept. on Contract AF 61(052)62. [1960] 29p. 24 refs. AFOSR-TN-60-298.
Order from LC mi$2.70, ph$4.80 PB 150 039

A preliminary study of the effect of a range of higher hydrocarbons on the second limit of the $H_2 + O_2$ reaction was made during the course of a war-time investigation. To elucidate the mechanism of inhibition, simpler hydrocarbons were selected and preliminary results with propane and detailed results with ethane have already been reported. With both hydrocarbons, the linear relation between explosion pressure and hydrocarbon mole fraction, obtained with the higher hydrocarbons has been confirmed over a wide range of conditions. With methane, however, the features of the inhibition show a remarkable difference from those of the higher hydrocarbons. This report describes these features in detail, and accounts for the difference between the behavior of methane and the higher hydrocarbons.

[Illinois U., Urbana].
FINAL REPORT, by E. Rabinowitch. Rept. for 1 Oct 51-30 Sep 59 on [Contract Nonr-1834(16)] [1959] 35p. 36 refs.
Order from LC mi$3.00, ph$6.30 PB 149 985

The general aim of the research was to gather information on the properties of chlorophyll and other plant pigment in vitro and in vivo which may be relevant to their function in photosynthesis. A considerable amount of valuable information has been obtained, but the specific nature of the processes involved in the conversion of light into chemical energy in photosynthesis still remains elusive. This applies in particular to the role of transfer and migration of energy among pigment molecules, which has been the central theme of the research. (See also PB 136 764)

Institute de Quimica Fisica (Spain).
ENERGY TRANSFER IN ORGANIC VAPOURS, by A. P. Masiá and M. D. Sonet. Annual technical rept. no. 1, 1 Mar 59-29 Feb 60, on Contract DA 91-591-EUC-1086. [1960] 54p. 23 refs; AD-234 911.
Order from LC mi$3.60, ph$9.30 PB 147 614

The "hot wire" method was used to measure the thermal conductivities of gaseous CCl_4, $CBrF_3$, CBr_2F_2, and CBr_2Cl_2 at different pressures and temperatures. The main part of the apparatus is a conductivity cell consisting of a Pt wire of 0.0376 mm diameter. This cylinder contains the gas under study.

Kent State U., Ohio.
THE MEASUREMENT OF THE PROTON-PROTON SEPARATIONS IN APPROPRIATE HYDRATES BY THE NUCLEAR MAGNETIC RESONANCE TECHNIQUE, by J. W. McGrath and A. A. Silvidi. Final rept. on Contract AF 49(638)168. 27 Aug 60, 31p. 37 refs. AFOSR-TR-60-103.
Order from LC mi$3.00, ph$6.30 PB 150 224

The proton-proton separations in hydrated water in ten compounds have been measured by the Pake method using proton magnetic resonance. The mean value is 1.595 ± 0.003 A with a range in values from 1.56 to 1.61 A. The orientations of the water molecule have been determined for eleven compounds. In every instance the orientation appears to be determined by formation of hydrogen bonds between the water oxygen and the nearest pair of electronegative atoms. In one instance, T_1 for protons in barium bromide monohydrate which is normally very long is sharply reduced. An rf unit for use in NMR spectrometers was designed, built and tested.

Laboratoire Méditerranéen de Recherches Thermodynamiques (France).
RESEARCHES ON THE PHENOMENA OBSERVED WHEN A BODY IS MOVING IN AN IONIZED ATMOSPHERE BY THE METHOD OF THE REVOLVING ARM, by F. Marcel Devienne and A. Roustan. Technical note on Contract AF 61(052)124. July 60, 77p. 3 refs. AFOSR-TN-60-907.
Order from LC mi$4.50, ph$12.30 PB 150 345

The phenomena produced on a body moving in an ionized atmosphere arising in the vicinity of the trajectory of the body were studied by the revolving arm method. Ionization was obtained with a high frequency field produced by an oscillator whose frequency may range between a few and a hundred megacycles. A pulse generator was used to study the equilibrium phenomena in a rarefied gas. The ionization was measured by means of Langmuir probes, generally plane. A study was made of the ionic current received by a metallic surface in function of the motion speed. The experiment shows that this variation is smaller than the theory points out, since the plates in motion are not quite clean, and the impurities, when charged, produce an electrical potential that tends to repulse the ions. The rise of temperature of an ionized gas was measured by comparing it with a non-ionized gas at the same pressure. Variations of ionic density were produced at the time of the passage of the revolving arm. The measurements show the influence of numerous factors on the perturbation caused by the motion of a body moving in an ionized medium. (Author)

Louisiana State U., Baton Rouge.
DOUBLE LAYER STRUCTURE AND RELAXATION METHODS FOR FAST-ELECTRODE PROCESSES. II. FARADAIC IMPEDANCE MEASUREMENTS, by Hiroaki Matsuda. Technical rept. no. 37 on Contract Nonr-330(00). Sep 59, 8p. 6 refs.
Order from LC mi$1.80, ph$1.80 PB 148 867

The elements of the equivalent circuit for the faradaic impedance are derived, due consideration being given to the structure of the double layer in the solution of the boundary value problem. It is shown that the classical theory is applicable but that measured exchange current densities and transfer coefficients must be corrected. The phase angle which is also affected can exceed π/4 when the reactants are strongly attracted in the diffuse double layer. Comparison is made with a similar treatment for the galvanostatic double pulse method. (Author)

Metallic Surfaces Research Labs., Ltd. Uxbridge, (Gt. Brit.)
THE EFFECT OF HIGH FREQUENCY HEATING ON THE DIFFUSION PROPERTIES OF ONE METAL INTO ANOTHER, by R. L. Samuel and J. D. Samuel. Annual technical rept. no. 1, 1 Apr 59-1 Apr 60, on Contract DA 91-591-EUC-1094. 10 Apr 60, 48p.
Order from LC mi$3.30, ph$7.80 PB 149 427

Further tests in confirmation of methods established in the previous period or utilizing new techniques have been carried out on the systems chromium-iron and chromium molybdenum. Solid-solid diffusion of chromium into iron has been studied on cylindrical specimens chromium-plated prior to the high-frequency diffusion treatment. A temperature range of 900°C to 1200°C has been covered and the results of systematic investigation confirm broadly that the rate of diffusion of chromium into Armco iron is accelerated by a factor of up to x 10 as compared to conventional methods of heating. Gas-solid diffusion of chromium into iron has been investigated by two methods. One, referred to as the "test tube" method, where the reacting gas is generated "in situ" has given variable results ranging from low diffusion rates to near-maximum rates. These results are discussed and some explanations are advanced to account for the variations observed. The other gas-solid diffusion method relies on the passage of chromium halide in vapor form around the iron specimen. The method of frequency measurement and a discussion on temperature control are given. The general conclusions are that all methods, correctly applied, give results which are broadly equivalent. Three general lines of explanation are suggested to account for the accelerated diffusion observed.

Naval Ordnance Lab., White Oak, Md.
A KINETIC STUDY OF THE LEAD-THIOUREA REACTION, by Marriner K. Norr. 15 June 58, 39p. 6 refs. NAVORD rept. 6168; AD-214 823.
Order from LC mi$3.00, ph$6.30 PB 147 566

A study of the reaction between lead nitrate, thiourea, and sodium hydroxide is given. The reaction was followed by analyzing for lead and total hydroxide. The ratio of sodium hydroxide to lead nitrate consumed during the reaction was found to be 2.0, within the experimental error. The reaction orders with respect to hydroxide and biplumbite ions vary with time: the former initially being zero and rising to one or two, the latter initially being 2.4 and falling to 1.25 ± 0.03. The reaction apparently is autocatalyzed by lead sulfide. (Author)

North Carolina U., Chapel Hill.
CHRONOPOTENTIOMETRY WITH CURRENT REVERSAL, by Richard M. King and Charles N. Reilley. Rept. on Contract AF 49(638)333. 16 Mar 60, 15p. 5 refs. UNC-Chem. no. 4-CNR; AFOSR-TN-60-766.
Order from LC mi$2.40, ph$3.30 PB 150 121

The transition time ratios for chronopotentiometry with current reversal are derived for the case in which the product of the forward electrochemical reaction decomposes immediately and irreversibly to two or more species which are not electrochemically active at the potential of the forward reaction but which do react consecutively following current reversal. The usual assumptions of semi-infinite linear diffusion control of mass transport are made. The derived results are found to be in good agreement with the experimental results of Geske. (Author)

Pennsylvania U., Philadelphia.
LOW TEMPERATURE IMPURITY CONDUCTION IN n-TYPE SILICON, by Kenneth Atkins, Robert Donovan, and Roger Walmsley. Technical rept. no. 1 on Contract Nonr-551(28). June 59, 43p. 41 refs.
Order from LC mi$3.30, ph$7.80 PB 147 889

This thesis describes measurements made on specially selected silicon samples to investigate the phenomenon of impurity conduction at low temperatures.

Phillips Petroleum Co., Bartlesville, Okla.
A CALORIMETRIC STUDY OF TRAPPED RADICALS PRODUCED BY GAMMA RADIATION, by Raymond L. Arnett, Eugene D. Guth, and Julius R. Berreth. Rept. on Contract AF 49(638)45. Sep 59, 49p. 20 refs. Research Div. rept. no. 2574-60R; AFOSR-TN-59-894; AD-235 427.
Order from LC mi$3.30, ph$7.80 PB 149 002

Several pure gases in the crystalline state (ammonia, methane, nitrogen, argon) and a glass of ammonia, water, acetone, have been irradiated in a gamma field. The amounts of energy stored in the solids are determined by calorimetry. A description is given of the calorimeter and experimental techniques.

Polytechnic Inst. of Brooklyn, N. Y.
COMPLEX CHEMICAL EQUILIBRIA BY MINIMIZING FREE ENERGY, by Leonard M. Naphtali. Rept. on Contract AF 49(638)165. Jan 60, 8p. 1 ref. AFOSR-TN-60-228; PRL-60-1; AD-233 497.
Order from LC mi$1.80, ph$1.80 PB 148 998

A technique is described for computing complex chemical equilibria by the minimization of free energy without utilizing the ideal gas assumption. An equilibrium in a system of 10 components was computed in 20 sec as a Fortran II subroutine with the IBM 704.

Princeton U., N. J.
NON-LINEAR PRESSURE OSCILLATIONS IN A COMBUSTION FIELD, by Gerald Rosen. Rept. on Project Squid, Contract Nonr-1858(25). Oct 59, 11p. 6 refs. Technical rept. PR-98-P; AD-227 730.
Order from LC mi$2.40, ph$3.30 PB 149 493

The unsteady combustion of liquid propellant droplets entrained in a burned gas flow is studied in terms of an idealized mathematical model. The model is used to derive an associated equation for non-linear pressure oscillations. Two necessary and sufficient conditions for unstable oscillations follow from a discussion of this equation. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
FUEL CELL SYSTEMS, by John E. McCormick. July 60, 20p. 4 refs. RADC TN-60-118.
Order from OTS $0.50 PB 161 972

This report discusses the thermodynamics of fuel cells, describes six different types of cells that have been proven feasible, and lists the advantages and limitations of these six types of cells. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE MEASUREMENTS OF THE VAPOR PRESSURE OF ATOMIC SPECIES FROM SPECTROPHOTOMETRIC MEASUREMENTS OF THE ABSORPTION OF THE RESONANCE LINES. IV. STANDARD ENTHALPY OF FORMATION OF SILICON CARBIDE, AND OSCILLATOR STRENGTH OF THE SILICON 2516 LINE, by G. L. Vidale. Rept. on Contract AF 04(647)269. July 60, 44p. 21 refs. Technical Information Series R60SD333. AD-239 281.
Order from LC mi$3.30, ph$7.80 PB 148 878

Spectrophotometric measurements of the absorption of the Si_{2516} resonance line were made of the equilibrium vapor over silicon metal and over silicon carbide, utilizing a hollow cathode discharge tube source previously described to generate a thin resonance line. From the ratio of the pressure of silicon atoms over silicon and over SiC, the standard free energy of formation was computed at 1700°K. The value of the standard heat of formation was then obtained with the aid of the known entropies and heats of warming of the various compounds.

Technical U., Vienna (Austria).
THE BEHAVIOR OF STREAMING AEROSOLS AND THEIR INTERACTION WITH ADSORBING SURFACES, by Alfred Dobrowsky. Final technical rept. for 1 Dec 59-31 Jan 60 on Contract DA 91-591-EUC-1349. 28 Feb 60, 26p. AD-238 720.
Order from LC mi$2.70, ph$4.80 PB 149 433

Functional correlation between filter mass, filter length, filter cross-section area, streaming velocity, pressure drop and filter collection efficiency are investigated on aerosol filters made of wadding, cellulose acetate and wood pulp fibers. The experimental equipment is described. The method is shown for getting experimental data and formulas, to facilitate further studies on this subject.

Tiltman Langley, Ltd. (Gt. Brit.)
TRACER STUDIES OF MIXING IN THE WAKE OF FLAME HOLDERS, by D. B. Spalding. Technical (scientific) note no. 2 on Contract AF 61(514)1213. 30 Nov 59, 111p. 3 refs. AFOSR-TN-60-1004.
Order from LC mi$6.00, ph$18.30 PB 150 359

The wake regions of four axially-symmetrical flameholders have been studied by the injection of a tracer (argon) at one location and the analysis of the tracer concentration at a second location. Both injection and sampling locations were varied so as to provide comprehensive description of mixing patterns in terms of influence coefficients, surveys being carried out when the gas stream was pure air (cold flow) and when the gas stream was a propane-air mixture burning behind the baffle (hot-flow). The influence coefficients were used to enable predictions to be made of the flameholding characteristics of the baffles, in terms of their dimensionless "chemical loading factor" for extinction. It was demonstrated that the values of the influence coefficients, and the sizes of the recirculation zones, were appreciably larger for the hot-flow than for the cold. Loading factors predicted from the hot-flow influence coefficients are therefore an order of magnitude greater than those based on the cold-flow coefficients. (Author).

Western Reserve U., Cleveland, Ohio.
THE OXYGEN ELECTRODE ON CARBON SURFACES, by M. O. Davies, Milton Clark and others. Technical rept. no. 11 on Contract Nonr-2391(00). 15 Nov 59, 108p. 37 refs. AD-237 103.
Order from LC mi$5.70, ph$16.80 PB 148 070

Anodic and cathodic polarization measurements and differential capacitance measurements have been made by interrupter techniques for the oxygen-hydrogen peroxide couple in alkaline solutions with carbon electrodes of the semi-lyophobic type. The results of these measurements have been compared with the surface area, pore distribution, and resistance for a large number of active carbons with different physical properties from various manufacturers. Surface areas and pore distributions have been determined by gas adsorption and desorption methods for both the original carbon and the carbon after incorporation into the electrodes. The polarization has been found to correlate particularly with that portion of the pore distribution

corresponding to radii in the range 4×10^{-7} to 2×10^{-6}cm and to show little correlation with micro pores with radii of 10^{-7} cm. or less. Indications are that the electrolyte does not penetrate into the micro pore structure. The results of this investigation should prove useful in applied work involving the oxygen cathode on carbon electrodes. (Author)

EARTH SCIENCES

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE GENERATION AND PROPAGATION OF SEISMIC ENERGY FROM A BURIED EXPLOSIVE SOURCE, by A. A. Thompson. June 60, 26p. Memo. rept. no. 1267.
Order from LC mi$2.70, ph$4.80 PB 150 091

When energy was measured near a deeply buried explosive source in sand, the seismic generation process proved to be of much longer duration than was expected from consideration of the rate at which the medium was loaded by a detonation. Since a large portion of the energy is applied to the medium while its particles are decelerating, the resistive forces of the strained medium are dominant during a good part of the time in which energy is transferred from the exploding source to the soil. Furthermore, the characteristics of the medium are more important in determining the frequency of oscillatory motion at a distance from the buried explosive source, than the loading rate as related to the detonation rate of the explosive. The detonation rate also had relatively little effect on the attenuation of seismic energy that was generated and propagated in the medium. Some conclusions are suggested concerning the use of seismic energy measurements, for determining mechanical energy input, and for prediction of damage to buried structures. (Author)

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford Mass.
CONTRIBUTIONS TO SATELLITE METEOROLOGY, by William K. Widger, Jr. June 60, 272p. 77 refs. GRD Research Notes no. 36; AFCRC-TN-60-427.
Order from LC mi$11.10, ph$42.60 PB 150 161

This report discusses: a concept of a meteorological system; applications of meteorological satellites; studies of large-scale cloudiness in the Northern Hemisphere; cloud patterns as seen from altitudes of 250-850 mi; the possibility of measuring cloud velocities from a satellite; a system for the meteorological use of satellite television observations; a photogrammetric method of obtaining the camera axis and its application in determining the time of photos taken from a space vehicle; synoptic-scale radiation processes; studies of atmospheric radiation as observed from satellites; a preliminary investigation of the nature of the infrared view of the earth's atmosphere from a satellite; satellite observations of infrared radiation; detection of ozone amounts from satellite measurements; and a generalized, schematic flow chart for the reduction and processing of satellite meteorological data. (Author)

Air Weather Service, Scott AFB, Ill.
USE OF ASYNOPTIC DATA IN ANALYSIS AND FORECASTING. 11 Mar 60, 30p. 1 ref. AWSM-105-10.
Order from LC mi$2.70, ph$4.80 PB 147 788

Asynoptic data are defined and the importance of utilizing them is stressed. A variety of feasible procedures for plotting, displaying, and analyzing asynoptic reports are illustrated for reconnaissance data, aireps, upper-air soundings, and surface data. Applications of these forecasting, briefing, and met watch are discussed.

Allied Research Associates, Inc. [Cambridge, Mass.]
THE DETECTION BY CPS-9 RADAR AND SHORT RANGE FORECASTING OF SEVERE AND VERY SEVERE THUNDERSTORMS, by Charles R. Shackford. Scientific rept. no. 5 on Contract AF 19(604)5204. 31 Dec 59, 20p. 9 refs. AFCRC-TN-59-660; AD-234 146.
Order from LC mi$2.40, ph$3.30 PB 147 875

The discovery exists that an important radar characteristic of severe and very severe thunderstorms is the reflectivity maximum at levels above 10,000 ft. As a result, a new operational technique was found necessary by which the reflectivity at various levels aloft of the most intense core of a thunderstorm can be quickly determined, and a practical method for doing this is described. The reflectivity profile of an echo can be obtained in 3 min or less and the values at 3 significant levels can be compared for forecast purposes with standard values associated in the past in New England with severe and very severe storms - i. e., storms which may possibly or are likely to produce tornadoes. The method also makes it possible to obtain more frequent reflectivity profile measurements, a very important consideration to meteorological research. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE COMPUTATION OF RAWINSONDE FLIGHTS BY GENERAL PURPOSE AUTOMATIC COMPUTERS, by Abraham Arnold and Marvin J. Lowenthal. 15 Oct 59, 25p. 8 refs. USASRDL Technical rept. 2063; AD-227 098.
Order from LC mi$2.70, ph$4.80 PB 147 825

The computation required for a rawinsonde flight is presented. Separate equations are given so that each element of meteorological information may be computed from the output data of Rawin Set AN/GMD-1( ). The equations are then programmed for a general purpose automatic computer which computes the temperature, humidity, height, and wind values from the raw data. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
HYGROTHERMOGRAPH SET AN/TMQ-10 ( ), by Joseph A. Siderman and Edward Lieblein. 1 June 59, 37p. USASRDL Technical rept. 2039; AD-219 317.
Order from LC mi$3.00, ph$6.30 PB 147 820

Results indicate that a satisfactory, low-cost indicator and indicator-recorder with medium accuracy can be

made available. Temperature elements that are accurate and reliable in the desired operating range are available for use with these models. At the present time, however, there are no humidity elements that are suitable for the intended application. Difficulties with existing humidity elements are saturation, short life resulting in high replacement rates, poor repeatability, nonlinear characteristics, poor accuracy, and poor response at low temperatures. A satisfactory humidity element must be developed before further development of the AN/TMQ-10( ) system can be continued. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A SIMPLE THUNDERSTORM WARNING DEVICE, by Heinz W. Kasemir. 15 June 59, 12p. USASRDL Technical rept. 2046; AD-219 318.
Order from LC mi$2.40, ph$3.30 PB 147 823

The first model of a thunderstorm warning device, using the dependence of the electrostatic field amplitude of lightning strokes on the distance to record the approach of a thunderstorm, is described. A warning bell or light can be set to give an alarm if the approaching thunderstorm underpasses a given distance which can be chosen between 10 and 150 miles. A plus-or-minus log recorder characteristic is applied to cover the wide variation of the field amplitude without range switching. The instrument is simple and inexpensive, and the maintenance is kept to a minimum. (Author)

General Mills, Inc., Minneapolis, Minn.
THE REVERSAL OF STRATOSPHERIC WINDS OVER NORTH AMERICA, by Arthur D. Belmont. Scientific rept. no. 1 on Contract AF 19(604)6618. 22 June 60, 89p. 18 refs. GMI rept. no. 2063; GRD-TN-[60]-490.
Order from LC mi$4.80, ph$13.80 PB 149 309

The prevailing monthly frequency and mean zonal component of easterly and westerly winds from 15 to 30 km are presented in the form of 48 vertical cross sections along the west and east coasts of North America for about five years of record. The tropical easterlies move northward in April and the polar easterlies (existent to some extent all winter) are first prevalent in March. Mid-latitude westerlies separate the two easterly belts in March and April, but in May there is easterly flow at most latitudes above 23 km except near the pole. By July easterlies prevail down to at least 15 km in low latitudes, to 20 km in mid-latitudes, and to 15-17 km at polar latitudes. In August the polar and tropical easterlies are separated and by September the tropical easterlies start retreating to their minimum frequency which is reached apparently in November. (Author)

International Inst. of Meteorology, U. of Stockholm (Sweden).
THE CENTRAL CIRCULATION OF THE ATMOSPHERE IN THE LIGHT OF MORE RECENT INVESTIGATIONS, by Freidrich Defant. Technical (Scientific) note no. 3 on Contract AF 61(514)963. Apr 59, 39p. 35 refs. AFCRC-TN-59-438; AD-234 548.
Order from LC mi$3.00, ph$6.30 PB 148 250

Extensive synoptic studies carried out for selected periods in midwinter 1956 and based on a total careful check of all the radiosonde ascents of the Northern Hemisphere (temperature and wind) allowed to specify the following important basic phenomena inside the General Circulation of the Atmosphere: (1) A threefold subdivision of the tropopause-level by means of two hemispheric tropopause breaks. (2) A classification of the radiosonde ascents giving important information about the baroclinic structure of the atmosphere. (3) Characteristic Polarfront Jetstream and Subtropical Jetstream have to be clearly distinguished from each other. (4) Meandering behaviour of the Subtropical Jetstream in form of suddenly occurring and rapid northward advances of it (subtropical impulses) towards higher latitudes with simultaneous formation of strong and extensive blocking-anticyclones over midlatitudes. The effect of these on the Polarfront Jet circulation has been demonstrated. These phenomena are discussed in this article.

International Inst. of Meteorology, U. of Stockholm (Sweden)
THE HORIZONTAL AND VERTICAL WIND PROFILES OF THE SUBTROPICAL AND POLAR JET FOR JANUARY 1-7, 1956 AND THE VARIATION OF THE EQUIVALENT BAROTROPIC LEVEL., by Hassam Taba. Technical (Scientific) note no. 4 on Contract AF 61(514)963. 2 July 59, 28p. 6 refs. AFCRC-TN-59-662; AD-234 426.
Order from LC mi$2.70, ph$4.80 PB 147 874

All the available wind information over central, west and north Europe, the Atlantic Ocean, the United States and Canada was studied for a period of seven days, January 1-7, 1956 0300 Z. Mean horizontal and vertical wind profiles were computed at 100 km intervals from the axis of both jets and are discussed. Both on these profiles, the average wind and the equivalent barotropic level is computed. It is shown that the height of the equivalent barotropic level changes as the distance from the axis of the jet varies. The equivalent barotropic level is shown to have a maximum height of 432 mb at the axis of the subtropical jet and a minimum height of 560 at a distance of 1000 km north of the polar jet. An average E. B. L. is computed and is shown to have a height of 505 mb. (Author)

Massachusetts Inst. of Tech., Cambridge.
THE LINEAR PREDICTABILITY OF WEATHER RADAR SIGNALS, by Thomas M. Noel and Aaron Fleisher. Research rept. no. 34 on Weather Radar Research, Contract AF 19(604)5220. June 60, 49p. 9 refs. AFCRC-TN-60-471.
Order from LC mi$3.30, ph$7.80 PB 149 569

A study has been made of the linear predictability of the plane field of radar signals from weather. The results are a description of the quality of the forecasts and their dependence on time and location, of the sources of information and of the eddy structure of precipitation. (Author)

Massachusetts Inst. of Tech., Cambridge.
STUDIES OF THE ATMOSPHERIC GENERAL CIRCULATION, III, by Victor B. Starr. Final rept., 1 Jan 58-31 Dec 59 on General Circulation Project, Contract AF 19(604)2242. Dec 59, 145p. 148 refs. AFCRC-TR-60-231; AD-237 778.
Order from LC mi$7.20, ph$22.80 PB 148 069

In general terms, the primary concerns were (1) to measure, as far as the existing data permit, the distribution, transfer and conversion of atmospheric energy as a function of wave number, and the hemispheric distribution and transfer of water vapor; and (2) to pursue theoretical studies of the dynamics of the general circulation. (Author)

McGill U. (Canada).
TEMPERATURE AND WIND FREQUENCY TABLES FOR EURASIA. VOL. 3. JULY-SEPTEMBER, by J. N. Rayner. Rept. on Contract DA 19-129-qm-1447. June 60, 209p. Arctic Meteorology Research Group Pub. in Meteorology no. 21.
Order from LC mi$9.30, ph$31.80 PB 150 188

See also PB 148 325

McGill U. (Canada).
TEMPERATURE AND WIND FREQUENCY TABLES FOR EURASIA. VOL. 4. OCTOBER-DECEMBER, by J. N. Rayner. Rept. on Contract DA 19-129-QM-1447. July 60, 209p. Arctic Meteorology Research Group Pub. in Meteorology no. 23.
Order from LC mi$5.70, ph$16.80 PB 150 189

See also PB 150 188

Office of Naval Operations, Washington, D. C.
UPPER WIND STATISTICS CHARTS OF THE NORTHERN HEMISPHERE (300, 200 AND 100 mb LEVELS), by Harold L. Crutcher. Aug 59, 97p. 32 refs. NAVAER 50-1C-535, Volume II.
Order from OTS $35.00 PB 161 995-2

See also PB 161 995-1

Office of Naval Operations, Washington, D. C.
UPPER WIND STATISTICS CHARTS OF THE NORTHERN HEMISPHERE (850, 700 AND 500 mb LEVELS), by Harold L. Crutcher. Aug 59, 94p. 32 refs. NAVAER 50-1C-535, Volume I.
Order from OTS $35.00 PB 161 995-1

See also PB 161 995-2

Pennsylvania State U. Mineral Industries Experiment Station, University Park.
TROPOSPHERIC BEHAVIOR ASSOCIATED WITH THE ARCTIC STRATOSPHERIC WARMING PHENOMENON, by Paul R. Julian. Final rept. Pt. 1 on Contract AF 19(604)2190. Dec 59, 111p. 31 refs. AFCRC-TR-60-240(1).
Order from LC mi$6.00, ph$18.30 PB 149 978

Eight winters, 1952 through 1959, have been investigated in an effort to ascertain tropospheric behavior occurring concurrently with the warming phenomenon. A precise definition of the warming phenomenon was formulated by assuming that the transition of the Canadian Arctic stratosphere from a baroclinic state, with wind speeds at 100mb two to three times those at 500mb, to a near-barotropic state, with the wind speeds at 100 and 500mb almost equal, was the systematic, and annually-recurring event of interest. The large-scale tropospheric behavior was determined by computing pressure-change charts from 30-day mean sea-level charts ending and commencing on the approximate date at which the stratospheric transition began. In all eight winters the sea-level pressure was observed to increase in the Canadian Arctic and decrease in middle latitudes as the transition occurred in the stratosphere. In the four winters with transition dates occurring before 1 March, the increase in arctic pressures was accompanied by a southward movement of the belt of maximum tropospheric westerlies and a pronounced primary index cycle. In the four winters with transition dates in March, the association of the polar pressure rises with an index cycle was not as clear, apparently because positive pressure anomalies at high lititudes existed previous to the transition date. Two winters of data from the Antarctic indicated increases in station pressures over the continent, as the antarctic stratospheric transition occurred.

Quartermaster Research and Engineering Center, Natick, Mass.
THE NIGHTTIME INFLUENCE OF IRRIGATION UPON DESERT HUMIDITIES, by Ivan Bennett and Ronald A. Nelson. July 60, 46p. 13 refs. Technical rept. EP-136.
Order from LC mi$3.30, ph$7.80 PB 150 184

A moderate increase was observed in moisture content of the air in the oasis compared with desert air. The magnitude of the increase was related to the general moisture level of the two prevailing summer air-masses; with dry Pacific air the increase amounted to 15 to 20 F degrees in dewpoint, and with moist air from the Gulf of Mexico it was limited to 5 to 10 F degrees. Similar but smaller differences were noted between moist and dry cropland within the oasis. Advection of moist air from the oasis into the desert could not be sharply delimited quantitatively, but within the first few hundred yards from the edge of the oasis, advection diminished rapidly and seemed barely evident at one mile. Nighttime evaporation and small daytime storage of heat in the oasis soil, contrasted with negligible nighttime evaporation and large heat storage in the soil of the desert, combined to produce minimum daily temperatures 5 to 15 F degrees lower in the oasis than in the adjoining desert. (Author)

Sperry Gyroscope Co., Great Neck, N. Y
A FLIGHT INVESTIGATION OF THE PERFORMANCE OF LOW CEILING/VISIBILITY METEOROLOGICAL EQUIPMENT. Rept. on Contract Cca-29773. Dec 54, 367p. 11 refs. Sperry rept. no. 5245-4059.
Order from LC mi$11.10, ph$56.10 PB 147 958

A flight test program to evaluate operationally the ceilometer-transmissometer system of measuring low ceiling/visibility weather with respect to what the pilot sees from the cockpit during actual weather ILS approaches has been conducted by Sperry Gyroscope Company, Division of The Sperry Corporation, under contract to the Air Navigation Development Board. This project has been conducted under the technical supervision of the Weather Bureau. A general analysis of the flight test data has been performed. The results of this analysis can be used to determine what a pilot will see from the cockpit under observed meteorological and photometric conditions at any airport equipped with the ceilometer-transmissometer system. Information which is not currently available to the pilot, such as the points from which he can first see the ground, the approach lights, and the end of the runway, can be obtained from this system. This information, when used by the pilot, can provide an improvement in approach success and an increase in the safety of instrument approaches. (See also PB 144 114)

Stanford Research Inst., Menlo Park, Calif.
ON METEOROLOGICAL OBJECTIVE ANALYSIS AND MODEL THEORY, by Manfred M. Hall. Final rept. on Contract AF 19(604)5703. July 60, 43p. 2 refs. GRD-TR-60-293; SRI Proj. 2890.
Order from LC mi$3. 30, ph$7. 80 PB 150 173

The development of a system for the analysis of meteorological distributions by the objective treatment of observational data is systematically discussed. The information sources are considered to fall into three categories: (1) data concurrent with the time of the space-distribution analysis, (2) near-past data containing information which may be extrapolated forward in time to the analysis, and (3) well-past data from which come physical laws, statistical and empirical relationships, and subjective, learned, skills. The investigation is limited to considerations of the space-time analysis of the state parameters (pressure, temperature and density) and the wind. The state-parameters are dealt with from the point of view of interrelationships, degree of independence, manners of specification, and transformations. The analysis system is built up on the use of a dynamical-numerical model as data vehicle. The basic system of governing equations is illustrated with density as principal dependent variable of state, and the importance of the horizontal-mass-divergence is indicated. The mass-continuity equation is shown to have a near-perfect numerical analogue. The mechanism by which the atmosphere maintains approximate geostrophic balance is considered. Numerical techniques are suggested for possible realization of this wind alignment to a natural degree in the integration without rigid imposition in the model. The propagation of meteorological "noise" and its suppression is also discussed. (Author)

Texas A. and M. Research Foundation, College Station.
DESIGN OF THE MOBILE MICROMETEOROLOGICAL STATIONS EMPLOYED ON PROJECT GREEN GLOW by William H. Clayton and Jerry D. Merryman. Final rept. on Contract AF 19(604)4562. Jan 60, 91p. 3 refs. Reference 60-IT; AFCRC-TR-60-252.
Order from LC mi$5. 40, ph$15. 30 PB 149 570

This paper outlines the design and construction of two mobile micrometeorological stations developed specifically for use on Project Green Glow and for study of the atmospheric boundary layer generally. The two stations are identical with respect to parameters measured and sensors employed, and differ only in the method of data readout. Station 2 (to which the major part of the discussion is devoted) presents the data as sequential parameter values in digitized form on typewritten sheets and punched cards, while Station 1 utilizes the familiar strip chart recorders and electrical counters. (Author)

Texas A. & M. Research Foundation, College Station.
MICROMETEOROLOGICAL DATA PROJECT GREEN GLOW. VOLUME I. WET AND DRY BULB TEMPERATURE, STATION 3, by William H. Clayton. Scientific rept. no. 1 on Contract AF 19 (604)5527. June 60, 700p. Reference no. 60-8D1; GRD-TN-60-489.
Order from LC mi$11. 10, ph$105. 90 PB 150 181

Two mobile micrometeorological stations were employed for the collection of these data. These stations, designated 2 and 3 on the accompanying field map, were equipped for air temperature measurements (wet and dry bulb) at eight levels, wind speed at eight levels, wind direction at one level, soil temperature at seven levels, soil heat flux, insolation, reflected insolation, net radiation, soil moisture, and standard surface observations. Only wet and dry bulb temperature values from Station 3 are given in this report.

Weather Services, Inc., Boston, Mass.
DEVELOPMENT OF A METHOD OF FORECASTING THE OCCURRENCE AND BASE ALTITUDE OF CONTRAIL FORMATION. Scientific rept. on Contract AF 19(604)1961. 20 Jan 60, 47p. AFCRC TN-60-231.
Order from LC mi$3. 30, ph$7. 80 PB 146 466

To forecast the occurrence of contrails, a simple mathematical predicting model was developed. This was based primarily on the shape of the ascent curve. The mathematical problem was one of discriminant analysis, in which a linear combination of three slopes was found, which maximized the ratio of the variability of the resulting combination between the two categories, contrails and no contrails. The discriminant values found for all cases separated well ranging from 85% to 100% correct. In the forecasting of the height of contrail formation, an equation was developed using the prevailing height of the tropopause to indicate approximate height of contrail formation and the height at which the -50C temperature occurred. The data was normalized providing a forecasting method, effective regardless of location. A graph of this equation resulted in a simple method of forecasting contrail height. (Author).

Wisconsin U. [Madison].
AN EXPERIMENT IN STRATIFIED CLIMATOLOGY OF UPPER WINDS, by Walter I. Christensen, Reid A. Bryson, and Charles W. Hutchins. Scientific rept. no. 2 on Contract AF 19(604)5191. Feb 60, 79p. 6 refs. AFCRC-TN-60-201; AD-235 072.
Order from LC mi$4. 50, ph$12. 30 PB 148 252

As an experiment in stratified climatology, a contingency technique is tested for forecasting 300 mb geostrophic winds over a central point in a given area for the month of March. Eight years of data (1950-1957 is incorporated into the forecast scheme and March 1958 is used for verification. Results are compared with other objective and subjective forecast methods with the results of this study comparing favorably with other objective methods but not surpassing the accuracy level of the Joint Numerical Weather Prediction Unit. Simplicity and rapidity of application of this contingency technique is preserved and stressed. It is believed that this method has merit and further research in this area may provide more significant results. (Author)

Wisconsin U. [Madison]
AN EXPERIMENT IN THE INTERPOLATION OF PRESSURE CONTOUR PATTERNS IN AREAS OF MISSING DATA, by James R. Blankenship, Reid A. Bryson, and Lyle H. Horn. Scientific rept. no. 1 on Contract AF 19(604)5191. Feb 60, 55p. 4 refs. AFCRC-TN-60-200; AD-235 071.
Order from LC mi$3. 60, ph$9. 30 PB 148 251

A method of interpolating the pressure pattern into an area of missing data is studied from adjacent areas of known data. The method is used to describe the known portions of the northern hemispheric 500-mb flow by the use of orthogonal polynomials. This method reduces the 500-mb contour pattern to a mathematical formula, which if converted back to the original map will usually contain 95% of the variance of the original 500-mb chart. By the use of the variable coefficients of the orthogonal polynomials, the values for these same coefficients can be interpolated for the silent area. This study indicates that a silent area chart can be produced by this method with an average accuracy of 88% or greater. The basic premise of this approach is that all weather patterns are themselves globally inter-dependent, therefore, the coefficients of the known area must reflect at least the main conditions in the missing area. The basic data were obtained from the US Navy project AROWA map series. This data, being on IBM cards, made it possible to utilize the IBM 650 electronic computer. (Author)

Wisconsin U., Madison.
HEAT FLUX IN LAKE MENDOTA, by John A. Dutton and Reid A. Bryson. Technical rept. no. 2 on Contract Nonr-1202(07). June 59, 106p. 15 refs.
Order from LC mi$5. 70, ph$16. 80 PB 150 049

In Chapter I the heat budget of the lake's surface is examined. Starting with a relationship that combines the factors of net radiation, evaporation, transfer of heat to the air, and the change in heat content of the lake, the balance of these factors from month to month are developed. The result is a quantitative understanding of how the heat provided by the sun at the lake's surface is partitioned through various processes, and how this partitioning changes with the season. Chapter II shows quantitatively how the heat which is transferred through the surface of the lake is distributed with depth, and demonstrates the development and decay of thermal structure through the ice-free season of the lake. A well-known method of solving Fourier's heat conduction equation is developed and applied to the lake. The first results of the attempt to relate the observed parameters of the lake to those of the atmosphere are presented in Chapter III. The value of the concept of the lake as an integrator of the climate is shown through the high correlation of lake surface temperatures and the average of air temperatures over periods from one week to a month.

Frost Science

Denver U. [Colo.]
ELASTIC PLATES WITH SIMPLY SUPPORTED STRAIGHT BOUNDARIES, RESTING ON A LIQUID FOUNDATION, by Arnold D. Kerr. Rept. on Bearing Capacity of Floating Ice Sheets, Contract DA 11-190-eng-34. Sep 59, 18p. 14 refs. SIPRE Research rept. 59; AD-237 338.
Order from LC mi$2. 40, ph$3. 30 PB 149 134

The deflection expression of an infinite plate subjected to a concentrated force is used with the "method of images" to obtain solutions for 6 plates with simply supported edges. The semi-infinite plate, the wedge-shaped plate, and its special case, the rectangular corner plate, are solved in closed form; and the infinite strip, the semi-infinite strip, and the rectangular plate are solved as rapidly convergent series. Behavior under a concentrated force is studied in more detail for the semi-infinite plate and the rectangular corner plate. Relationships for obtaining bending moments, shear forces and reaction distributions as well as derivatives of the kei-function with respect to r and θ are given. (Author)

Denver U. [Colo.]
PLASTIC DEFORMATION OF FLOATING ICE PLATES SUBJECTED TO STATIC LOADS, by Arnold D. Kerr. Rept. on Bearing Capacity of Floating Ice Sheets, Contract DA 11-190-eng-34. Sep 59, 15p. 12 refs. SIPRE Research rept. 57; AD-237 533.
Order from LC mi$2.40, ph$3.30 PB 149 132

The problem is analyzed mathematically for decreasing and increasing rates of deflection. The analysis is based on the assumptions that for decreasing rates of deflection the floating ice plate will deform under lateral load without failure until the weight of the displaced water is equal to that of the load, and that for increasing rates, deflection increases until the ice plate collapses under and near the load. It is also suggested that the total deflection at a certain time is the result of the elastic deflection surface and the plastic deflection due to shear only, the shear forces obeying Newton's law of viscosity. Deflection equations for plastic deflection due to shear are derived for an infinite plate subjected to a line load, an infinite plate subjected to a concentrated force (axially symmetrical flexure), and an infinite plate subjected to uniform circular load. Equations for elastic deflection to be added to the plastic deflection due to shear are suggested. According to the statements and assumptions made and the results obtained, the total system of an ice plate resting on a liquid base can be considered as a Kelvin body for the case of decreasing rates of deflection. (Author)

Geodesy

Aeronautical Chart and Information Center, St. Louis, Mo.
GEODETIC DISTANCE AND AZIMUTH COMPUTATIONS FOR LINES OVER 500 MILES. Rev. Dec 59, 90p. 27 refs. ACIC Technical rept. no. 80.
Order from OTS $2.25 PB 161 994

This is the third and final report of a series containing the results of a geodetic investigation of existing formulae suitable for computing geodetic distance and azimuth of the basic geodetic curves; the geodesic, normal section and great elliptic arc. It recommends those formulae not too complex for general use and adaptable to desk calculator and electronic digital computer. Eighteen equations were evaluated; seven for the great elliptic; seven for the geodesic and four for the normal section. The accuracy criteria for this report are set at 1:100,000 in length and one second of arc in azimuth. (Author). (See also PB 124 647, PB 131 980).

Aeronautical Chart and Information Center, St. Louis, Mo.
A PHOTOCHEMICAL PROCESS FOR PREPARATION OF MASTER TERRAIN MODELS, Aug 60, 13p. 7 refs. ACIC Interim Technical rept. no. 91.
Order from OTS $0.50 PB 161 993

The primary purpose of this report is to present a standardized procedure for rapidly and economically preparing master terrain model surfaces by photomechanical methods to support production of shaded relief masters now being prepared by artist airbrush and hand rendering. Further processing of these products can afford users wide selection of related topographic items. In this procedure, white light is admitted through a variable-toned transparency directly into a particular sentized liquid plastic (initially formulated and patented by Haloid Xerox, Inc.) for a predetermined exposure. Exposure of this projected image will produce a hardened three-dimensional surface of the plastic, thus reducing conventional terrain model making to a more simplified photomechanical operation. Reproduction of this master with select molding media will provide various photographic and thermo-formed by-products. The process described here does not intend to furnish all-purpose solutions to user requirements, but does afford rapid means of effectively portraying terrain detail in 3-dimensional form and provides stimulas to continue investigation toward improving photomechanical techniques and products relating to terrain identification and simulated effects useful to analysis, training, and briefing. (Author).

Naval Photographic Interpretation Center, Washington, D. C.
STUDY OF VEGETATION AND TERRAIN CONDITIONS FROM AERIAL PHOTOGRAPHY, by P. E. Truesdell. Final rept. on Proj. TED PIC PH-4747.4. May 59, 81p. PIC rept. 207/59-U.
Order from LC mi$4.80, ph$13.80 PB 150 786

This report released for sale to the public 11 Oct 60.

A study was conducted concerning the interpretation of vegetation and associated terrain conditions from aerial photography obtained from a selected area in the Northern Hemisphere. The study consisted of a field trip to the area to be investigated and laboratory work with the aerial photography as a basis for determining the recognition characteristics of the vegetation observed on the field trip. It is concluded that, the study will be an aid to the photo interpreter in becoming familiar with certain vegetation types and their associated terrain conditions. (Author)

Geology

American Geographical Society, New York.
GLACIAL GEOLOGY OF THE LAGUNA SAN RAFAEL AREA, by Ernest H. Muller. Rept. on American Geographical Society Southern Chile Expedition, 1959, Contract Nonr-641(04). Oct 59, 35p. 22 refs. AD-227 472.
Order from LC mi$3.00, ph$6.30 PB 149 864

Contents:
Pre-Tempanos glaciation
Tempanos glaciation
  Topographic expression
  Exposures in the banks of Rio Tempanos, near Otqui, and in shore-bluffs of Laguna San Rafael
  Correlative moraines of adjacent glaciers
Oscillations of recent centuries
  Recent moraines
  Modern outwash plain
  Stratigraphic evidence
  Historic evidence of recent fluctuations
San Rafael glacier in 1959
  Ice cave observations
  Moraine deposition

Instituto de Edafologia y Fisiologiya Vegetal, Madrid (Spain).
STUDY OF THE SOILS OF THE EBRO VALLEY. I. PROVINCES OF LOGRONO AND NAVARRA, by J. M. Albareda, F. Monturiol and others. Final technical rept. for 1 Mar 59-30 Feb 60 on Contract DA 91-591-EUC-1085. [1960] 126p. 25 refs. AD-235 137.
Order from LC mi$6.30, ph$19.80 PB 147 622

Soil maps were drawn of the provinces of Navarra and Logrono with special consideration of the study of profiles in the terrain. The maps and a study of the geological characteristics of both provinces allowed the establishment of 11 different soil series, in some of which the lithosoil stage was also mapped. Four distinct sectors corresponding to 4 different natural regions, with their different reliefs and patterns were distinguished. The types of climate which correspond to these 4 natural regions were studied supported by climatological data. The geological history of the Ebro Valley, the main mineral resources, and the terrain belonging to different ages and stories are described; the lithology of the different materials was analyzed. Studies were made of spontaneous vegetation, in which the main constitutive species of the xerophytic thicket and humid woodland, hydrography, and agrarian economy are examined. The mineralogical study of sands and clays was undertaken of the 11 soil series. Study of clays revealed the constancy of the illite-kaolinite association. Different Fe forms, particularly geothite, were very abundant in every profile. The results of the mineralogical analysis of the heavy fractions indicated that very resistant species such as tourmaline, zircon, and rutile predominate. Opaque grains were very abundant.

Oceanography

Office of Naval Research, Washington, D. C.
THE NEXT TEN YEARS IN OCENAOGRAPHY (A SURVEY OF THE GROWTH POTENTIAL TO EXISTING INSTITUTIONS) by Gordon G. Lill, A. E. Maxwell, and F. D. Jennings. 1 Jan 59, 33p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 150 586

This report released for sale to the public 11 Oct 60.

Several groups, including the Office of Naval Operations, members of Congress and the Committee on Oceanography of the National Academy of Sciences - National Research Council, have requested that a broad long range program of oceanographic research be formulated to present the current status and the future requirements that are necessary to maintain the needs of the country. This document has been prepared as an essential part of that research.

Texas A. and M. Coll., College Station.
DATA REPORT FOR TWO IGY CRUISES, by Hugh J. McLellan. Rept. on Contract N7onr-48702. Apr 59, 117p. 2 refs. Reference 59-15D; AD-220 390.
Order from LC mi$6.00, ph$18.30 PB 148 270

Cruise 58-H1 was carried out March 23 to April 3, 1958. A line of stations to a maximum depth of 3500 meters was occupied along the 94°30' W meridian crossing the Gulf of Mexico from North to South. The locations of stations are shown on the track chart. Fourteen hydrographic stations were occupied, 4 bottom cores taken and 144 B. T. observations made. Cruise 58-H4 May 13 to June 29, 1958. The track followed and the positions at which observations were made are shown. In all 90 hydrographic stations were occupied. Twenty-eight bottom cores were taken and 410 B. T. observations made.

Woods Hole Oceanographic Institution, Mass.
OCEANOGRAPHIC DATA FROM MEDITERRANEAN SEA, RED SEA, GULF OF ADEN, AND INDIAN OCEAN; ATLANTIS CRUISE 242 FOR THE INTERNATIONAL GEOPHYSICAL YEAR 1957-58, by A. Conrad Neumann and Dana Densmore. Rept. on Contract Nonr-2196(00). Dec 59, 44p. 9 refs. Reference no. 60-2.
Order from LC mi$3.30, ph$7.80 PB 146 999

The data of 51 hydrographic stations plus a list of surface salinity and temperature values are presented.

Physics of the Atmosphere

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
COMPOSITION OF RADIATION TRAPPED IN THE GEOMAGNETIC FIELD AT ALTITUDES UP TO 1,000 KILOMETERS, by Francis E. Holly and Richard G. Johnson (Lockheed Missile and Space Research Lab.) Mar 59, 18p. 5 refs. AFSWC-TN-59-15; AD-216 354.
Order from LC mi$2.40, ph$3.30 PB 147 815

An instrument package containing 8 Geiger tubes was flown at an altitude of 1,000 km in a region of the lower Van Allen radiation belt. Five different thicknesses of absorber were used to obtain a range spectrum of penetrating particles. The radiation penetrating 30 $\frac{mg}{cm^2}$ Al absorber (> 160 kev electrons) was determined, by magnetic selection, to be predominantly electrons. Ninety-nine percent of the flux in the measurement energy range (30 kev to 4 Mev for electrons) would not penetrate the same absorber thickness as a 600 kev electron. A trapped high energy component was observed. (Author)

Avco Corp., Wilmington, Mass.
IONOSPHERIC DISTURBANCES FOLLOWING A SOLAR FLARE, by G. E. Hill. Scientific rept. no. 6 on Research Concerning Forecasting Anomalous Propagation at High Latitudes, Contract AF 19(604)4092. Aug 60, 46p. 14 refs. Technical rept. RAD-TR-60-22; AFCRC-TN-60-598.
Order from LC mi$3.30, ph$7.80 PB 150 341

Northern Hemispheric charts of f min, foEs, and foF2 at intervals of 3 hours have been constructed for the disturbed period from 12 through 15 September 1957. Enhanced f min values have been found over the polar cap on 12 September. By the time of the sudden commencement (SC) of geomagnetic activity (0046Z, 13 September) the f min disturbance spread outward to the auroral zone. Following the SC, the f min disturbance formed in an elliptically shaped ring around the earth while the polar cap f min disturbance dissipated. The elliptical ring (coincident with constant dip lines) then expanded southward, and by 0900Z, the approximate time of the main phase, the f min ring disturbance reached a constant dip of about 72 degrees. Just to the north of this ring, in Canada, a crescent-shaped sporadic E disturbance developed. It also moved southward. Subsequently, a band of sporadic E appeared over northern Asia. The foF2 disturbance began about the time of the SC and lasted about 36 hours. On the basis of the f min and foEs patterns, it is concluded that prior to the SC, solar corpuscles impinge on the lower ionosphere directly from outside of the earth's "magnetosphere". The post-SC f min and foEs disturbances is attributed to trapped radiation drifting at relatively low altitudes (below about 2000 km). The southward expansion of the disturbances is a result of the strengthening of the solar stream. (Author).

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INSTRUMENTATION USED FOR IONOSPHERE ELECTRON DENSITY MEASUREMENTS, by William J. Cruickshank. May 60, 20p. 7 refs. Technical note no. 1317; AD-239 903.
Order from LC mi$2.40, ph$3.30 PB 150 093

The technique employed for the measurement of ionospheric electron densities through study of differential propagation effects on two-phase coherent frequencies broadcast from high altitudes is discussed. A brief description of the stable airborne transmitters and of the rocket vehicle designated "Strongarm" which was used in an initial experiment to carry the airborne transmitters to an altitude of 1,000 miles is presented. The very narrow band receivers and recording equipment needed to provide data reception and information separation are discussed. A summary is given of the results of the two "Strongarm" rockets that have been fired, and the schedule of future experiments is outlined. (Author)

Electromagnetic Research Corp., Washington, D. C.
DETERMINATION OF IONOSPHERE PARAMETERS BY MEANS OF A SATELLITE ANTENNA-TYPE PROBE, by W. W. Zachary, E. A. Wolff, and M. Katzin. Scientific rept. no. 1 on Contract AF 19(604)6656. 30 June 60, 57p. 11 refs. Rept. no. CRC-6656-1; GRD-TN-60-492.
Order from LC mi$3.60, ph$9.30 PB 149 844

A spherical antenna-type probe for determining the parameters of the ionosphere is described. This consists of a main slot around which are disposed pairs of small orthogonal slots. By applying a driving voltage to the main slot and measuring the input impedance as well as the voltages induced in the orthogonal slots, the ionization density, collision frequency, and vector earth's magnetic field may be determined. These are local values since the reaction of the medium on the probe is effectively limited to distances of the order of less than a wavelength. As a preliminary to the main analysis, the input admittance of a slotted plane antenna in a magneto-ionic medium is analyzed. The solution is obtained in a form suitable for numerical evaluation. Measurement systems for the determination of the quantities necessary to evaluate the parameters of the ionized medium are considered. Three systems are shown and their relative advantages and disadvantages are outlined. A suitable measurement system appears to be quite feasible of realization. (Author)

Institute of Geophysics, U. of California, Los Angeles.
THEORETICAL AND LABORATORY STUDIES IN CHEMICAL AERONOMY, by William J. Schade. Final rept. for 1 Mar 57-30 Apr 60 on Contract AF 19(604)2144. Apr 60, 14p. 8 refs. AFCRC-TR-60-241.
Order from LC mi$2.40, ph$3.30 PB 149 535

A new portable high-speed ultraviolet spectrograph is described. The specifications of the instrument are given. A laboratory source for the study of some aeronomic chemical reactions is considered. This source is seen to be useful for studying the recombination processes of atomic oxygen. (Author)

International Inst. of Meteorology, U. of Stockholm (Sweden).
INVESTIGATIONS ON THE DETAILED STRUCTURE OF THE ATMOSPHERE IN NORTHERN HEMISPHERE MID-SUMMER (15-20 JULY 1957, IGY-DATA) by Friedrich Defant. Technical (scientific) note no. 5 on Contract AF 61(514)963. 1 Sep 59, 126p. AFCRC-TN-59-664; AD-234 430.
Order from LC mi$6.30, ph$19.80 PB 147 873

Contents:
Synoptic situation (15-20 July 1957); worldwide check on the summer tropopause-level and on the level of maximum wind; position of polarfront jet and subtropical jet; the summer-polarfront
Presentation of mean vertical temperature distributions in each of the special selected atmospheric spaces (polar, midlatitude, tropical, and in the vicinity of the summer subtropical jet) and a comparison of these average distributions with that obtained for mid-winter periods.
Presentation of frequency distributions of temperature for various isobaric surfaces in each of the atmospheric space selected in order to demonstrate the conservative character of the average temperature in each space; proof for the existence of 3 principal air masses as opposed to system of 2 principal masses (polar - tropical)
Dependence of the summer temperature on latitude in various levels of the naturally subdivided atmospheric spaces
Presentation of mean meridional cross-sections of the actual and the potential temperature for northern hemisphere summer
Average values of the vertical gradient of potential temperature in each of the atmospheric spaces; presentation and discussion of a mean meridional cross-section of the static stability for northern hemisphere summer

Maryland U., College Park.
THE LATITUDE AND ALTITUDE DISTRIBUTION OF GEOMAGNETICALLY TRAPPED PROTONS, by S. F. Singer. Rept. on Contract AF 49(638)530. 17 June 60, 8p. 12 refs. AFOSR-[TN]-60-747.
Order from LC mi$1.80, ph$1.80 PB 149 883

Massachusetts Inst. of Tech., Cambridge.
ENERGY TRANSFORMATION AND VERTICAL FLUX PROCESSES OVER THE NORTHERN HEMISPHERE, by Clayton E. Jensen. Scientific rept. no. 1 on Planetary Circulations Project, Contract AF 19(604)6108. Aug 60, 260p. 39 refs. AFCRC-TN-60-460.
Order from LC mi$11.10, ph$39.60 PB 149 971

The integrals in the mechanical energy equation representing energy transformation and vertical flux processes have been individually evaluated as a function of selected pressure layers and as a function of a broad division of eddies in the atmosphere over the Northern Hemisphere for January and April 1958. Values of the vertical divergence of energy and measures of the energy transformation process have been introduced into the energy balance equation leaving a residual which approximates the order of magnitude of the dissipative action within the particular region of the atmosphere being sampled. (Author)

Ohio State U. Research Foundation, Columbus.
INFRARED STUDIES OF THE ATMOSPHERE, by J. W. Birkeland, R. L. Bowman and others. Final rept. for 1 Sep 57-30 Mar 60 on Thermal Radiation Methods of Atmospheric Probing, Contract AF 19(604)2759. Apr 60, 97p. 4 refs. GRD TR-60-285.
Order from LC mi$5.40, ph$15.30 PB 150 163

The results of a two and one-half year program of investigating the atmosphere by infrared techniques are described. Measurements have been made of the abundance of atmospheric carbon monoxide, nitrous oxide, and methane. High-resolution spectra of NH_3 and ND_3 have been analyzed, and methods for the wavelength calibration of infrared spectrometers have been developed. Investigations of the pressure modulation of infrared absorption by gases have been conducted, and a search for the molecule NH_4OH in mixtures of NH_3 and H_2O has been undertaken using infrared techniques.
Included in the report are:
Pressure Modulation of Infrared Absorption. I. Entire Vibration-Rotation Bands, by James C. Gilfert and Dudley Williams. Pub. in the Jnl. of the Optical society of America 48:765-769, Nov 58.
The Abundance of Atmospheric Carbon Monoxide above Columbus, Ohio, by J. H. Shaw. Pub. in The Astrophysical Jnl. 128:428-440, Sep 58.
Abundance of Nitrous Oxide in Ground-Level Air, by J. W. Birkeland and J. H. Shaw. Pub. in the Jnl. of the Optical Society of America 49:637-638, June 59.

Rensselaer Polytechnic Inst., Troy, N. Y.
UTILIZATION OF ENERGY OF THE UPPER ATMOSPHERE, by P. Harteck, R. R. Reeves, Jr., and G. G. Mannella. Final technical rept. on Contract AF 19(604)2205. 8 Apr 60, 35p. 14 refs. AFCRC-TR-60-264.
Order from LC mi$3.00, ph$6.30 PB 149 863

A research program dealing with problems connected with the chemistry of the upper atmosphere has been carried on for three years. The program covered laboratory investigations on chemical reactions and atom chemistry; and the evaluation of the HARE, a vehicle designed to use the energy of recombination of O-atoms as a means of propulsion. In connection with this work, an experiment was carried out on the NRL-52 rocket at White Sands, New Mexico, to measure the O-atom concentration of the upper atmosphere.

ENGINEERING

Aeronautical Engineering

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
INVESTIGATION OF LARGE EXPANSION DIFFUSERS FOR MINIMUM ROTOR AREA, by Jean F. Duvivier and Robert B. McCallum. Rept. on Contract DA 44-177-tc-486. Nov 59, 102p. 56 refs. Technical rept. 81-1; AD-233 528.
Order from LC mi$5.70, ph$16.80 PB 147 831

Means of reducing the size of a ducted fan for a given thrust and exit area were investigated. Short diffusers with expansion ratios from 4 to 8.71, were studied in two-dimensional and three-dimensional flow downstream of an operating fan with several wall shapes; center vanes, boundary layer control by localized suction and air injection, and shaped center bodies were used to control the flow in the diffusers. Various pressure distributions and velocity profiles were measured

Airborne Instruments Lab., Mineola, N. Y.
EVALUATION OF OMNI-BEARING-DISTANCE SYSTEM OF AIR NAVIGATION, by W. R. Rambo, J. S. Pritchard and others. Summary rept. Oct 50, 42p. 7 refs. Rept. no. 540-1.
Order from LC mi$3.30, ph$7.80 PB 147 952

The Omni-Bearing-Distance (OBD) system of air navigation is based on range and bearing information furnished from a preselected single site by a UHF Distance-Measuring Equipment (DME) and a VHF Visual Omnidirectional Range (VOR). The addition of a Course-Line Computer enables flight between any two selected points within the service area of the ground equipments. The principal objective of the evaluation program was to determine the accuracy of the navigation information provided by an OBD facility within its coverage area.

American Machine and Foundry Co., Chicago, Ill.
MODEL TESTS AND STUDIES OF THE PROBLEMS OF DYNAMIC TENSIONS IN AIRCRAFT-ARRESTING GEAR CABLES, by Frank T. Sasaki, Norman F. Eslinger, and Glen L. Neidhardt. Rept. on Contract AF 33(616)5282. Oct 59, 190p. 10 refs. WADC Technical rept. 59-495; AD-237 294.
Order from OTS $3.00 PB 171 007

A one-tenth scale model aircraft arresting gear incorporating a cable tension alleviation device was tested. It is concluded that the analytical method employed is practical and can be used to determine cable behavior in an arresting gear with sufficient accuracy. The theoretical treatment of cable waves as kinks was observed as a realistic approximation from high-speed photography. The tests indicate that the absence of cable hysteresis causes greater travel of the alleviator sheaves. A servo-controlled tension-alleviating device for aircraft-arresting gear systems is shown to be feasible. Controlled movable sheaves are employed, the motion being restrained by a servo-controlled breaking force. The fundamental physical parameters of wire rope are discussed, and the use of titanium or alloys instead of steel is proposed.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
STATISTICAL QUALITY CONTROL IN THE IRAN PROGRAM, by W. G. Ireson. Technical rept. no. 43 on Contract N6onr-25126. 23 Oct 59, 14p. AD-228 271.
Order from LC mi$2.40, ph$3.30 PB 149 502

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF AN OZONE ANALYZER FOR USE IN AIRCRAFT, by Joseph F. Roesler and C. R. McCully. Rept. for 1 Apr 58-30 June 60 on Contract AF 19(604)3884, continuation of Contract AF 19(604)1814. June 60, 25p. ARF 3128-12; Final rept.; GRD-TR-60-282.
Order from LC mi$2.70, ph$4.80 PB 149 862

The objective of this program was to develop an instrument to detect 0-100 ppm of ozone for use in aircraft at altitudes up to 80,000 ft. The resulting analyzer detects 0.1 ppm of ozone with an accuracy of 10%. It has a sensitivity of 44 μv/ppm of ozone and a response time of 22-30 sec. Field tests of the ozone analyzer have not only showed that it is practicable, but they have led to additional improvements in sensitivity and stability. The instrument is sensitive to changes in humidity, but a dry ice trap has been successfully employed to remove moisture without removing ozone. Changes in ambient temperature and flow rate have no effect on drift-resistant system.

Armour Research Foundation, Chicago, Ill.
EVALUATION AND ALLOY DEVELOPMENT OF HOT-WORK DIE STEELS FOR STRUCTURAL PURPOSES, by Michael Schneider and John P. Sheehan. Rept. for 15 Apr 58-30 June 59 on Metallic Materials, Contract AF 33(616)5633. May 60, 94p. 32 refs. WADC Technical rept. 59-705.
Order from OTS $2.25 PB 171 008

A program to investigate the tensile properties of three commercial hot-work die steels, Vascojet 1000, Potomac M, and Peerless 56 has been carried out. The results indicate that in sheet form these materials are essentially equivalent and developed the following nominal peak properties when air cooled from 1850°F and double tempered at 1000°F: 295,000 psi ultimate tensile strength; 233,000 psi yield strength at 0.2% offset; and 7% elongation in 2 in. gage length. Approximately 30 experimental alloy steels were melted, in which most of the common alloying elements were investigated to determine their effects on tensile properties. Of these, several developed yield strengths of 280,000-290,000 psi, ultimate tensile strengths of 340,000-360,000 psi and tensile elongatons of 3-5% in 2 in. gage length on sheet material approximately 0.080 in. thick. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn].
SOME COMMENTS CONCERNING THE DEVELOPMENT TRENDS AND GROWTH CHARACTERISTICS OF TURBOJET ENGINES, by Robert E. Smith, Jr. Rept. on ARO, Contract AF 40(600)800. Mar 60, 33p 3 refs. AEDC TN-60-54.
Order from LC mi$3.60, ph$6.30 PB 149 975

Some of the development trends of the turbojet engine for aircraft application in the United States in terms of changes in overall engine performance and component performance are shown for the period 1943-1958. The changes in performance resulting from changes in basic design and from refinements (growth) of a given design are presented. Only performance of unsupercharged engines at military rated power at sea level static conditions is considered. Performance improvements in American-designed engines are compared with improvements in English-designed engines over the period from 1943 to 1951. (Author)

Avco Corp., Nashville, Tenn.
DESIGN, DEVELOPMENT AND FABRICATION OF A LIGHT WEIGHT AIRFRAME. Monthly progress rept. no. 2 for June 1960 on Contract DA 33-008-ORD-1968. 15 July 60, 88p. This report includes "Light Weight Airframe Stress Analysis", Rept. SR-000-010.
Order from LC mi$4.80, ph$13.80 PB 150 047

Specific problems solved are: (a) the re-design of the weight support structure at Station 43.00 to provide greater rigidity; (b) a thorough study of methods of providing a safety lock for the locking ring at the body break at Station 48.00; and (c) the selection of material and design of the sealing gasket at Station 48.00. (See also PB 149 302)

Avco Corp., Nashville, Tenn.
DESIGN, DEVELOPMENT AND FABRICATION OF A LIGHT WEIGHT AIRFRAME, by A. V. Forte. Monthly progress rept. no. 3, July 60, on Contract DA 33-008-ORD-1968. 15 Aug 60, 31p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 150 279

The structural arrangement was established based on an aluminum honeycomb construction which design studies had shown best satisfied the optimum requirements of weight, shell stability, aerodynamic smoothness, deflection and strength criteria. Materials were selected for the Airframe design which would meet the service requirement of safety withstanding a 400°F temperature exposure for 5 minutes. The test program which defined the proposed methods for substantiating the structural, environmental and mechanical requirements of the airframe was completed and submitted for approval. (See also PB 150 047).

Battelle Memorial Inst., Columbus, Ohio.
THE EVALUATION OF THE EFFECTS OF VERY LOW TEMPERATURES ON THE PROPERTIES OF AIRCRAFT AND MISSILE METALS, by Leonard P. Rice, James E. Campbell, and Ward F. Simmons. Rept. for 1 May 59-29 Feb 60 on Metallic Materials, Contract AF 33(616)6345. June 60, 61p. WADD TR-60-254.
Order from OTS $1.75 PB 171 016

In the past few years, the use of liquefied gases such as oxygen, nitrogen, hydrogen, and helium has increased enormously in the aircraft and missile industries. There is a great deal of interest in metallic materials to store, transport, or otherwise handle these extremely low-temperature liquids. This investigation presents the tensile and hardness properties of eight different alloys of interest to the aircraft and missile industries at temperatures ranging from -253 C (liquid hydrogen) to room temperature. These alloys are Ti-6Al-4V, Ti-5Al-2.5Sn-1V, Ti-16V-2.5Al, and B-120VCA (all beta alloy) titanium alloys, 17-7PH, PH15-7Mo, and Type 301XH stainless steels, and Vascojet 1000 alloy steel. In general, the values for hardness, elastic modulus, and tensile and yield strengths of these materials tended to increase as the test temperature was reduced to -253 C. However, of the eight alloys investigated, the Ti-6Al-4V and the Ti-4Al-3Mo-1V titanium alloys and the Type 301XH stainless steel were the only ones that did not reveal a serious loss of ductility or did not fracture before reaching 0.2 per cent offset strain at -253 C. (Author)

Bio-Mechanics Lab., Tufts U., Medford, Mass.
LIGHT-WEIGHT SEATING: DESIGN RESEARCH ON A NYLON NET SEAT. ONE OF A SERIES OF STUDIES PERTAINING TO CREW COMPARTMENT HABITABILITY FOR EXTENDED MISSIONS, by Jess Forrest, Edward A. Wade and others. Rept. on Biophysics of Space Flight, Contract AF 33(616)3068. Dec 58, 39p. 18 refs. WADC Technical rept. 58-309; AD-209 380.
Order from OTS $1.00 PB 151 702

This report describes a design research program for a light-weight aircraft seat made from nylon netting. An empirical approach was used to evaluate a series of exploratory designs and to modify solutions on the basis of subjective reports by individuals occupying the seats. A number of specific design problems were investigated with the results indicating that human factors requirements of a seat for long term occupancy can be met by a nylon net seat. (Author)

Chicago Midway Labs., U. of Chicago, Ill.
THERMAL PROTECTION OF STRUCTURAL, PROPULSION, AND TEMPERATURE-SENSITIVE MATERIALS FOR HYPERSONIC AND SPACE FLIGHT. PART I. RELATIVE PERFORMANCE OF ABLATING MATERIALS EXPOSED TO LOW AND HIGH HEAT FLUX ENVIRONMENTS, by John H. Bonin and Channon F. Price. Rept. for Aug-Oct 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)6006. May 60, 62p. WADC Technical rept. 59-366, Part I.
Order from OTS $1.75 PB 161 956

The experimental equipment used is briefly described, and test results for 19 different test specimens are presented. The data are used to compare the relative performance of the ablating materials with heat sink materials on a weight-per-unit area basis. (Author)

David Taylor Model Basin, Washington, D. C.
STATIC BEHAVIOR OF A RECTANGULAR PLAN FROM GEM MODEL UTILIZING AN INTEGRATED SYSTEM FOR LIFT AND PROPULSIVE THRUST, by Anibal Alfredo Tinajero. June 60, 29p. 4 refs. Aero rept. 948.
Order from LC mi$2.70, ph$4.80 PB 149 898

Augmentation, propulsive thrust ratios, and efficiency ratios were obtained for range of jet nozzle angles and tangential jet deflection angles. It was confirmed that theoretical equations predicting performance of GEM in hovering regime are valid for all jet discharge angles if proper efficiency values are chosen. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A MATHEMATICAL ANALYSIS OF SOME PHASES OF AIR TRAFFIC FLOW, by E. L. Fritz, R. S. Grubmeyer, and R. S. Miller. Rept. on Study of Air Traffic Flow Problems, Contract AF 33(616)3613. July 58, 61p. 5 refs. ARDC Technical rept. 58-57; AD-204 051.
Order from LC mi$3.90, ph$10.80 PB 150 585

This report released for sale to the public 11 Oct 60.

The mechanics of flow control in the enroute area using speed-reduction flow-control methodswere investigated and mathematically defined with suitable models. Since the samples frequently included large numbers of consecutive arrival intervals occupied by aircraft after smoothing, the probability of smoothed groups of aircraft of various sizes was investigated analytically for three values of system loading. The mechanics of flow control in the enroute area were investigated using a combination of speed-up and slow-down control to see what benefits were derived therefrom. Navigation errors were then introduced into the enroute area smoothing problem. The effect of error on the flow-control process was investigated as was a multiple check-point technique for limiting the effect of the error. Some new equipments and procedures required for an efficient speed-control system were discussed. Use of a 30-minute speed-control area at seven airports in the New York and Pittsburgh Air Route Traffic Control areas was examined. The percentage of delay absorbed by slow-down varied from 50% to 97%.

Guggenheim School of Aeronautics, Georgia Inst. of Tech., Atlanta.
AN INVESTIGATION OF AN APPROACH TO THE PROBLEM OF DETERMINING THE OPTIMUM DESIGN OF SHROUDED PROPELLERS. APPENDIX I. VORTEX SYSTEM. APPENDIX II. CALCULATION OF THRUST AND POWER. APPENDIX III. DETERMINATION OF THE OPTIMUM LOADING FOR A HEAVILY LOADED PROPELLER HAVING AN INFINITE NUMBER OF BLADES. APPENDIX IV. OUTLINE OF DESIGN PROCEDURES FOR SHROUDED PROPELLERS, by Robin B. Gray and Walter Castles, Jr. Rept. on Contract DA 44-177-TC-24. May 60, 92p. 7 refs. TREC 60-44.
Order from LC mi$5.40, ph$15.30 PB 150 116

Two methods of obtaining the necessary optimum combination of design parameters for a lightly loaded, single rotation shrouded propeller are described for the case in which the ultimate wake vortex system moves as a rigid body and is composed of helical vortex filaments of equal geometric pitch. One method employs the electrical potential tank techniques while the other uses a digital computer to numerically integrate the Biot-Savart relation. The optimum blade bound vortex distribution for a two-bladed and a four-blade propeller having an ultimate wake geometric pitch of 1.308 as determined by the potential tank method is presented for illustrative purposes. The results of the computer method were inconclusive due to wake end numerical inaccuracies. However, it is concluded that the digital computer approach is the most promising and the recommendation is expressed that any further work be in this area. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INSTRUMENTATION USED FOR IONOSPHERE ELECTRON DENSITY MEASUREMENTS, by William J. Cruickshank. May 60, 20p. 7 refs. Technical note no. 1317; AD-239 903.
Order from LC mi$2.40, ph$3.30 PB 150 093

The technique employed for the measurement of ionospheric electron densities through study of differential propagation effects on two-phase coherent frequencies broadcast from high altitudes is discussed. A brief description of the stable airborne transmitters and of the rocket vehicle designated "Strongarm" which was used in an initial experiment to carry the airborne transmitters to an altitude of 1,000 miles is presented. The very narrow band receivers and recording equipment needed to provide data reception and information separation are discussed. A summary is given of the results of the two "Strongarm" rockets that have been fired, and the schedule of future experiments is outlined. (Author)

Electromagnetic Research Corp., Washington, D. C.
DETERMINATION OF IONOSPHERE PARAMETERS BY MEANS OF A SATELLITE ANTENNA-TYPE PROBE, by W. W. Zachary, E. A. Wolff, and M. Katzin. Scientific rept. no. 1 on Contract AF 19(604)6656. 30 June 60, 57p. 11 refs. Rept. no. CRC-6656-1; GRD-TN-60-492.
Order from LC mi$3.60, ph$9.30 PB 149 844

A spherical antenna-type probe for determining the parameters of the ionosphere is described. This consists of a main slot around which are disposed pairs of small orthogonal slots. By applying a driving voltage to the main slot and measuring the input impedance as well as the voltages induced in the orthogonal slots, the ionization density, collision frequency, and vector earth's magnetic field may be determined. These are local values since the reaction of the medium on the probe is effectively limited to distances of the order of less than a wavelength. As a preliminary to the main analysis, the input admittance of a slotted plane antenna in a magneto-ionic medium is analyzed. The solution is obtained in a form suitable for numerical evaluation. Measurement systems for the determination of the quantities necessary to evaluate the parameters of the ionized medium are considered. Three systems are shown and their relative advantages and disadvantages are outlined. A suitable measurement system appears to be quite feasible of realization. (Author)

Institute of Geophysics, U. of California, Los Angeles.
THEORETICAL AND LABORATORY STUDIES IN CHEMICAL AERONOMY, by William J. Schade. Final rept. for 1 Mar 57-30 Apr 60 on Contract AF 19(604)2144. Apr 60, 14p. 8 refs. AFCRC-TR-60-241.
Order from LC mi$2.40, ph$3.30 PB 149 535

A new portable high-speed ultraviolet spectrograph is described. The specifications of the instrument are given. A laboratory source for the study of some aeronomic chemical reactions is considered. This source is seen to be useful for studying the recombination processes of atomic oxygen. (Author)

International Inst. of Meteorology, U. of Stockholm (Sweden).
INVESTIGATIONS ON THE DETAILED STRUCTURE OF THE ATMOSPHERE IN NORTHERN HEMISPHERE MID-SUMMER (15-20 JULY 1957, IGY-DATA) by Friedrich Defant. Technical (scientific) note no. 5 on Contract AF 61(514)963. 1 Sep 59, 126p. AFCRC-TN-59-664; AD-234 430.
Order from LC mi$6.30, ph$19.80 PB 147 873

Contents:
Synoptic situation (15-20 July 1957); worldwide check on the summer tropopause-level and on the level of maximum wind; position of polarfront jet and subtropical jet; the summer-polarfront
Presentation of mean vertical temperature distributions in each of the special selected atmospheric spaces (polar, midlatitude, tropical, and in the vicinity of the summer subtropical jet) and a comparison of these average distributions with that obtained for mid-winter periods.
Presentation of frequency distributions of temperature for various isobaric surfaces in each of the atmospheric space selected in order to demonstrate the conservative character of the average temperature in each space; proof for the existence of 3 principal air masses as opposed to system of 2 principal masses (polar - tropical)
Dependence of the summer temperature on latitude in various levels of the naturally subdivided atmospheric spaces
Presentation of mean meridional cross-sections of the actual and the potential temperature for northern hemisphere summer
Average values of the vertical gradient of potential temperature in each of the atmospheric spaces; presentation and discussion of a mean meridional cross-section of the static stability for northern hemisphere summer

Maryland U., College Park.
THE LATITUDE AND ALTITUDE DISTRIBUTION OF GEOMAGNETICALLY TRAPPED PROTONS, by S. F. Singer. Rept. on Contract AF 49(638)530. 17 June 60, 8p. 12 refs. AFOSR-[TN]-60-747.
Order from LC mi$1.80, ph$1.80 PB 149 883

Massachusetts Inst. of Tech., Cambridge.
ENERGY TRANSFORMATION AND VERTICAL FLUX PROCESSES OVER THE NORTHERN HEMISPHERE, by Clayton E. Jensen. Scientific rept. no. 1 on Planetary Circulations Project, Contract AF 19(604)6108. Aug 60, 260p. 39 refs. AFCRC-TN-60-460.
Order from LC mi$11.10, ph$39.60 PB 149 971

The integrals in the mechanical energy equation representing energy transformation and vertical flux processes have been individually evaluated as a function of selected pressure layers and as a function of a broad division of eddies in the atmosphere over the Northern Hemisphere for January and April 1958. Values of the vertical divergence of energy and measures of the energy transformation process have been introduced into the energy balance equation leaving a residual which approximates the order of magnitude of the dissipative action within the particular region of the atmosphere being sampled. (Author)

Ohio State U. Research Foundation, Columbus.
INFRARED STUDIES OF THE ATMOSPHERE, by J. W. Birkeland, R. L. Bowman and others. Final rept. for 1 Sep 57-30 Mar 60 on Thermal Radiation Methods of Atmospheric Probing. Contract AF 19(604)2759. Apr 60, 97p. 4 refs. GRD TR-60-285.
Order from LC mi$5.40, ph$15.30 PB 150 163

The results of a two and one-half year program of investigating the atmosphere by infrared techniques are described. Measurements have been made of the abundance of atmospheric carbon monoxide, nitrous oxide, and methane. High-resolution spectra of NH_3 and ND_3 have been analyzed, and methods for the wavelength calibration of infrared spectrometers have been developed. Investigations of the pressure modulation of infrared absorption by gases have been conducted, and a search for the molecule NH_4OH in mixtures of NH_3 and H_2O has been undertaken using infrared techniques. Included in the report are:
Pressure Modulation of Infrared Absorption. I. Entire Vibration-Rotation Bands, by James C. Gilfert and Dudley Williams. Pub. in the Jnl. of the Optical society of America 48:765-769, Nov 58.
The Abundance of Atmospheric Carbon Monoxide above Columbus, Ohio, by J. H. Shaw. Pub. in The Astrophysical Jnl. 128:428-440, Sep 58.
Abundance of Nitrous Oxide in Ground-Level Air, by J. W. Birkeland and J. H. Shaw. Pub. in the Jnl. of the Optical Society of America 49:637-638, June 59.

Rensselaer Polytechnic Inst., Troy, N. Y.
UTILIZATION OF ENERGY OF THE UPPER ATMOSPHERE, by P. Harteck, R. R. Reeves, Jr., and G. G. Mannella. Final technical rept. on Contract AF 19(604)2205. 8 Apr 60, 35p. 14 refs. AFCRC-TR-60-264.
Order from LC mi$3.00, ph$6.30 PB 149 863

A research program dealing with problems connected with the chemistry of the upper atmosphere has been carried on for three years. The program covered laboratory investigations on chemical reactions and atom chemistry; and the evaluation of the HARE, a vehicle designed to use the energy of recombination of O-atoms as a means of propulsion. In connection with this work, an experiment was carried out on the NRL-52 rocket at White Sands, New Mexico, to measure the O-atom concentration of the upper atmosphere.

ENGINEERING

Aeronautical Engineering

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
INVESTIGATION OF LARGE EXPANSION DIFFUSERS FOR MINIMUM ROTOR AREA, by Jean F. Duvivier and Robert B. McCallum. Rept. on Contract DA 44-177-tc-486. Nov 59, 102p. 56 refs. Technical rept. 81-1; AD-233 528.
Order from LC mi$5.70, ph$16.80 PB 147 831

Means of reducing the size of a ducted fan for a given thrust and exit area were investigated. Short diffusers with expansion ratios from 4 to 8.71, were studied in two-dimensional and three-dimensional flow downstream of an operating fan with several wall shapes; center vanes, boundary layer control by localized suction and air injection, and shaped center bodies were used to control the flow in the diffusers. Various pressure distributions and velocity profiles were measured

Airborne Instruments Lab., Mineola, N. Y.
EVALUATION OF OMNI-BEARING-DISTANCE SYSTEM OF AIR NAVIGATION, by W. R. Rambo, J. S. Pritchard and others. Summary rept. Oct 50, 42p. 7 refs. Rept. no. 540-1.
Order from LC mi$3.30, ph$7.80 PB 147 952

The Omni-Bearing-Distance (OBD) system of air navigation is based on range and bearing information furnished from a preselected single site by a UHF Distance-Measuring Equipment (DME) and a VHF Visual Omnidirectional Range (VOR). The addition of a Course-Line Computer enables flight between any two selected points within the service area of the ground equipments. The principal objective of the evaluation program was to determine the accuracy of the navigation information provided by an OBD facility within its coverage area.

American Machine and Foundry Co., Chicago, Ill.
MODEL TESTS AND STUDIES OF THE PROBLEMS OF DYNAMIC TENSIONS IN AIRCRAFT-ARRESTING GEAR CABLES, by Frank T. Sasaki, Norman F. Eslinger, and Glen L. Neidhardt. Rept. on Contract AF 33(616)5282. Oct 59, 190p. 10 refs. WADC Technical rept. 59-495; AD-237 294.
Order from OTS $3.00 PB 171 007

A one-tenth scale model aircraft arresting gear incorporating a cable tension alleviation device was tested. It is concluded that the analytical method employed is practical and can be used to determine cable behavior in an arresting gear with sufficient accuracy. The theoretical treatment of cable waves as kinks was observed as a realistic approximation from high-speed photography. The tests indicate that the absence of cable hysteresis causes greater travel of the alleviator sheaves. A servo-controlled tension-alleviating device for aircraft-arresting gear systems is shown to be feasible. Controlled movable sheaves are employed, the motion being restrained by a servo-controlled breaking force. The fundamental physical parameters of wire rope are discussed, and the use of titanium or alloys instead of steel is proposed.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
STATISTICAL QUALITY CONTROL IN THE IRAN PROGRAM, by W. G. Ireson. Technical rept. no. 43 on Contract N6onr-25126. 23 Oct 59, 14p. AD-228 271.
Order from LC mi$2.40, ph$3.30 PB 149 502

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF AN OZONE ANALYZER FOR USE IN AIRCRAFT, by Joseph F. Roesler and C. R. McCully. Rept. for 1 Apr 58-30 June 60 on Contract AF 19(604)3884, continuation of Contract AF 19(604)1814. June 60, 25p. ARF 3128-12; Final rept.; GRD-TR-60-282.
Order from LC mi$2.70, ph$4.80 PB 149 862

The objective of this program was to develop an instrument to detect 0-100 ppm of ozone for use in aircraft at altitudes up to 80,000 ft. The resulting analyzer detects 0.1 ppm of ozone with an accuracy of 10%. It has a sensitivity of 44 μv/ppm of ozone and a response time of 22-30 sec. Field tests of the ozone analyzer have not only showed that it is practicable, but they have led to additional improvements in sensitivity and stability. The instrument is sensitive to changes in humidity, but a dry ice trap has been successfully employed to remove moisture without removing ozone. Changes in ambient temperature and flow rate have no effect on drift-resistant system.

Armour Research Foundation, Chicago, Ill.
EVALUATION AND ALLOY DEVELOPMENT OF HOT-WORK DIE STEELS FOR STRUCTURAL PURPOSES, by Michael Schneider and John P. Sheehan. Rept. for 15 Apr 58-30 June 59 on Metallic Materials, Contract AF 33(616)5633. May 60, 94p. 32 refs. WADC Technical rept. 59-705.
Order from OTS $2.25 PB 171 008

A program to investigate the tensile properties of three commercial hot-work die steels, Vascojet 1000, Potomac M, and Peerless 56 has been carried out. The results indicate that in sheet form these materials are essentially equivalent and developed the following nominal peak properties when air cooled from 1850°F and double tempered at 1000°F: 295,000 psi ultimate tensile strength; 233,000 psi yield strength at 0.2% offset; and 7% elongation in 2 in. gage length. Approximately 30 experimental alloy steels were melted, in which most of the common alloying elements were investigated to determine their effects on tensile properties. Of these, several developed yield strengths of 280,000-290,000 psi, ultimate tensile strengths of 340,000-360,000 psi and tensile elongatons of 3-5% in 2 in. gage length on sheet material approximately 0.080 in. thick. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn].
SOME COMMENTS CONCERNING THE DEVELOPMENT TRENDS AND GROWTH CHARACTERISTICS OF TURBOJET ENGINES, by Robert E. Smith, Jr. Rept. on ARO, Contract AF 40(600)800. Mar 60, 33p. 3 refs. AEDC TN-60-54.
Order from LC mi$3.00, ph$6.30 PB 149 975

Some of the development trends of the turbojet engine for aircraft application in the United States in terms of changes in overall engine performance and component performance are shown for the period 1943-1958. The changes in performance resulting from changes in basic design and from refinements (growth) of a given design are presented. Only performance of unaugmented engines at military rated power at sea-level static conditions is considered. Performance improvements in American-designed engines are compared with improvements in English-designed engines over the period from 1943 to 1951. (Author)

Avco Corp., Nashville, Tenn.
DESIGN, DEVELOPMENT AND FABRICATION OF A LIGHT WEIGHT AIRFRAME. Monthly progress rept. no. 2 for June 1960 on Contract DA 33-008-ORD-1968. 15 July 60, 88p. This report includes "Light Weight Airframe Stress Analysis", Rept. SR-000-010.
Order from LC mi$4.80, ph$13.80 PB 150 047

Specific problems solved are: (a) the re-design of the weight support structure at Station 43.00 to provide greater rigidity; (b) a thorough study of methods of providing a safety lock for the locking ring at the body break at Station 48.00; and (c) the selection of material and design of the sealing gasket at Station 48.00. (See also PB 149 302)

Avco Corp., Nashville, Tenn.
DESIGN, DEVELOPMENT AND FABRICATION OF A LIGHT WEIGHT AIRFRAME, by A. V. Forte. Monthly progress rept. no. 3, July 60, on Contract DA 33-008-ORD-1968. 15 Aug 60, 31p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 150 279

The structural arrangement was established based on an aluminum honeycomb construction which design studies had shown best satisfied the optimum requirements of weight, shell stability, aerodynamic smoothness, deflection and strength criteria. Materials were selected for the Airframe design which would meet the service requirement of safety withstanding a 400°F temperature exposure for 5 minutes. The test program which defined the proposed methods for substantiating the structural, environmental and mechanical requirements of the airframe was completed and submitted for approval. (See also PB 150 047).

Battelle Memorial Inst., Columbus, Ohio.
THE EVALUATION OF THE EFFECTS OF VERY LOW TEMPERATURES ON THE PROPERTIES OF AIRCRAFT AND MISSILE METALS, by Leonard P. Rice, James E. Campbell, and Ward F. Simmons. Rept. for 1 May 59-29 Feb 60 on Metallic Materials, Contract AF 33(616)6345. June 60, 61p. WADD TR-60-254.
Order from OTS $1.75 PB 171 016

In the past few years, the use of liquefied gases such as oxygen, nitrogen, hydrogen, and helium has increased enormously in the aircraft and missile industries. There is a great deal of interest in metallic materials to store, transport, or otherwise handle these extremely low-temperature liquids. This investigation presents the tensile and hardness properties of eight different alloys of interest to the aircraft and missile industries at temperatures ranging from -253 C (liquid hydrogen) to room temperature. These alloys are Ti-6Al-4V, Ti-5Al-3Mo-1V, Ti-16V-2.5Al, and B-120VCA (all-beta alloy) titanium alloys; 17-7PH, PH15-7Mo, and Type 301XH stainless steels; and Vascojet 1000 alloy steel. In general, the values for hardness, elastic modulus, and tensile and yield strengths of these materials tended to increase as the test temperature was reduced to -253 C. However, of the eight alloys investigated, the

Ti-6Al-4V and the Ti-4Al-3Mo-1V titanium alloys and the Type 301XH stainless steel were the only ones that did not reveal a serious loss of ductility or did not fracture before reaching 0.2 per cent offset strain at -253 C. (Author)

Bio-Mechanics Lab., Tufts U., Medford, Mass.
LIGHT-WEIGHT SEATING: DESIGN RESEARCH ON A NYLON NET SEAT. ONE OF A SERIES OF STUDIES PERTAINING TO CREW COMPARTMENT HABITABILITY FOR EXTENDED MISSIONS, by Jess Forrest, Edward A. Wade and others. Rept. on Biophysics of Space Flight, Contract AF 33(616)3068. Dec 58, 39p. 18 refs. WADC Technical rept. 58-309; AD-209 380.
Order from OTS $1.00 PB 151 702

This report describes a design research program for a light-weight aircraft seat made from nylon netting. An empirical approach was used to evaluate a series of exploratory designs and to modify solutions on the basis of subjective reports by individuals occupying the seats. A number of specific design problems were investigated with the results indicating that human factors requirements of a seat for long term occupancy can be met by a nylon net seat. (Author)

Chicago Midway Labs., U. of Chicago, Ill.
THERMAL PROTECTION OF STRUCTURAL, PROPULSION, AND TEMPERATURE-SENSITIVE MATERIALS FOR HYPERSONIC AND SPACE FLIGHT. PART I. RELATIVE PERFORMANCE OF ABLATING MATERIALS EXPOSED TO LOW AND HIGH HEAT FLUX ENVIRONMENTS, by John H. Bonin and Channon F. Price. Rept. for Aug-Oct 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)6006. May 60, 62p. WADC Technical rept. 59-366, Part I.
Order from OTS $1.75 PB 161 956

The experimental equipment used is briefly described, and test results for 19 different test specimens are presented. The data are used to compare the relative performance of the ablating materials with heat sink materials on a weight-per-unit area basis. (Author)

David Taylor Model Basin, Washington, D. C.
STATIC BEHAVIOR OF A RECTANGULAR PLAN FROM GEM MODEL UTILIZING AN INTEGRATED SYSTEM FOR LIFT AND PROPULSIVE THRUST, by Anibal Alfredo Tinajero. June 60, 29p. 4 refs. Aero rept. 948.
Order from LC mi$2.70, ph$4.80 PB 149 898

Augmentation, propulsive thrust ratios, and efficiency ratios were obtained for range of jet nozzle angles and tangential jet deflection angles. It was confirmed that theoretical equations predicting performance of GEM in hovering regime are valid for all jet-discharge angles, if proper efficiency values are chosen. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A MATHEMATICAL ANALYSIS OF SOME PHASES OF AIR TRAFFIC FLOW, by E. L. Fritz, R. S. Grubmeyer, and R. S. Miller. Rept. on Study of Air Traffic Flow Problems, Contract AF 33(616)3613. July 58, 61p. 5 refs. ARDC Technical rept. 58-57; AD-204 051.
Order from LC mi$3.90, ph$10.80 PB 150 585

This report released for sale to the public 11 Oct 60.

The mechanics of flow control in the enroute area using speed-reduction flow-control methodswere investigated and mathematically defined with suitable models. Since the samples frequently included large numbers of consecutive arrival intervals occupied by aircraft after smoothing, the probability of smoothed groups of aircraft of various sizes was investigated analytically for three values of system loading. The mechanics of flow control in the enroute area were investigated using a combination of speed-up and slow-down control to see what benefits were derived therefrom. Navigation errors were then introduced into the enroute area smoothing problem. The effect of error on the flow-control process was investigated as was a multiple check-point technique for limiting the effect of the error. Some new equipments and procedures required for an efficient speed-control system were discussed. Use of a 30-minute speed-control area at seven airports in the New York and Pittsburgh Air Route Traffic Control areas was examined. The percentage of delay absorbed by slow-down varied from 50% to 97%.

Guggenheim School of Aeronautics, Georgia Inst. of Tech., Atlanta.
AN INVESTIGATION OF AN APPROACH TO THE PROBLEM OF DETERMINING THE OPTIMUM DESIGN OF SHROUDED PROPELLERS. APPENDIX I. VORTEX SYSTEM. APPENDIX II. CALCULATION OF THRUST AND POWER. APPENDIX III. DETERMINATION OF THE OPTIMUM LOADING FOR A HEAVILY LOADED PROPELLER HAVING AN INFINITE NUMBER OF BLADES. APPENDIX IV. OUTLINE OF DESIGN PROCEDURES FOR SHROUDED PROPELLERS, by Robin B. Gray and Walter Castles, Jr. Rept. on Contract DA 44-177-TC-24. May 60, 92p. 7 refs. TREC 60-44.
Order from LC mi$5.40, ph$15.30 PB 150 116

Two methods of obtaining the necessary optimum combination of design parameters for a lightly loaded, single rotation shrouded propeller are described for the case in which the ultimate wake vortex system moves as a rigid body and is composed of helical vortex filaments of equal geometric pitch. One method employs the electrical potential tank techniques while the other uses a digital computer to numerically integrate the Biot-Savart relation. The optimum blade bound vortex distribution for a two-bladed and a four-blade propeller having an ultimate wake geometric pitch of 1.356 as determined by the potential tank method is presented for illustrative purposes. The results of the computer method were inconclusive due to time and financial limitations. However, it is concluded that the digital computer approach is the more promising and the recommendation is suggested that any further work be in this area. (Author)

Hiller Aircraft Corp. [Palo Alto, Calif.]
ANNULAR NOZZLE EJECTOR, SUMMARY REPORT, PHASE I PROGRAM, by C. H. Spiegelberg. Rept. on Contract Nonr-2840(00). Nov 59, 57p. 8 refs. Rept. no. ARD-243.
Order from LC mi$3.60, ph$9.30 PB 150 209

The purpose of the complete program is to show the effect of scale and the elevated temperature of the primary flow on ejector performance through the design, construction and testing of a full scale annular nozzle ejector using a jet engine as the source of the hot primary gas. Phase I of the program included small scale model tests for determining the geometry of the full size hardware and also includes detail design of the full scale ejector and test hardware.

Just, W.
LATERAL-DIRECTIONAL STABILITY AND CONTROL OF HELICOPTERS. EFFECT OF DESIGN PARAMETERS, by W. Just, H. Georgi, and U. Schwellinger. Final Technical rept. no. 1, 1 Oct 58-30 Oct 59, on Contract DA 91-591-EUC-959. [1959] 236p. 1 ref.
Order from LC mi$10.20, ph$36.30 PB 149 908

The present theoretical study deals with control and stability investigations of helicopters, especially with lateral-directional stability. Theories of various degrees of accuracy have been presented and compared against each other. In order to ascertain the effect of the design parameters upon the stability qualities, numerous examples have been computed. Diagrams have been plotted against the design parameters for the time to damp to 1/2 amplitude, for the time to double the amplitude or, for the period of oscillation, as well as for the stability measurement t_w/T resp. t_b/T. Furthermore, the courses of motion as functions of time have been computed for excitations in form of square pulse, step pulse, and sinusoidal pulse. (Author)

Michigan U. [Research Inst.] Ann Arbor.
MODERN ICING TECHNOLOGY - LECTURE NOTES, by Myron Tribus. Rept. on Contract AF 18(600)51. Jan 52, 155p. 98 refs. ATI-139 596.
Order from LC mi$7.50, ph$24.30 PB 152 052

This report released for sale to the public 14 Oct 60.

Contents:
An introduction to the icing problem
Trajectories of water drops around streamlined bodies
Removing the ice
The energy transfers at an icing surface
Analysis of the separate modes of energy transfer
The complete energy balance and some applications
The design of a continuously anti-iced air-heated wing
Intermittent heating
Meteorological conditions for design

National Aviation Facilities Experimental Center, Atlantic City, N. J.
AIRCRAFT INSTALLATION AND OPERATION OF AN EXTINGUISHING-AGENT CONCENTRATION RECORDER, by James E. Demaree and Paul R. Dierdorf. 25 Sep 59, 35p. 1 ref. Technical Development rept. no. 403.
Order from OTS $1.00 PB 161 991

This report covers the utilization of a gas-analyzing instrument for evaluating aircraft fire-extinguishing systems. This instrument records the extinguishing-agent air concentrations resulting when the extinguishing system is discharged, and thereby provides a means of evaluating the aircraft extinguishing system under actual flight conditions. This report is intended to serve as an instruction manual for installation and operation of the instrument. Calibration data based on available information to aid in the reduction and interpretation of the test data obtained also are included The instrument and the principles of operation are described briefly. (Author)

National Aviation Facilities Experimental Center, Atlantic City, N. J.
INSTALLATION AND TESTING OF VISUAL GLIDE PATH INDICATORS, by Richard S. Griffith. Final rept. June 60, 87p. 12 refs.
Order from OTS $2.25 PB 161 992

Flight tests were conducted to comparatively evaluate five different types of visual glide path indicators. The systems installed at the National Aviation Facilities Experimental Center (NAFEC) were: Westinghouse Tri-Color, Navy Mirror, USAF Interim Mirror, Australian Cumming-Lane, and British RAE. All of the systems were set up on Runway 13, and as nearly as possible, each system was adjusted to the same vertical angle as the ILS glide path. A wide cross section of pilots from all segments of aviation participated. A cross section of aircraft was employed, from a Piper Tri-Pacer to the Boeing 707. Initial testing was directed toward selecting the more promising systems followed by concentrated testing and comparative evaluation of the selected systems. Accordingly, the last six weeks of the program were devoted to comparative evaluation of the Australian Cumming-Lane and the British RAE system. Subjective data indicate that more pilots prefer the RAE system than prefer the Cumming-Lane. All pilots but one indicated that a requirement exists, under certain conditions, for visual glide path assistance. Theodolite recordings show that no significant differences exist in the maximum range at which the lights can be seen (with respect to the systems named above), or in the maximum range at which guidance is available. The RAE system, however, provides guidance to a lower altitude than does the Cumming-Lane system. (Author)

National Research Labs., Ottawa (Canada).
RADIAL GRIDS WITH WATER INJECTION FOR SUPPRESSING THE NOISE OF JET ENGINES, by H. U. Wisniowski. 21 Mar 60, 31p. 13 refs. Aeronautical rept. LR-281.
Order from LC mi$3.00, ph$6.30 PB 149 744

Noise-suppression experiments were made with water sprays introduced into the stream of exhaust gases from a jet engine by means of radial grids with tubular perforated arms. This method proved to be very satisfactory for the test cell installation with an appreciable length of exhaust duct. An over-all noise-level reduction of 31.5 db. was obtained at a water flow rate of 259 Imp. gal./min. for a jet engine of 100 lb./sec. mass flow. In the field installation, the

method was found less attractive because of the necessity of using a rather long exhaust duct to obtain higher noise attenuation. It was shown that a cylindrical shroud mounted on the grid suppresses the noise (called "hoot") produced when the grid is mounted too far from the engine final nozzle. (Author)

Office of Defense Research and [Engineering] Washington, D. C.
CHARACTERISTICS OF MAJOR UNITED STATES TRANSONIC AND SUPERSONIC WIND TUNNELS AND AIR-BREATHING ENGINE TEST FACILITIES.
3 Oct 56, 34p. Coordinating Committee on Aeronautical Facilities rept. CAF-201/2; AD-115 871.
Order from LC mi$3.00, ph$6.30 PB 149 072

This survey contains data on major United States wind tunnels and engine test facilities owned by the Department of Defense, the National Advisory Committee for Aeronautics (NACA), universities and industrial organizations. Facilities in operation, under construction and currently authorized are included.

[Pacific] Missle [Range] Port Mugu, Calif.
NOISE AND VIBRATION TEST OF THE KD2G-1 (FIREFLY) TARGET P/A, by Everett O. Throndsen. 22 June 49, declassified 12 June 56, 53p. Proj. TED MTC PA-203; Technical rept. no. 50.
Order from LC mi$3.60, ph$9.30 PB 148 628

A series of vibration tests of the KD2G-1 (FIREFLY) target pilotless aircraft was conducted to: (a) measure the frequencies and amplitudes of vibration present at various points of the airframe as a result of operation of the pulsejet engine, (b) measure the over-all level and frequency content of the acoustic noise within the fuselage when the engine is operating, (c) make a functional check of KD2G-1 equipment during periods of engine operation.

[Pacific] Missile [Range] Port Mugu, Calif.
STABILITY AND CONTROL ANALYSIS OF THE RPS-2 AUTOPILOT/KD2R-2 AIRFRAME COMBINATION, by L. E. Day. Rept. on Proj. TED MTC EL-310. 15 Jan 50, declassified 12 June 56, 109p. 12 refs. Technical rept. no. 65.
Order from LC mi$5.70, ph$16.80 PB 148 634

An analysis has been made of the stability and control characteristics of the RPS-2 autopilot and KD2R-2 target P/A combination. This analysis was based on the frequency-response characteristics of the autopilot that were obtained by laboratory tests and on the calculated aerodynamic frequency-response characteristics of the airframe. The characteristics of both the autopilot and the airframe were combined in accordance with standard servomechanism theory. Stability was determined by the Nyquist criterion.

[Pacific] Missile [Range] Port Mugu, Calif.
TESTS OF THE KD2C-1 POWER PLANT, by Ray Fremlin. 24 Mar 50, declassified 12 June 56, 69p. Technical rept. no. 69.
Order from LC mi$3.90, ph$10.80 PB 148 635

Captive flight tests were made with the KD2C-1 (SKEET) target P/A that incorporated an internally mounted 14-inch pulsejet engine. These tests were made to evaluate performance of the power plant and to compare the performance with that of an identical, bare engine mounted externally in the free air stream.

Princeton U., N. J.
EFFECT OF C. G. POSITION, DUCT AREA RATIO AND DUCT ANGLE RATIO ON THE PERFORMANCE OF AN AERIAL JEEP, VTOL TYPE AIRCRAFT, by Joseph J. Traybar. Rept. on Contract DA 44-177-TC-524. Jan 60, 47p. 6 refs. Dept. of Aeronautical Engineering rept. no. 494.
Order from LC mi$3.30, ph$7.80 PB 150 186

Theoretical investigations are made on the performance of aerial jeep-type aircraft as influenced by various configuration changes. The primary objective of this report is the study of the relative effects on the power caused by selected design variations rather than the determination of the total power required for a specific vehicle. Attention is given to a configuration which utilizes ducted rotors in a triangular arrangement. It is assumed that the ducted rotors can be rotated with respect to the fuselage and that control is obtained by differential variations in thrust. The forward flight equilibrium equations are derived using simple momentum theory where duct angle of attack, exit slipstream velocity and forward speed are the variables. The specific quantities changed in order to determine their relative effects on the power are duct area ratio, duct angle of attack ratio and longitudinal center of gravity location. (Author)

Republic Aviation Corp., Farmingdale, N. Y.
THEORETICAL INVESTIGATION OF DUCTED PROPELLER AERODYNAMICS. VOLUME I. THEORETICAL DEVELOPMENTS, by Th. Theodorsen. Rept. on Contract DA 44-177-TC-606. 10 Aug 60, 87p.
Order from LC mi$4.80, ph$13.80 PB 149 934

This report covers certain theoretical developments, including some new ones of fundamental aspects. The theory of the line sink in a two-dimensional wing represents a classical solution in the airfoil theory. Closed expressions are given for the hitherto unknown pitching moment. There is a short appendix giving certain specific design and performance problems.

Republic Aviation Corp., Farmingdale, N. Y.
THEORETICAL INVESTIGATION OF DUCTED PROPELLER AERODYNAMICS. VOLUME II. REVIEW AND ANALYSIS OF EXPERIMENTAL INVESTIGATIONS ON DUCTED FANS, by Th. Theodorsen. Rept. on Contract DA 44-177-TC-606. 10 Aug 60, 250p. 84 refs.
Order from LC mi$11.10, ph$37.80 PB 149 935

A comprehensive survey of published experimental work on ducted fan configurations is made, which gives an outline of some analytic relations used to document and analyze experimental result. It then selects a number of experimental papers which make significant and consistent contributions and analyzes

their results in detail. Major subsections deal with the performance in the static or hovering case of the configuration, with performance fields for the case where the fan is moving in axial direction and with the analysis of the performance in non-axial flow which is the flow encountered by a configuration making a transition from hovering to forward flight. Specific observations derived from the analysis, concerning the distribution of rolling and pitching moments for a shrouded and unshrouded propeller, evidence and recognition of flow separation on the shroud, etc., follow. Special arrangements of fans in wing, multiple fan arrangements, and ground proximity effects are reviewed. The concluding part briefly reviews the general considerations that go into the design of ducted fan systems. (See also PB 149 934)

Chemical Engineering

Electric Boat Div., General Dynamics Corp., Groton, Conn.
WATER RECOVERY SYSTEMS (MULTI-VARIABLE) by Harold Wallman and Stanley M. Barnett. Rept. on Equipment for Life Support in Aerospace, Contract AF 33(616)6425. Mar 60, 76p. 50 refs. WADD Technical rept. 60-243.
Order from OTS $2.00 PB 171 022

A study has been conducted to determine the optimum design of several urine-to-potable-water recovery systems for use on space flights having different flight durations and crew sizes. Phase change processes, solvent extraction, ion exchange, membrane processes and integrated systems are covered. On the basis of the evidence presented, it has been recommended that: (1) a simple distillation unit be used for flights of six or more with up to two men, (2) a vapor compression system be used for long flights (four days or more) having large crews (three to twenty men), and (3) sufficient water be stored aboard the vehicle for flights of short duration. Recommendations are also made for a laboratory study of other promising methods of water recovery. It has been concluded that a healthy man can ingest water reclaimed from urine without incurring any harmful effects. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDIES AND INVESTIGATIONS OF AGGLOMERATION AND DEAGGLOMERATION OF SOLID PARTICLES, by Clyde Orr, Jr., J. M. Dallavalle and others. Final rept. 15 June 57. 76p. 5 refs. AD-150 490.
Order from LC mi$4.50, ph$12.30 PB 150 131

The deagglomeration of powder masses and the tensile strength of powders were investigated. Deagglomeration was studied by blowing powders with a series of gas pressures through capillary tubes of various diameters and lengths. Particle size distributions were determined after passage through the tubes, and the velocity of powder movement was determined by high-speed photography. Deagglomeration was also carried out by blasting powders through an annular port at various pressures. The tensile strengths were measured by forming a bed of powder on a device one part of which moved on precision ball bearings. Essentially complete deagglomeration was attained for all powders For the finest powders, this required a gas pressure of 400 psi, a tube diameter no greater than 0.02 in., and a tube length of up to 3 inches. The tensile strengths of bulk, dry, biological powders were in the range of 2×10^{-3} to 9×10^{-3} psi, or less than the strength of the material of which the powder was composed. The tensile strengths of bulk uncompacted FT-3 and FP were 8.6×10^{-3} and 6.0×10^{-3} psi. respectively. No definite correlation existed between the bulk tensile strength of powders and its ease of dispersibility. The force of adhesion of spheres to solid surfaces was proportional to the particle diameter. Washing generally increased the dispersibility of bacterial powders. Grinding had less influence on dispersion. (See also PB 140 304).

Office of Saline Water, Washington, D. C.
ONE MILLION GALLON PER DAY LONG TUBE VERTICAL EVAPORATOR MULTIPLE EFFECT DISTILLATION PLANT AT FREEPORT, TEXAS. Rept. on Contract OSW 14-01-001-195. 24 May 60, 347p. Specification no. 195.
Order from LC mi$11.10, ph$53.10 PB 148 924

Specifications, special requirements, technical requirements, detailed specifications.

Pennsylvania State [U., University Park].
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 4 for 1 Apr-1 July 52. 1 July 52, 63p. 21 refs.
Order from LC mi$3.90, ph$10.80 PB 150 128

The dimensional analysis for the swirl chamber atomizer is presented. It was found that an analysis based on initial conditions at the orifice versus an analysis based on the design parameters was possible. This lead to the formulation of the mode of atomization, mean droplet diameter ratio, and orifice diameter ratio, as functions of the Reynolds Number, Z number, T number peculiar to the swirl chamber atomizer and angles of spray. A recapitulation of a Study of Aerosols in general is discussed. Conditions for aerosols formation before, during and after atomization are explained. The process of film formation is discussed. In order to lessen the burden of a mathematical analysis it was suggested that the elimination of the rotational component in the film formation be achieved by having laminar liquid flow impinge on a flat circular disk. The subsequent disintegration phenomena for four cases (spurious, drop, ligament and film formation) is presented.

Pennsylvania State [U., University Park].
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 5 for 1 July-1 Oct 52. 1 Oct 52, 49p. 31 refs.
Order from LC mi$3.30, ph$7.80 PB 150 129

Chapter I is essentially a thorough critique of a recent Russian treatise on capillary waves. Some errors in it have been pointed out, and the treatment therein has been extended. Further expansion of the theory of stability of two liquid surfaces is indicated. Chapter II presents some contributions to the theory of sedimentation and decay of aerosols, based essentially on an existing detailed treatment by Dr. Charles A. Boyd. The problems of correction of mass-percent recovery and of the particle-size distribution are dealt with in some detail. (See also PB 150 128)

Pennsylvania State [U., University Park] Pa.
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 6 for 1 Oct-31 Dec 52. 1 Jan 53, 80p. 67 refs.
Order from LC mi$4.50, ph$12.30 PB 149 986

Chapter I is the description of the Spray Chamber with its auxiliary equipment, namely the Hydraulic System, the Shutter-Mechanism, the Vacuum System for Sampling, and the Exhaust System. Chapter II is a critical analysis, from a statistical point of view, of the several droplet-size distribution formulas which have been proposed in the past. It is proposed that the population distribution of droplet sizes be described by use of the confidence-interval technique. Chapter III contains about 60 new titles dealing with literature in the field of sprays, together with their brief abstracts. These will be incorporated in the new edition of the "Bibliography on Sprays" which is under preparation at present. Chapter IV contains the photographs and drawings pertaining to the Closed Spray Chamber and its Auxiliary Equipment. (Author)

Pennsylvania State [U., University Park]
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 7 for 1 Jan-31 Mar 53. 1 Apr 53, 76p. 6 refs.
Order from LC mi$4.50, ph$12.30 PB 150 130

Chapter 1 is a derivation of the most general form of the Orr-Sommerfeld equation for laminar boundary layers. In Chapter 2 the theory of conformal mapping with free streamlines is applied to jet theory. Chapter 3 presents an attempted extension of the theory of Borodin and Dityakin 1951 for the instability of the interface of two viscous fluids to the case of a sheet. Work on size distribution by the settling method is covered in Chapter 4. Chapter 5 presents a brief introduction to the subject of spinning disc atomization. Chapter 6 is a summary of the work done on nozzle and shutter-calibration in an attempt to get reproducible amounts of fluids sprayed into a closed tank. (See also PB 150 129)

Civil Engineering

Army Engineer Research and Development Labs., Fort Belvoir, Va.
RESPONSE OF AN ELASTO-PLASTIC SINGLE DEGREE OF FREEDOM SYSTEM TO AN EXPONENTIALLY DECAYING BLAST WAVE, by James W. Maloney. 23 June 59, 64p. Technical rept. 1581-TR; AD-228 734.
Order from LC mi$3.90, ph$10.80 PB 150 200

The complete spectrum of results of an elasto-plastic single degree of freedom system subjected to the classical exponentially decaying blast wave is presented in dimensionless form. The equivalent triangular pulses to give the same maximum displacement and time of maximum response and the response of the rigid plastic system are presented as appendices. (Author)

Bureau of Supplies and Accounts, Navy Dept., Washington, D. C.
DESIGN AND OPERATION OF DEHUMIDIFIED NAVAL WAREHOUSES. July 54, 64p. NAVSANDA PUB. 230.
Order from LC mi$3.90, ep$12.30 PB 149 615

This report released for sale to the public 23 Sep 60.

Part A covers the operation of the dehumidification equipment, care and maintenance of instruments, and the maintenance of the warehouse as a container for materials. Part B covers the storage of materials in dehumidified warehouses, preparation of the material for storage, and the coordination of material handling operations with open door time to reduce the admission of humid air.

Engineer Corps, Washington, D. C.
SOIL AS A FACTOR IN SHOALING PROCESSES, A LITERATURE REVIEW. June 60, 51p. 81 refs. Technical Bulletin no. 4.
Order from LC mi$3.60, ph$9.30 PB 149 742

This literature survey was made to assess, on the basis of available information, the probable influence of soil properties on the transport, deposition, and stability of shoal materials in estuaries. Descriptions are presented of the physical and engineering characteristics of soil, particularly the clay minerals, kaolinite, montmorillonite, and illite, which are carried in suspension and may be deposited in shoal areas. The various factors influencing the process of sedimentation are discussed; these include hydraulic factors, sediment type and concentration, salinity, temperature, pH, organic matter, industrial wastes, etc. Finally, available information is presented on the mode of deposition and physical characteristics of the sediment deposits. The results of the literature survey show that the principal source of shoal materials is suspended, fine-grained soil material carried into an estuary by fresh-water streams. The suspended sediment tends to flocculate in the presence of salt water, forming aggregates which settle to the bottom and form shoals. The rate of settling is influenced primarily by the salinity of the water; temperature and turbulence of the water, and nature and concentration of the soil particles are of lesser importance.

Electrical and Electronic Engineering

Admiral Corp., Chicago, Ill.
EVALUATION AND DEVELOPMENT OF MIL-C-14157 CAPACITORS FOR NUCLEAR RADIATION ENVIRONMENT, by E. R. Pfaff. Scientific rept. no. 4 on Contract NObsr-77612. Aug 60, 129p. 1 ref.
Order from LC mi$6.30, ph$19.80 PB 149 902

In the second environmental test all of the irradiated samples failed in 312 hours. Twenty-one of the fifty control units remained on test at 320 hours. Units with C_{16-18} Alkyl biphenyl dielectric fluid failed very rapidly. The failure rate for Bis(phenoxyphenyl) either unit was similar to the standard unit and slightly lower for the Monoisopropylbiphenyl unit. With the special units the gas formation is no longer a problem. The addition of inhibitor may improve the gamma failure rate of these units significantly and the use of the larger group will improve the statistical significance of the results. (Author) (See also PB 148 237)

Aerial Reconnaissance Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
THE MATHEMATICS OF FRESNEL REGION FIELD DISTRIBUTIONS FOR PLANE RECTANGULAR APERTURE ANTENNAS, by Arthur L. Haywood. Master's thesis. Rept. for Nov 58-Jan 59. [1959] 13p. 16 refs. WADC TR-59-462; AD-230 705.
Order from LC mi$2.40, ph$3.30 PB 150 591

This report released for sale to the public 11 Oct 60.

The problem of determining the near-field gain of a plane rectangular aperture antenna is treated quantitatively. The Fresnel integrals are used as the chief mathematical tool in evaluating the double integrals for electrical intensities in the far-zone (Fraunhofer region) and the near-zone (Fresnel region). The study ends with the quantitative determination of operationally significant quantities in important practical systems. The systematic formulation of this antenna theory and its application are directed to the mathematician whose primary interest is rigor, and the practical engineer who desires only a final working formula or a set of charts. The mathematical representations are in forms that provide an insight into the physical aspects of the problem and reasonable quantitative accuracy in their numerical evaluation. (Author)

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
EVALUATION OF MIDGET-TYPE, 28-VOLT, DIRECT-CURRENT RELAYS. Final rept. Rept. on TED Project no. ADC-EL-52059. 4 Aug 54, 11p. 6 refs. Rept. no. NADC-EL-L5457 (Revision A), supersedes same of 25 May 54; AD-44 470.
Order from LC mi$2.40, ph$3.30 PB 152 020

This report released for sale to the public 11 Oct 60.

Ten commercially available midget-type, 28-v, dc, 2-pole and 4-pole double-throw relays were evaluated for conformance with the drawing requirements and applicable requirements for Spec. no. MIL-R-6106 (ASG). Seven of the 10 relays were unsatisfactory. The following midget-type, 28-v, dc relays were approved for use in naval aircraft: (1) type R, parts no. A-54504 and B-54504; (2) type SM, parts no. 28026-0, revision A, and 28027-0, revision A; and (3) type TM, parts no. C4595 and C4596.

Air Crew Equipment Lab., Naval Air Material Center, Philadelphia, Pa.
MULTIPURPOSE ELECTRONIC TIMER, by R. L. Burdick. Rept. on TED Projects NAM AE-1403 and AE1403.2. 27 Oct 59, 13p. NAMC ACEL-420; AD-228 355.
Order from LC mi$2.40, ph$3.30 PB 149 554

An economical, versatile, and dependable electronic timer was developed for intervals of 0.1 to 30 sec which can be used to control apparatus or machinery. Three modes of operation are available: (1) a momentary electrical event initiates a condition of predetermined duration; (2) an electrical event of sufficient duration initiates a condition of predetermined duration; and (3) two conditions, each of independent and predetermined duration, alternate. In addition, external signals may be superimposed to (1) begin an interval in progress over again or (2) terminate an interval in progress producing the same effect as if the interval had been permitted to terminate normally. Dependability, accuracy, and stability are discussed. Construction, calibration, and operation instructions are included, together with suggestions for integrating this timer with particluar needs. (Author)

Airborne Instruments Lab., Inc., Mineola, N. Y.
STUDY OF PRINTED ANTENNAS, by J. A. McDonough, R. G. Malech, and J. Kowalsky. Final rept. for June 54-July 55 on Contract DA 36-039-sc-63116. Aug 55, 57p. 6 refs. Rept. no. 3232-1.
Order from LC mi$3.60, ph$9.30 PB 150 677

This report released for sale to the public 11 Oct 60.

This report discusses several types of printed antenna arrays and related feeds and baluns. Detailed consideration is given to the Franklin array, Chireix-Mesny array, and the capacitively coupled collinear array. Experimental techniques, such as probing the magnitude and phase distribution of the current along a printed array and measuring the impedance and phase velocity that characterize printed balanced lines are described. The antenna performance characteristics for the types of arrays that were studied are given, including gain, loss, impedance, size, side-lobe levels, and half-power beamwidths.

Alford, Andrew, Consulting Engineers, Boston, Mass.
ANTENNA GROUP OA-716(XE-1)/GL, by Fred Abel and W. Hugo Liepmann. Final technical rept. on Contract DA 36-039-sc-64491. Jan 60, 28p. 6 refs. AD-236 104.
Order from LC mi$2.70, ph$4.80 PB 148 545

The Antenna Group OA-716(XE-1)/GL is a passive, high-gain, transportable, search antenna system used with a receiving set to detect the presence of electromagnetic signals throughout the frequency range of 12,000 megacycles to 18,000 megacycles. A broadly directional antenna, 10 - 15° horizontal beam width, is used for searching. A highly directional antenna, 1 - 1.5° horizontal beam width, is used for direction finding. The vertical beam width of both antennas is 10 - 15°. Both antennas are circularly polarized. Position or velocity servos are used to rotate the antennas. The azimuth orientation of the antennas is indicated on direction indicator dials, and the intercepted signal may be fed to a receiving set. A broadband waveguide rotary joint was developed for use in this antenna system. The device involves a pair of broadband circularly polarized horns coaxially arranged pointing into one another. The transfer of energy from one horn to the other is very nearly

constant as one horn is axially rotated with respect to the other, and the transfer is accomplished with very little attenuation (about 1 db) over a 1.5 to 1 frequency range. (Author)

Applied Mathematics and Statistics Labs., Stanford U., Calif.
INCREASED RELIABILITY WITH MINIMUM EFFORT, by Arthur Albert and Frank Proschan. Technical rept. no. 50 on Contract N6onr-25140. 9 Oct 59, 29p. 2 refs. AD-227 453.
Order from LC mi$2.70, ph$4.80 PB 149 943

A specific mathematical model is formulated describing the situation of improving the system reliability with minimum expenditure of effort. Also shown is how to determine that allocation of effort among subsystems which yields the desired system reliability at minimum total expenditure of effort.

Arizona U., Tucson.
TRANSISTOR EQUIVALENT CIRCUIT CRITERIA, by Thomas L. Martin, Jr., David J. Sakrison and others. Final rept. on Contract DA 36-039-sc-67465. 30 Aug 56. 83p. 7 refs. AD-107 814.
Order from LC mi$4.80, ph$13.80 PB 147 539

A hybrid parameter equivalent circuit for the common emitter connection is developed. The basic circuit is modified for high frequency use in such a way that the parameters of the equivalent circuit are independent of frequencies. Methods of measuring these various parameters are discussed in detail and circuit diagrams are provided for each such measurement. The proposed transistor equivalent circuit is then used in the analytical development of circuit design equations and criteria for low pass, high pass, and band pass amplifiers. (Author)

Armour Research Foundation, Columbus, Ohio.
INVESTIGATION AND DEVELOPMENT OF CIRCULAR WAVEGUIDE COMPONENTS, by Alva C. Todd, Dick M Joe, and Demetrios P. Kanellakos. Rept. on Contract AF 33(616)3973. Apr 59, 136p. 16 refs. WADC Technical rept. 58-661; AD-207 247.
Order from LC mi$6.90, ph$21.30 PB 150 589

This report released for sale to the public 11 Oct 60.

The design and development are presented of components for use in a circular waveguide system employing the low-loss TE_{01} circular electric wave mode. Components were investigated with regard to direct scaling for use with 2.710-in. ID and 0.725-in. ID circular waveguide at 9.375 kmc and 35 kmc, respectively. Direct scaling for the increased waveguide diameter used in this program was found practicable in certain cases, however, in other instances major modification of dimensions were required. Some new components were developed. These components include a straight waveguide section, a flexible waveguide section, couplings, transitions, bends, a mode absorber, a rotary joint, a high-power load, a low-power load, waveguide switches and windows. Proposed designs are presented for directional couplers and ferrite components. All experimental work was done in the X-band. (Author)

Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.
SYNTHETIC VIDEO AS AN ELECTRONICS COUNTER-COUNTER MEASURE: A STUDY OF PULSATED AND STEADY STATE SYMBOLOGY, by Charles Fried and Claude D. Patton. Aug 60, 24p. 5 refs. Technical memo. 11-60.
Order from LC mi$2.70, ph$4.80 PB 150 087

A study was conducted to determine the effectiveness of pulsing a suggested Antiaircraft Operations Center (AAOC) symbol in overcoming the concealment effects of white noise jamming. Pulsing resulted in a flickering symbol on a Plan Position Indicator. Four degrees of jamming intensity were studied along with four flicker rates, 0, 2, 4, and 8 cycles per second. The psychophysical technique of method of limits was used to determine if flicker improved detection with a background of jamming. The results indicate that no advantage is gained in pulsing a synthetic symbol in overcoming the effects of jamming. A discussion of this result with a review of procedures is included. (Author)

Army Signal Research and Development Labs., Fort Monmouth, N. J.
CHARACTERISTICS OF MICROWAVE DUPLEXER TUBES UNDER SPURIOUS RADIATION CONDITIONS, by Irving Reingold. 31 Mar 59, 27p. 5 refs. USASRDL Technical rept. 2042; AD-220 395.
Order from LC mi$2.70, ph$4.80 PB 147 821

An investigation was conducted on several types of TR duplexer tubes and a waveguide filter commonly used in systems, to determine their effectiveness in rejecting spurious microwave radiation. The devices studied were all designed for operation in the 2800-megacycle frequency band. The low power level characteristics of these devices were checked over a frequency range of 2600 to 35,000 megacycles. Results of the investigation showed that neither the TR tube nor the waveguide filter can be relied upon to provide adequate protection against unwanted signals at frequencies higher than the operational frequency of the system incorporating the device. Other techniques for providing crystal protection without undue sacrifices in insertion loss, or other operational system characteristics, are described and recommended for use by microwave system designers. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
FREQUENCY REPEATABILITY OF CRYSTAL IMPEDANCE METER TS-330/TSM, by Marvin Bernstein. 15 May 60, 12p. USASRDL Technical rept. 2118; AD-237 335.
Order from LC mi$2.40, ph$3.30 PB 149 415

Quartz crystal units, operated within the frequency range of 1.0 to 15.0 mc, were subjected to repeated frequency measurements after simulating the recalibration of the C. I. Meter TS-330/TSM by readjusting the oscillation amplitude level and frequency of the test set in the calibrate condition. Generally, it was found that the oscillation frequency of plated AT resonators is critically dependent upon drive; that the 0 to 100 milliampere RF meter cannot be used to adjust the drive level within accurate enough limits; that with a proper

standardized test procedure, frequency resetrability of the Crystal Impedance Meter TS-330/TSM is better than 10^{-7} throughout the range of the instrument except at the very lowest capacitance settings of the tuning dial. (Author)

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
RADAR-TYPE PROPAGATION SURVEY EXPERIMENTS FOR COMMUNICATION SYSTEMS, by C. E. Sharp. Nov 57, 23p. Technical memo. no. M-1928, supplement to TM-1760; AD-156 257.
Order from LC mi$2.70, ph$4.80 PB 148 120

SCEL Technical Memorandum 1760 "Radar-Type Propagation Survey Experiments for Communications" presented the need for additional frequency channels, reviewed the various methods of site survey for microwave relay systems and the requirement for a rapid survey instrument. This memorandum is considered as supplementary to TM-1760 giving additional supporting experimental data and a discussion of other application aspects of this radar backscatter communications equipment siting method.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
SPEECH SECURITY FOR TACTICAL OPERATIONS, by Arthur C. Prichard. 1 May 59, 10p. USASRDL Technical rept. 2044.
Order from LC mi$1.80, ph$1.80 PB 147 822

Technical and systems aspects of speech scrambling are considered. Reduced requirements for tactical voice message security can very probably be met to an appreciable extent by an improved version of speech scrambling equipment basically similar to a system developed during World War II. (Author)

Bell Telephone Labs., Inc. [New York]
ENGINEERING SERVICES ON TRANSISTORS, by M. M. Atalla, C. A. Bittmann and others. Interim technical rept. no. 16, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-64618. [1959] 22p; AD-219 227.
Order from LC mi$2.70, ph$4.80 PB 149 001

Transistor reliability: Preliminary results of continuing studies of thermally oxidized silicon surfaces show progress toward a better quantitative understanding and the development of a model for the mechanism of oxidation. New and improved transmission-type transistors: Fabrication of M2107 microwave germanium transistors has shown that structure employing a 0.5 mil wafer thickness and 2 mil by 2 mil mesa are feasible. Evaluation of these transistors indicates that a further reduction of the base width to 1/4 micron and a decrease in the base doping will be necessary to meet the design objectives. Feasibility of the design of the M2090 n-p-ν-n transistor was demonstrated by operation of rated frequency and power output. Control of the diffusion processes has exceeded the objective of 10%. Transistor test methods: Substantial amounts of drawing information up-to-dating, prove-in instruction writing, and remaining equipment design and construction were completed this period on the final model of the 5- to 250-mc transistor phase set. (See also PB 140 251)

Bell Telephone Labs., Inc. [New York].
ENGINEERING SERVICES ON TRANSISTORS, by J. R. Ligenza, C. A. Bittmann and others. Iterim technical rept. no. 17, 1 Apr-30 June 59, on Contract DA 36-039-sc-64618. 15 July 59, 37p. 3 refs.
AD-227 825.
Order from LC mi$3.00, ph$6.30 PB 148 329

Transistor reliability: The kinetics of reactions of various alkali hydroxides with thermally grown silicon dioxide on silicon surface were determined. The rate of reaction is temperature dependent and has an activation energy of 17.0 kcal/mol. in the 100 to 300°C temperature range. These reactions provided one controlled means for localized oxide removal necessary for contacting purposes. New and improved transmission type transistors: Evaluation of the M2107 transistor has shown the structure to be capable of operation in the 1 to 5 kmc region. The observation of lower values of f_T than predicted for 1/4 micron base thicknesses indicates the possibility that too high a base surface concentration was employed, and that a modification of the doping levels will be necessary to meet the design objectives. Recent changes in the base layer diffusion process for M2090 transistors have made possible the fabrication of base layer diodes (p-ν-n+) having excellent reverse bias characteristics. A comparison of transistors of comparable maximum frequency of oscillation indicates that oscillator efficiency improves with increasing current gain cutoff frequency. Transistor test methods: Principal remaining work is concerned with accuracy evaluation. (Author) (See also PB 149 001)

Bell Telephone Labs., Inc. [New York]
ENGINEERING SERVICES ON TRANSISTORS, by J. R. Ligenza, B. A. Bittmann and others. Interim technical rept. no. 18, 1 July-30 Sep 59, on Contract DA 36-039-sc-64618. 15 Oct 59, 45p. 1 ref.
AD-232 248.
Order from LC mi$3.30, ph$7.80 PB 148 330

Studies have continued on the properties of thermal oxides on silicon, oxidized silicon surfaces, and oxidized silicon junctions. Considerable progress toward a detailed understanding of the process of oxidation has been made recently through study of the infrared transmission properties of the oxide films and the use of the isotopic frequency-shift in the absorption peaks associated with the O^{18} isotope. Work has continued on the M2107 microwave germanium transistor for 3-kmc service and on the M2090 2-watt silicon transistor for service in the 50 to 100-mc band. Processing difficulties have limited the fabrication of M2107 transistors. Theoretical studies and high frequency electrical measurements on the transistors fabricated to date have shown that the initial design chosen was not optimum. M2090 transistors fabricated within the past quarter were capable of delivering 2 watts at over 100 mcps when a collector bias of 80 volts was used. Transistors with thinner intrinsic layers are being fabricated in order to improve the power oscillator performance at lower collector biases. (Author) (See also PB 148 329)

California U., Los Angeles.
ON THE OPTIMUM SYNTHESIS OF SAMPLED DATA MULTIPOLE FILTERS WITH RANDOM AND NONRANDOM INPUTS, by H. C. Hsieh and C. T. Leondes. Rept. on Contract AF 49(638)438. Feb 60, 43p. 8 refs. AFOSR-TN-60-440. AD-239 646.
Order from LC mi$3.30, ph$7.80 PB 149 170

This report considers the synthesis of optimum sampled data multipole filter with n inputs and m outputs. The signal portion of each input is assumed to consist of a stationary random component and a polynomial with unknown coefficients but known maximum order. Each signal is corrupted by stationary random noise. The filter under investigation is linear, time invariant, and has finite memory. Each input to the filter consists of a sequence of impulses with a constant period T. Each impulse is assumed to have an area equal to the value of the signal plus noise at the sampling instant. The synthesis procedure to be developed is to specify the weighting functions of the filter such that the system error, which is defined as the difference between the actual and ideal outputs, has zero ensemble mean and the system ensemble mean square error is minimum. The weighting functions thus obtained will have, in general, abrupt jumps at the sampling instants but they are continuous within the sampling intervals.

Carnegie Inst. of Tech., Pittsburgh, Pa.
ELECTROMAGNETIC PROPERTIES OF INSULATORS, I, by Vinay Ambegaokar (Doctoral thesis) and Walter Kohn. Technical rept. no. 9 on Contract Nonr-760(13). [1959] 43p. 16 refs. AD-227 621.
Order from LC mi$3.30, ph$7.80 PB 148 866

A discussion is presented on the response of a perfect insulator to weak external electromagnetic fields of long wavelength from a many particle point of view. The method is to treat the Coulomb interaction between all electrons to all orders of perturbation theory and analyze the structure of the corresponding Feynman graphs. A result of this graphical analysis shows that the response of the many particle system to long wavelength external fields of arbitrary polarization is completely described by a single frequency-dependent dielectric constant. (Author)

Collins Radio Co., Burbank, Calif.
ELECTROMECHANICAL FILTERS: 100 Kc CARRIER AND SIDEBAND FILTERS, by W. D. Peterson and R. N. Muret. Rept. no. 8 (Final), 1 Apr-30 Sep 57, on Contract DA 36-039-sc-73039. 28 Oct 57, 38p. IDR-W429-3A; AD-201 254.
Order from LC mi$3.00, ph$6.30 PB 149 368

A number of experimental filters have been built to arrive at designs and performance limits consistent with the present state of the art. Results obtained by these filters are discussed and compared with the specifications set forth in Signal Corps Technical Requirements SCL-1721. A discussion of the possible advancement of the state of the art is discussed. A metallurgical research program has shown that powder metallurgy techniques can be employed to produce alloys for disk resonators with excellent characteristics over a wide range of temperatures. These alloys, however, did not exceed the performance characteristics of the batch of commercially available Ni-Span "C" employed in the experimental samples. (Author)

Collins Radio Co., Burbank, Calif.
ELECTROMECHANICAL FILTERS: FEASIBILITY INVESTIGATION FROM 50 KC TO 1 MC, by W. D. Peterson and R. N. Muret. Rept. no. 17 (Final), 1 Apr 57-28 Dec 58, on Contract DA 36-039-sc-73039. 31 Mar 58, 25p. IDR-W429-5; AD-201 255.
Order from LC mi$2.70, ph$4.80 PB 149 369

This report covers the feasibility of fabricating electromechanical filters to the requirements of SCL-1721 in the frequency range of 50 Kc to 1 Mc. Probable characteristics of filters in this frequency range are compared by means of curves. Relative advantages and/or disadvantages are discussed for the various frequencies. Conclusions are drawn as to which of the possible frequencies might be the best choice for optimum filter characteristics. (Author)

Columbia Radiation Lab., New York.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM, by P. Kusch. Quarterly progress rept. no. 1, 16 Dec 59-15 Mar 60, on Contract DA 36-039-sc-78330, and rept. on Contracts Nonr-266(45), AF 49(638)-(-507, -557, and -631). 15 Mar 60, 41p. 25 refs. CU 3-60 SC-78330.
Order from LC mi$3.30, ph$7.80 PB 147 633

Cerenkov radiation in the K-band range has been observed in a system that has recently been under design and study. An experimental investigation of the parameters governing the generation of power has been started. An M-band maser radiotelescope is in an advanced stage of design and construction and details of the system are described. The purpose of the radiotelescope is to obtain data from which it should be possible to determine the density of oxygen in the atmosphere as a function of height above the earth's surface. Progress in the design of a maser to operate at the frequency of the hyperfine structure line of atomic hydrogen is reported. Studies directed in the achievement of maser action at infra-red frequencies are continuing. Molecular spectroscopy by use of masers is discussed. Work in a variety of studies of atomic hyperfine structures by several techniques is reported. (See also PB 146 112)

Cruft Lab., Harvard U., Cambridge, Mass.
A DIPOLE ANTENNA COUPLED ELECTROMAGNETICALLY TO A TWO-WIRE TRANSMISSION LINE (THEORETICAL AND EXPERIMENTAL STUDIES) by Kun-Mu Chen. Scientific rept. no. 6 (Series 2) on Contract AF 19(604)4118. 10 Mar 60, 67p. 7 refs. AFCRC-TN-60-387.
Order from LC mi$3.90, ph$10.80 PB 150 197

A dipole antenna coupled electromagnetically to a two-wire transmission line is studied theoretically and experimentally. The antenna currents induced when the transmission line has (1) a standing-wave pattern, (2) a traveling-wave pattern, (3) an unbalanced current, are considered. The variations of antenna currents

with (1) the angle of rotation of the antenna, (2) the length of the antenna, (3) the distance separating the antenna from the line, (4) the spacing of the line, are investigated. (Author)

David Sarnoff Research Center, Princeton, N. J.
MOLECULAR AMPLIFIERS AND GENERATORS, by H. R. Lewis. Triannual progress rept. no. 5, 1 Feb-31 May 59, on Contract DA 36-039-sc-73031. 15 June 59, 16p. AD-225 337.
Order from LC mi$2.40, ph$3.30 PB 149 367

Equipment was set up and tested for paramagnetic resonance work in the 40-50 kmc range and the 50-70 kmc range. The hamiltonian describing the energy levels of Cr^{3+} in TiO_2 was checked by observing the spectrum at frequencies of 45 and 57 kmc. The spectrum was previously observed only at 9 and 24 kmc. A program was written for the IBM 650 computer to calculate transition probabilities for spin 3/2 ions in axial or othorhombic environments. Using this program, computations were made for the Cr^{3+} ion in TiO_2 at points of interest for maser operation. Population inversion was observed at 4.2°K in Cr^{3+} in TiO_2. While the population difference achieved was not sufficient to produce amplification, it is believed that minor modifications will produce an operating maser using this new material shortly. The signal frequency in this experiment was 24 kmc; the pump frequency was 50 kmc. (Author)

Davies Labs. Div., Minneapolis-Honeywell Regulator Co., Beltsville, Md.
HETERODYNE FREQUENCY METER AND CALIBRATOR, by R. W. Gran. Final development rept. for 12 Mar 53-30 June 57, on Contract NObsr-63310. 15 July 57, 25p. AD-141 003.
Order from LC mi$2.70, ph$4.80 PB 148 856

A heterodyne frequency meter has been developed which will measure frequencies directly to six significant figures over a frequency range of 500 to 30,000 mc. The system involves the usual heterodyne oscillator principles, plus an automatic beat counting system, plus an electrical, linear, interpolation device.

Defense Electronic Products, Radio Corp. of America, Camden, N. J.
TIME DIVISION MULTIPLEX SYSTEMS, by W. J. Bieganski, L. M. Glickman and others. Final rept. for 1 Jan-31 May 56 on Contract DA 36-039-sc-64459. 29 June 56, 82p. 21 refs. AD-102 296.
Order from LC mi$4.80, ph$13.80 PB 149 102

The purpose of this project was to develop a model time division multiplex system, using circuits and techniques applicable to time division multiplexed communications, which will be more reliable, less complex, lighter, of greater stability, and which may also be produced at reduced cost. The study phase is divided into the following parts: (1) study of time division multiplex systems; (2) general investigation of circuit techniques; (3) investigation of transistor circuits; and (4) investigation of magnetic circuits. The experimental model development (Phase II) is divided into the following parts: (1) final development of circuit blocks; (2) layout and packaging; (3) construction of the models; and (4) final tests.

Directorate of Labs., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ERROR ANALYSIS FOR DETERMINATION OF TARGET POSITION AND VELOCITY FROM TWO OR MORE OBSERVERS, by Edouard E. Perret. June 60, 38p. 1 ref. WADD Technical note 60-70.
Order from OTS $1.00 PB 161 979

If a target is observed from two or more separate points, it may be possible to determine the target's position and motion from the measurements obtained. However, since these measurements contain errors, there will be errors in the determination of the target's position and velocity. This paper investigates the significance of statistical errors of measurement of target position and velocity for any location of the target relative to the observers by the following two measuring systems: (1) System employing angle only information from two observers. (2) System employing range only information from three observers. Gaussian errors with zero mean are assumed throughout. The various errors for each measuring system are first considered individually and then combined. This yields statistical error boundaries in target position which are determined by ellipses for the two dimensional case and by ellipsoids for the three dimensional case. The main axes of the error geometries and their angles relative to some reference are computed and their loci plotted for any target position. (Author)

Electric Storage Battery Co., Yardley, Pa.
INVESTIGATION OF AgO PRIMARY BATTERIES, by P. Ruetschi and R. F. Amlie. Quarterly rept. no. 3, 1 Dec 59-29 Feb 60, on Contract DA 36-039-sc-78319. 31 Mar 60, 21p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 149 610

The solubility of Ag_2O and AgO in alkaline electrolyte has been studied by a polarographic technique using a rotating platinum electrode. Evidence is presented that AgO in contact with alkaline electrolyte does not dissolve to produce a divalent silver species in solution. Also, the self-discharge of the electroformed AgO plate is nearly the same as for the best chemical AgO sample. (Author) (See also PB 147 974)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
A NEW METHOD OF DRIVING-POINT FUNCTION SYNTHESIS, by Wan Hee Kim. Interim technical rept no. 1 on Contract DA 11-022-ORD-1983. 1 Apr 56, 61p. 41 refs. [OOR rept. 1571:...] AD-91 478.
Order from LC mi$3.90, ph$10.80 PB 150 727

This report released for sale to the public 3 Oct 60.

A new method for synthesizing driving-point functions with passive, linear, bilateral elements in non-series-parallel structures is presented. The method is based on topological analysis and on the analysis of network poles and zeros. By the new method, the driving-point functions which can be synthesized with a minimum number of elements are found, and the minimum number of reactive elements required to realize a minimum function is given. These results extend the relationship of the number of elements in a network realization to the order of the driving-point function. The synthesis method is reduced to solving simultaneous equations for the value of each element. The minimum function synthesis method is shown to be a modification of Pantell's process.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ON MINIMAL REALIZATION OF RC TWO-PORTS, by S. L. Hakimi and J. B. Cruz, Jr. Interim technical rept. no. 18 on Contract DA 11-022-ORD-1983. 4 Mar 60, 28p. 5 refs. OOR rept. no. 2207.7-E; AD-238 874.
Order from LC mi$2.70, ph$4.80 PB 150 393

From a given RC-realizable open-circuit voltage transfer function, some lower bounds are obtained for the minimum possible number of elements in the network. In the case of bilinear and biquadratic functions, network realizations have been tabulated which are minimal although not all realizable biquadratic functions are covered. In the case of an n-pole transfer function with symmetrically clustered zeros, a realization involving at most two elements more than the minimum requirement is obtained using Guillemin's parallel ladder procedure. The effects of interchanging the input terminals and interchanging the R's and C's in a network are also considered. (Author)

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
DETECTION OF NON-GAUSSIAN SIGNALS IN GAUSSIAN NOISE, by Richard L. Townsend. Rept. on Contract DA 19-020-ORD-4637. June 60, 12p. 7 refs. Rept. 7967-R-5; OOR rept. no. 2001.4-E; AD-240405.
Order from LC mi$2.40, ph$3.30 PB 150 408

Considerable difficulty is generally encountered when attempting to determine the structure of a likelihood ratio test for the detection of non-gaussian signals in the presence of additive gaussian noise. Consideration is given to the possibility of detecting such signals by sub-optimum means. The performance of a class of suboptimum tests which are obtained by averaging over the signal ensemble the optimum test for each ensemble member is evaluated. Besides having the advantage of being very simple in form, this class of tests compares favorably with the optimum test for a wide range of signals. (Author)

[Electronic Systems Lab.] Mass. Inst. of Tech., Cambridge.
NON-LINEAR ADAPTION IN MANUAL CONTROL SYSTEMS, by Robert W. Roig. Rept. on Contracts NObs-72017 and DA 19-020-ORD-4637. June 59, 87p. 11 refs. Rept. nos. 7420-R-4 and 7967-R-2; [OOR rept. 2001:...] AD-226 293.
Order from LC mi$4.80, ph$13.80 PB 150 405

The human operator, as a feedback control element, has been tested in a simple control system utilizing random input signals from a non-Gaussian process. The rms error performance of the human operator has been evaluated and compared with that obtainable from an optimum linear system. The form of the error response for the human operator and the optimum linear system is also compared. The results indicate that the manual control system produces a mean square error which is comparable to that of a highly constrained optimum linear system. However, the human operator shows a more adaptable control characteristic than the optimum linear system when the form of the error response is compared. The human operator was tested using visual displays of the error signal which allowed him to view a portion of the immediate past history of the error and which showed only the instantaneous value of the error. A comparison of the results show no significant advantage for one display over the other. (Author)

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
OPTIMUM CONTROL SYSTEMS FOR A CLASS OF STOCHASTIC SIGNALS, by Robert B. Streets, Jr. Rept. on Contract DA 19-020-ORD-4637. Mar 60, 53p. 9 refs. Rept. 7967-R-4; OOR rept. no. 2001.3-E; AD-240 404.
Order from LC mi$3.60, ph$9.30 PB 150 409

The class of stochastic signals considered is composed of data components which are continuous sections of analytic arcs, and of Gaussian noise components. Analytic arcs denote a linear combination of known functions and random coefficients which possess a Gaussian distribution. (Author)

Electronics Research Lab., U. of California, Berkeley.
BEHAVIOR OF A FIELD-SWEPT MASER OSCILLATOR, by J. C. Kemp. Rept. on Contract AF 49(638)102. 19 Apr 60, 31p. 15 refs. Series no. 60, issue no. 275; AFOSR-TN-60-509.
Order from LC mi$3.00, ph$6.30 PB 149 239

Electronics Research Lab., U. of California, Berkeley.
NONLINEAR ANALYSIS OF A TRANSISTOR HARMONIC OSCILLATOR, by D. O. Pederson and R. S. Pepper. Rept. on Contract N7onr-295(29). 15 Oct 59, 25p. 1 ref. Rept. no. 96; Series no. 60, issue no. 255; AD-230 507.
Order from LC mi$2.70, ph$4.80 PB 149 497

The analysis of a tuned-collector transistor oscillator concerns the development of both graphical and piecewise linear techniques for obtaining the composite negative resistance characteristic that is presented to the tank circuit. This is done for the common-emitter connection of the transistor; however, the common-base connection can also be used. With the negative resistance characteristic, conventional phase plane and limit cycle analysis can be used to predict the oscillator output. Higher order effects are inspected, and it is found that the simplifying assumptions made are quite valid. Thus, the second order differential equation provides a good approximation of the system. Experimental results are given that show predicted and observed values are within a few percent for amplitude of oscillation, period of oscillation, and wave shape, i.e., harmonic content. (Author)

Electronics Research Lab., U. of California, Berkeley.
OPERATIONAL ANALYSIS OF FINITE-PULSED SAMPLED-DATA SYSTEMS, by T. Nishimura. Rept. on Contract AF 18(600)1521. 10 May 60, 39p. 9 refs. Series no. 60, issue no. 279; AFOSR-TN-60-510.
Order from LC mi$3.00, ph$6.30 PB 149 092

The theory of the operational analysis of the finite-pulse-width system is developed in this report. The closed-form expression of the response from such system is described by means of several well-known operators such as the z-transform, the modified z-transform and the simple form of the p-transform. Finding the incremental responses and their superposition is the basic principle of the theory and it is also applied to two-sampler systems as well as multi-rate sampling systems. (Author)

Electronics Research Lab., U. of California, Berkeley.
QUARTERLY PROGRESS REPORT. Rept. for 1 July-30 Sep 59 on Contracts N7onr-29529, Nonr-222(53), 222(54), and 222(57). 31 Oct 59, 26p. Series no. 60, issue no. 26; AD-230 521.
Order from LC mi$2.70, ph$4.80 PB 149 874

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Back-scattering from cones
Scattered fields from anisotropic media
Microwave parametric amplifiers
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Information theory
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Magnetic amplifiers. (See also PB 145 072)

Engelhard Industries, Inc., East Newark, N. J.
INVESTIGATIVE RESEARCH PERTAINING TO CATALYTIC HEATING OF PRIMARY BATTERIES, by Herbert J. Greenberg. Final rept. (including Quarterly rept. no. 2) for 1 May-31 Dec 59 on Contract DA 36-039-sc-78914. [1960] 27p.
Order from LC mi$2.70, ph$4.80 PB 149 611

The technical approach to be followed for a fuel-catalyst program is presented. Ignition of methanol at -40°F without the addition of an external heat source was found to be unattainable. Self sustaining combustion of methanol at -40°F min. was demonstrated, but only with preheating of the fuel-air mixture. Ignition of methane was tried, but required an external heat source also (glow coil), and then was effected only when a temperature of +470F was reached. (Author)

Feltman Research Lab., Picatinny Arsenal, Dover, N. J.
COMPLIANT ELECTRODES FOR DIELECTRIC MEASUREMENTS, by Andrew R. Blanck. Aug 60, 12p. 4 refs. Technical notes no. FRL-TN-1.
Order from OTS $0.50 PB 161 670

Compliant Electrodes which give improved surface contact were developed. (Compliant Electrodes are electrodes which conform or "comply" to the surface of the test specimen. The surface may be essentially planar or curved.) This technique is simpler than those using the pasted foil, flexible foil, painted, or evaporated electrodes and will give more reproducible results because of the intimate contact with the specimen surface. If a conductive silicone elastomer is used for the electrodes they can be used for measurements from -100° to +400°F. When electrodes of different shapes are required to suit the dimensions of available test material, they may be easily and quickly fabricated in the laboratory. (Author).

General Electric Microwave Lab., Palo Alto, Calif.
MEASUREMENT AND CONTROL OF HARMONIC AND SPURIOUS MICROWAVE ENERGY, by Vernon G. Price. Final rept. Change B for Dec 59-Apr 60 on Contract AF 30(602)1670. 20 May 60, 83p. 22 refs. Rept. TIS R60ELM112-5; RADC TR-60.
Order from LC mi$4.80, ph$13.80 PB 150 281

An experimental harmonic calorimeter was fabricated to measure harmonic powers in waveguides. By measuring the sum of the power levels of the individual waveguide modes at a given harmonic frequencies, one can quickly measure the total power without recourse to mathematical analysis. This simpler measurement method (compared with the probe analysis method) is accomplished at the expense of identification of the individual modal power levels. S-band and L-band model ferrite attenuators were received for test and evaluation. A summary of these tests and the test methods is included. In order to continue the study and investigation of the reduction of spurious outputs in microwave systems, a novel filter arrangement was conceived which makes it possible to achieve a relatively narrow band pass filter characteristic as well as a broad stop band characteristic. A preliminary design for a filter of this type is included. (Author) (See also PB 148 534)

General Telephone and Electronics Labs., Inc., Bayside, N. Y.
STUDY OF NONLINEAR EFFECTS ON SEMICONDUCTIVE MATERIALS, by E. Conwell, V. Fowler, and J. Zucker. Final rept. on Contract AF 19(604)5714. 31 Mar 60, 107p. 15 refs. TR 60-206, 301.4; AFCRC-TR-60-148; AD-239 723.
Order from LC mi$5.70, ph$16.80 PB 149 168

The objectives of this program were to study nonlinearities in conductivity and dielectric constant of silicon and germanium at microwave frequencies, and to determine efficiency of harmonic generation at milli meter and sub-millimeter wavelengths attainable by use of these nonlinearities.

Gilfillan Bros., Inc., Los Angeles, Calif.
INTERROGATOR SET AN/UPX-16. Final rept. on Contract AF 30(602)2054. 12 Apr 60, 29p. RADC rept. no. TR-60-90.
Order from LC mi$2.70, ph$4.80 PB 148 770

The equipment consists of two AN/UPX-4 Interrogators, one modified as a directional channel and the other modified to be a reference channel. The two together

are used to provide both active and passive side-lobe suppression for the Mark X IFF/SIF system. The active technique, known as Interrogation Side-Lobe Suppression (ISLS), minimizes false replies, reduces total aircraft "dead time"; and also minimizes actuation of the Aircraft AOC. The passive technique, known as Responser Side-Lobe Suppression (RSLS) minimizes display of signals which are valid replies to other interrogators. The use of these side-lobe suppression techniques results in marked system improvement. (Author)

Haskins Labs., New York.
RESEARCH ON AUDIBLE OUTPUTS OF READING MACHINES FOR THE BLIND, by J. Bastian. Progress rept. no. 4 for 1 July 59-30 June 60 on Contract V1005M1253. [1960] 52p. 1 ref.
Order from LC mi$3.60, ph$9.30 PB 149 881

The basic problems towards which the research has been directed are the formulation and testing of rules for speech synthesis and the study of isolated spoken words with a view to their combination into acceptable sentences. The objective in both cases is an audible output for a reading machine that will be like speech or acceptable as speech.

Hazeltine Electronics Corp., Little Neck, N. Y.
INSTRUCTION BOOK FOR RADAR SAFETY BEACON TEST SET TYPE 2.3NA3. Rept. on Contract NOas-55-438-c. 1 Mar 55, 30 Nov 55, 225p.
Order from LC mi$9.90, ph$34.80 PB 147 959

Radar Safety Beacon Test Set Type 2.3NA3 is a portable, a-c operated instrument, designed to perform rapid pre-flight checks of installed Radar Safety Beacon, Type III, airborne transponders. The following features of these beacons (transponders) are checked simultaneously: (a) transmitter frequency, (b) relative transmitter power output, (c) decoding of interrogations, (d) reply codes, (e) receiver frequency, and (f) relative receiver sensitivity. The results of these checks are simultaneously resolved into a single REJECT or ACCEPT indication on an operating panel meter.

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY, by George Grant, James M. McKendry. Rept. 5 on Human Factors in Maintenance, Contract N61339-330. 4 Apr 60, 25p. 12 refs. Technical rept. NAVTRADEVCEN-330-1
Order from LC mi$2.70, ph$4.80, PB 150 174

Maintainability can be quantitatively defined as the speed with which troubles are detected, localized, and corrected. A minimization of this "downtime" can occur through the use of any number of approaches: (a) improving equipment design, (b) improving technicians' skills via training, and (c) providing more effective maintenance aids, especially trouble-shooting guides. The purpose of the work reported in this summary document was aimed at devising methods for achieving the first goal, which seems to be the most basic of the three mentioned above.

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT I. AN EXPERIMENTAL INVESTIGATION OF EQUIPMENT PACKAGING FOR EASE IN MAINTENANCE, by J. M. McKendry, J. F. Corso and others. Rept. 5 on Human Factors in Maintenance, Contract N16339-330. 4 Apr 60, 123p. 5 refs. Technical rept. NAVTRADEVCEN 330-1, Supplement 1.
Order from LC mi$6.30, ph$19.80 PB 150 175

A preliminary examination of maintenance research showed that human engineering recommendations were primarily restricted to exterior characteristics of equipment. This technical report summarizes the findings of a study which was aimed at attacking the maintenance problem at a more basic level, that of devising equipment packaging philosophies which should decrease fault localization time. Four such philosophies were devised. The "Standard Method" weighed factors such as: heat loss, component and unit size, and component weight, to arrive at a compromise which varied for each equipment made. A "Component Grouping" method placed similar components together. A "Circuit Grouping" method placed similar circuits together. A "Logical Flow" technique employed a modular concept where subdivisions were made when the signal underwent a marked change. (See also PB 150 174)

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT II. SURVEY INFORMATION: (A) DESCRIPTION OF THE TRAINING DEVICE TECHNICIAN; (B) ENGINEERS' ESTIMATES OF CIRCUITS AND SYSTEM MAINTAINABILITY, by J. M. McKendry, G. Grant, and J. F. Corso. Rept. 5 on Human Factors in Maintenance, Contract N61339-330. 4 Apr 60, 111p. 10 refs. Technical rept. NAVTRADEVCEN 330-1, Supplement 2.
Order from LC mi$6.00, ph$18.30 PB 150 176

The survey data obtained from TRADEVMEN included: background and training, work environment, organization of the work group, familiarity and preferences in regard to tests equipments and manuals, troubleshooting techniques, and the relationship between fault localization time and fault correction time. It was found that only the more experienced men knew enough to give accurate preferences about the above categories. For this reason, the data included apply to a more experienced group only. Design and Field Engineers were questioned about system and equipment troubleshooting procedures. Most of this information dealt with specific representative circuits and included such aspects as test point and component location, parameters important in troubleshooting, and the test equipment needed to check these parameters. No significant differences were noted between the replies of field and design engineers. It was also found that both engineers and technicians preferred to use similar procedures in troubleshooting a system. (Author) (See also PB 150 175)

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT III. ANTHROPOMETRY OF ONE HANDED MAINTENANCE ACTIONS, by P. Baker, J. M. McKendry, and G. Grant. Rept 5 on Human Factors in Maintenance, and Contract N61339-330. 4 Apr 60, 39p. 7 refs. Technical rept. NAVTRADEVCEN 330-1, Supplement 3.
Order from LC mi$3.00, ph$6.30 PB 150 177

In examining present and anticipated maintenance tasks, four basic types of dynamic maintenance actions were isolated: (a) the motion required to turn screwdrivers and spintites, (b) the action required to grasp, remove and replace plug-in units, (c) the action required to grasp, turn, and cut with pliers and wirecutters, and (d) the motion required to turn wrenches. The space envelopes required for each of the above actions was determined by a photographic process. Subjects employed in the study included experienced and inexperienced subjects with 95th percentile hand sizes. The dimensions for each envelope were obtained. (A more exact listing of dimensions would also subdivide the last action (d above) according to the main turning axis, i.e., a horizontal or vertical turning axis.) It was found that there seem to be three main factors influencing the size of the space envelope required for a task. The first, and most important, was the type of action required. The second was the size of the component or tool being manipulated, and the third, the tightness of the component mounting socket. (Author) (See also PB 150 176)

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT IV: MAINTAINABILITY HANDBOOK FOR ELECTRONIC EQUIPMENT DESIGN, by J. M. McKendry, G. Grant and others. Rept. 5 on Human Factors in Maintenance, Contract N61339-330. 4 Apr 60, 384p. 184 refs. Technical rept. NAVTRADEVCEN 330-1-4.
Order from OTS $5.00 PB 161 025

This handbook provides data which should be useful for the designer in improving the maintainability of existing equipment. Greater maintainability can be achieved by the use of any combination of four different approaches: (1) the improvement of technical proficiency of repairmen by training, (2) the improvement of maintenance aids available to the technician, (3) the improvement of equipment design, and (4) the improvement of the layout and arrangement of the work situation. The third approach which is the main approach covered in the handbook is described in detail. (See also PB 150 177)

Hughes Aircraft Co., Culver City, Calif.
ARBITRARILY POLARIZED PLANAR ANTENNAS, by F. J. Goebels, Jr. and K. C. Kelly. Rept. on Contract AF 33(600)31582. July 59, 29p. 6 refs. Technical memo. no. 592.
Order from LC mi$2.70, ph$4.80 PB 148 275

This report describes the analysis and design of a class of two-dimensional, planar antennas which can radiate and receive constant shape pencil beams with arbitrary elliptical polarization (including the special cases of linear polarization and polarization in either circular sense) by a simple adjustment in the feed circuit. Such radiators are termed arbitrarily polarized antennas. Their basic radiating element is an annular slot whose broadside radiation pattern displays 8 db sidelobes in all ϕ planes. Arraying such elements readily produces lowered sidelobes. Standing-wave and traveling-wave array designs are discussed and results of experiments conducted at X-band are given. (Author).

Hughes Aircraft Co., Culver City, Calif.
TWO-DIMENSIONAL MODEL FOR THE EVALUATION OF RADOME ANALYSIS APPROXIMATIONS, by Alexander D. Jacobson. Rept. on Contract AF 33(038)28634. June 58, 62p. 11 refs. Technical memo. no. 580; AD-207 279.
Order from LC mi$3.90, ph$10.80 PB 147 507

Several methods in common use for analyzing antenna-radome pointing errors involve two major assumptions: (1) the electric field existing in the presence of the radome on a surface lying between the antenna and the radome, can be approximated by the electric field measured over the surface in the absence of the radome; and (2) the interior field can be transmitted through the radome wall using plane-wave plane-sheet transmission coefficients. The validity of these assumptions is evaluated by employing them to determine the field of a 2-dimensional model and comparing the results to the exact fields of this system.

Illinois U., Urbana.
HIGH-TEMPERATURE ELECTRICAL INSULATING INORGANIC COATINGS ON WIRE, by David L. Wilcox, Clifton G. Bergeron and others. Rept. for Feb 59-Feb 60 on Electrical and Electronic Materials, Contract AF 33(616)3943. May 60, 75p. 5 refs. WADC Technical rept. 58-12; Part III.
Order from OTS $2.00 PB 161 954

This report discusses the work on flexibility of coated wire, coating trials on clad copper wires, firing procedure for two coats of 58C on copper wire, vitreous silica and boron nitride mill additions to glass coating 58C, and vitreous coatings sheathed with organics. Also, test data were obtained on high-temperature insulated wire supplied by various manufacturers. A heat treatment of the coating increased coating flexibility. Sheathing of vitreous coatings with organics showed promise as a method of retaining the flexed vitreous coating on the wire. (Author) (See also PB 151 943)

International Business Machines Corp., Kingston, N. Y.
THIN FILM CIRCUIT FUNCTIONS, by H. J. Beatty, W. N. Carroll and others. Quarterly progress rept. no. 1, 1 Aug-31 Oct 59, on Contract DA 36-039-sc-84547. [1959] 72p. 10 refs. AD-232 959.
Order from LC mi$4.50, ph$12.30. PB 150 807

This report released for sale to the public 13 Oct 60.

The initial effort is presented of a long range research and development program on the formation of miniature functional thin film circuit units, of essentially planar form factor, which will provide a broad

range of basic electronic functions for Army electronic equipment. A functional thin film circuit is an integrated combination of single and/or multi-layer films which is capable of transforming a given form of input energy into a desired form of output energy (e.g. providing a specific electronic function) when connected to associated electronic circuitry. The ultimate objective of the long range program is a circuit fabrication method which, in conjunction with appropriate optimum integration techniques, will make possible the reduction in size of electronic equipment by several orders of magnitude over what is attainable with existing methods (including the Army Micromodule technique with its current types of microelements). (Author)

International Business Machines Corp., Kingston, N. Y.
THIN FILM CIRCUIT FUNCTIONS, by H. J. Beatty, W. N. Carroll and others. Quarterly progress rept. no. 2, 1 Nov-31 Jan 60, on Contract DA 36-039-sc-84547. [1960] 48p. 3 refs. AD-235 639.
Order from LC mi$3.30, ph$7.80 PB 150 808

This report released for sale to the public 13 Oct 60.

The following information is given on preliminary circuit selections: bulk-component design of IF and RF amplifiers as related to difficulty in fabricating high-valued thin film inductors; the film layout of the OR switching circuit; anticipated parts densities; a description of artwork used in photo-etch mask fabrication; results of initial circuit fabrications and difficulties encountered. A thermo-compression bonding machine, results achieved, and ease of bonding with three metallic systems (copper, aluminum, and gold) are described. Glass has been selected as substrate material on the basis of S_iO undercoating studies. However, some circuits will be deposited on sapphire. Also discussed are fabrication equipment and multilayering techniques, including topological factors, materials selection, substrate processing and post-fabrication processing; plans for environmental tests and surface protection of passive elements and chip-type active elements are presented. Experimental data are presented concerning vapor-deposition growth of single-crystalline semiconductor layers by the disproportionating reaction of S_iI_2. Also described is a method of approximating impurity concentrations in samples from resistivity measurements over a temperature range. (Author) (See also PB 150 807)

International Telemeter Corp., Los Angeles, Calif.
HIGH-SPEED ELECTRONIC CIRCUITS. Technical rept. no. 23 [on Contract AF 30(602)1566]. 20 Nov 57, 116p. RADC-TN-58-13; AD-148 546.
Order from LC mi$6.00, ph$18.30 PB 147 803

The following high speed electronic circuits are discussed: scanner circuit, high-speed logic circuits, flip flops, flip-flop gating circuits, buffers, special gating boards, super cathode follower, high-speed clocks, low-to-high speed clock, power supplies, power supply sequencer, and low- and high-speed board testers.

John Hopkins U., Baltimore, Md.
REPRESENTATION AND ANALYSIS OF SIGNALS. PART V. FLOW-GRAPH REPRESENTATION OF SYSTEMS AND SYSTEM DYNAMICS, by W. H. Huggins. Rept. on Contracts AF 19(604)1941 and Nonr-248(53). 15 Nov 59, 97p. 10 refs. AFCRC-TN-59-971; AD-235 141.
Order from LC mi$5.40, ph$15.30 PB 148 301

Flow-Graph Representation of Systems: The flow-graph representation which may be used to express and investigate the relations between the signals (i.e. observables) of a system is discussed. For linear and constant-parameter systems, the flow-graph can be manipulated to solve the simultaneous equations that describe the system. The flow-graph leads to the programming of a computer and provides a technological esperanto which is well adopted to the needs of systems modeling.. System Dynamics: The extension of the flow-graph concepts to dynamical systems is accomplished by introducing the exponential signal, A exp(st), which is characteristic of all linear, stationary systems. The concepts, usually obtained by application of the Laplace transform, are shown to emerge naturally as a consequence of the use of this characteristic signal to describe linear stationary operators. This approach offers an enhanced appreciation of the ties between signals and systems. Application to both deterministic and stochastic systems is illustrated. (Author) (See also PB 137 788)

Land-Air, Inc., Holloman, N. Mex.
PHASE LOCK TRACKING FILTER, by W. M. Riker and Claude Rudy. Final rept. (Revised) on Contract DA 29-040-ORD-1010. Nov 58, rev. Nov 59, 167p. 1 ref. LA-59-04, formerly LA-58-16 dated Nov 58; AD-231 347.
Order from LC mi$7.80, ph$25.80 PB 147 575

The Phase-Lock Tracking Filter is a closed-loop system which generates a signal, and phase-compares it with data containing the desired Doppler signal, then evaluates it through bandpass selection. The system accepts real-time or recorded real-time data over a signal intelligence range of 250 cps to 100 kc at a minimum level of .02 volts rms having a noise-to-signal content of no more than 16 db. Analog outputs of velocity, acceleration, and correlation are provided. Single-frequency outputs of the restored Doppler signal and a biased frequency containing the restored Doppler are available for digital operations, and for photographic recordings utilizing the cathode-ray oscillograph. The Model 1 is housed in a de luxe desk-type console, equipped with controls and meters which provide quick-look information. The Model 4 is housed in a standard equipment rack. Both models utilize improvements which became feasible after a trial period of operational use in the field. (Author)

Martin Co., Baltimore, Md.
RADIOISOTOPE TUBE HEATER. Rept. on Thermionics and Solid State Electronic Technology, Contract AF 33(616)6325. Mar 60, 66p. WADD Technical rept. 60-246.
Order from OTS $1.75 PB 171 015

The feasibility of heating a vacuum tube cathode using a radioisotope-fueled heat source was demonstrated when emission and amplification were obtained using a 200-curie Polonium-210 heat source, encapsulated in a double stainless steel container, to heat the cathode of a Type X-766 vacuum tube built by Eitel-McCullough, Inc. The tube and heat source were assembled together and provided with a manual temperature control system. Operation of the temperature control system proved that the decreasing heat output of a decaying radioisotope can be controlled to obtain constant cathode temperature. Tube characteristics were obtained using an electrical simulated heater prior to final tests with the radioisotope fuel source installed. No correlation was obtained between the characteristics obtained with the two heating systems because the maximum cathode temperature achieved using the radioisotope was 640°C, while the cathode temperature for the electrically heated tests was 700°C. Various tube configurations were tested prior to final tests, and the conceptual design of an operational tube is presented. (Author)

Mauch Labs., Inc., Dayton, Ohio.
THE DEVELOPMENT OF A READING MACHINE FOR THE BLIND, by H. A. Mauch. Summary rept. for 1 July 59-30 June 60 on Contract V1005 M-1943. 30 June 60, 11p.
Order from LC mi$2.40, ph$3.30 PB 150 140

Scanning optimization studies and photocell studies support the expectation of eventual attainment of recognition operation, using a "spelled speech" output. Basic solutions were found for the identification of characters other than small letters and of various types of print. Code studies for the word synthesizer resulted in the adoption of a 6-bit code which follows closely the principles of conventional codes. Only 48 of the possible 64 combinations need be used. This will keep the size and weight of the machine within acceptable limits. Important improvements were introduced regarding matrix design, word separation techniques, control relay circuitry, and reliability of mechanical operation. Functional models of the scanning device including opaque projector and display panel, as well as of the word synthesizer, were built and demonstrated.

Mellon Inst., Pittsburgh, Pa.
HIGH TEMPERATURE PRINTED CIRCUITRY. Final rept. for 1 Oct 56-30 Apr 60, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 1 June 60, 25p. 3 refs. AFCRC-TR-60-154.
Order from LC mi$2.70, ph$4.80 PB 149 147

The various contractually-assigned Fellowship objectives are presented together with a brief summation of the successive accomplishments in each research area over the entire contract term. In every case, reference is made to the specific scientific quarterly report in this series in which the cited investigations may be found. (Author) (See also PB 149 146)

Melpar, Inc., Falls Church, Va.
DEVELOPMENT OF STANDARDIZED MODULES FOR AVIONICS EQUIPMENT. Final rept. on N62269-513. Rept. on TED Proj. no. ADC AV44005. 24 Sep 59, 75p. 27 refs. Rept. no. NADC EL5988. 27 refs. Rept. no. NADC EL-5988.
Order from LC $4.50, ph$12.30 PB 152 021

This report released for sale to the public 11 Oct 60.

Melpar, Inc., Falls Church, Va.
GENERATION OF MULTIPOLARIZED ELECTROMAGNETIC WAVES FOR ECM APPLICATIONS, by Edward F. Henry. Scientific rept. no. 1 on Contract AF 19(604)4988. Apr 60, 36p. 3 refs. AFCRC-TN-60-592.
Order from LC mi$3.00, ph$6.30 PB 149 751

Two methods are described for generating a multipolarized wave for ECM jamming purposes. Both methods generally involve the excitation of two orthogonally oriented linear antennas at slightly different frequencies. Discussions and mathematical analyses of the performances of both systems are presented, and some experimental data is included. General design considerations are also outlined. Curves of theoretical relationships are plotted to illustrate performance characteristics. (Author)

Michigan U. Research Inst., Ann Arbor.
DESIGN CONSIDERATIONS FOR A CAPACITANCE-MODULATED VFO, by T. W. Butler, Jr. Technical memo. no. 60 on Contract DA 36-039-sc-63203. Sep 58, 21p. 3 refs. 2262-159-T; AD-208 106.
Order from LC mi$2.70, ph$4.80 PB 147 607

The use of ferroelectric capacitors in the design of a band switching capacity-modulated VFO which will meet FCC specifications regarding Narrow-Band frequency modulation (NFM) is presented. The chief advantage of NFM is that it reduces or eliminates certain types of interference to broadcast reception and is quite simple and inexpensive to construct using capacitance-modulation techniques. (Author)

Michigan U. Research Inst., Ann Arbor.
ELECTRIC-TUNED CAPACITY-MODULATED VHF OSCILLATOR, by T. W. Butler, Jr. Technical memo. no. 59 on Contract DA 36-039-sc-63203. Aug 58, 25p. 2 refs. 2262-186-T; AD-208 108.
Order from LC mi$2.70, ph$4.80 PB 147 606

A method of utilizing the voltage tuning characteristics of ferroelectric capacitors in an electric tuned capacity modulated VHF oscillator is described. The oscillator employs titanate ceramic capacitors as both the tuning and modulating elements. The capacity of the tuning elements is varied by changing the electric field applied to the capacitors. The oscillator may be designed to work in the VHF and UHF regions where reactance-tubes and phase modulation methods are unwieldy. This electric-tuned capacity-modulated VHF oscillator is the result of a development program designed to indicate the direction engineers can take in developing a voltage tunable frequency modulated oscillator suitable for operational use. (Author)

Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF DUPLEXING TECHNIQUES AT HIGH DUTY CYCLE CONDITIONS, by Lawrence Gould. Quarterly progress rept. no. 6, 1 Jan-31 Mar 60, on Contract DA 36-039-sc-78233. [1960] 17p.
Order from LC mi$2.40, ph$3.30 PB 149 609

The leakage power and recovery time characteristics of crystal protector TR tubes designed for high duty cycle duplexers have been investigated. The results show that the leakage power is strongly dependent on receiver mismatch. The role of the various elements of the tube in controlling leakage power and recovery time is described. Preliminary results on a semiconductor switch yield a switching ratio of 0.6 db to 30 db with variation of voltage from -6v to +1 v. (Author). (See also PB 146 796).

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
REFLEX MULTIPACTOR EFFECT, by B. Epsztein. Rept. on Contract AF 18(600)1505. 22 Sep 59, 18p. Research rept. R-763-59; PIB-691; AFOSR-TN-59-1103 AD-228 708.
Order from LC mi$2.40, ph$3.30 PB 149 997

This paper is concerned with the theoretical study of a new type of multipactor which can take place on a single surface in the presence of a tangential d. c. magnetic field. The analysis shows that the presence of this effect depends only on the ratio of the cyclotron frequency corresponding to the applied magnetic field to the operating frequency, once a threshold for the r. f. field is reached. The value of this threshold depends on the secondary emission properties of the surface. Conditions for stable reflex multipactor are given. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
SYNTHESIS AND APPLICATIONS OF LINEAR AND NONLINEAR NETWORKS, by A. B. Giordano. Final rept. for 1 Feb 54-31 May 59 on Contract Nonr-839(05). 15 June 59, 31p. 3 refs. Rept. no. R-747-59; PIB-675; AD-220 686.
Order from LC mi$3.00, ph$6.30 PB 147 612

Details are presented of accomplishments relating to network analysis and synthesis, applications of magnetic amplifiers, nonlinear electronic circuits, and information-networks, including staff and special reports issued. (Author)

National Bureau of Standards [Washington, D. C.].
PROJECT TINKERTOY: A BUREAU OF AERONAUTICS INDUSTRY PREPAREDNESS MEASURE. 30 June 52, declassified, 54p. 4 refs.
Order from LC mi$3.60, ph$9.30 PB 149 618

This report released for sale to the public 23 Aug 60.

The code name TINKERTOY has been given to a system of modular design of electronic equipment especially adaptable to mechanized production. The TINKERTOY System is one of a number of possible embodiments of the building-block principle of construction whereby a variety of complicated electronic equipments may be assembled from a number of small standardized units. Each such unit, or module, consists normally of an electron tube and its associated passive components.

Naval Research Lab., Washington, D. C.
LUMINANCE REQUIRED OF OPAQUE AND TRANSPARENT CATHODE-RAY-TUBE PHOSPHORS, by R. H. Brown. 19 Aug 60, 9p. 10 refs. NRL rept. 5504.
Order from LC mi$1.80, ph$1.80 PB 146 610

Detection and recognition of objects presented on intensity-modulated screens depend on human properties of luminance discrimination and on electronic parameters of the display. An analysis has been made of the human requirements in terms of the variation in the incremental luminance of a signal as a function of the background luminance, and the minimal luminance of a signal for a radar display was derived utilizing assumptions based on state-of-the-art considerations regarding electronic parameters. The theoretical minimal luminance required of the conventional opaque phosphors, with and without circular-polarizing filters, and of the recently developed transparent phosphors were compared with the luminous output currently available. It was determined that at present the opaque phosphor in conjunction with a circular-polarizing filter provides the most visible signal when there is considerable illumination on the display. It seems likely, however, that with further development and by careful choice of the electronic parameters the low available luminance of the transparent phosphors may be increased enough to provide the most visible signal, since the luminance required is less than is required on the opaque phosphors. (Author)

Naval Research Lab., Washington, D. C.
PARASITIC SPIRAL ARRAYS, by R. M. Brown, Jr. and R. C. Dodson. Interim rept. 15 Aug 60, 39p. 6 refs. NRL rept. 5497.
Order from LC mi$3.00, ph$6.30 PB 146 394

The radiation pattern of an array of circularly polarized elements can be scanned by a mechanical rotation of the elements, since the element phase is a function of orientation. This principle has been used in the design of two different arrays of Archimedean spirals, one a "parasitic lens array" and the other a "parasitic reflector array." The lens consists of two arrays of spirals mounted on opposite sides of a conducting plane, each spiral on one side being connected by a transmission line to a corresponding spiral on the opposite side. A feed horn is used to illuminate one of the arrays; the energy received by this array passes through the ground plane via the transmission lines and is reradiated by the spirals on the far side. If the elements are rotated to particular orientations, the incident spherical wave can be focused, and, further, the beam can be scanned if the spirals are rotated properly. The spiral reflector is a single array (using no transmission lines) mounted above a ground plane and, like the lens, is illuminated by a feed horn. It has the same focusing and scanning properties as the lens. Neither array is limited to circular polarization. With a combination of right- and left-hand elements, linear polarization can be used. Twenty-element lenses (two by ten) and 100-element reflectors (ten by ten) have been built and the results have verified the predicted performance. (Author)

Naval Research Lab., Washington, D. C.
A TARGET SIMULATOR, by A. J. Stecca, N. V. O'Neal, and J. J. Freeman. Interim rept. 9 Feb 56, declassified 2 Oct 57, 20p. 10 refs. NRL rept. 4694.
Order from LC mi$2.40, ph$3.30 PB 150 587

This report released for sale to the public 11 Oct 60.

A radar target simulator for quantitative analysis of target noise is described and its correspondence with theory analyzed. The basic idea is the utilization of suitable voltages developed by synchro generators to represent the reflections from a complex target. Experiments to determine target noise characteristics as a function of target reflectivity distribution, target motion, and steady-state tracking error are described. It is shown that the total noise power is independent of target motion, whereas both tracking error and reflectivity distribution and target motion on the noise spectrum is exhibited, increasing rates of target rotation cause the greatest redistribution of the noise power from the low-frequency region to higher frequencies. (Author)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by J. W. Davisson, Joseph Pasternak and others. Status rept. no. 5, Aug 60, 64p. NRL memo. rept. 1089.
Order from OTS $1.75 PB 161 977

Progress continues to be good on thermoelectric materials development. Higher efficiencies continue to be achieved both in materials for Peltier cooling and for power generation, with no indication of reaching a point of diminishing returns. Particularly encouraging are the early results from high energy radiation damage studies. Two studies have progressed to the point where at least preliminary results can be evaluated. The prospects for useful military applications of thermoelectric systems now appear very good. A substantial number of the thermocouple elements exceeded design hopes in efficiency and power output though the average performance of the production runs of elements are considerable lower. Development programs and feasibility studies are in various stages of progress covering a wide range of power levels. The most difficult measurements are those of thermal conductivity, especially at high temperature. In the appendix a discussion on the methods used for measuring thermal conductivity is presented. (See also PB 147 307)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY ABSTRACTS. Bibliography no. 4, Aug 60, 94p. 2092 refs.
Order from OTS $2.25 PB 161 714

This bibliography includes current periodicals and research reports received in the Library of the U. S. Naval Research Laboratory and the following index and abstract journals: Abstracts Journal, Metallurgy (USSR); Applied Mechanics reviews; Applied Science and Technology; ASM Review of Metal Literature; Battelle Technical Review; Bell Telephone Laboratories. Technical Information Libraries. Index to Current Technical Literature; Ceramic Abstracts; Chemical Abstracts; Dissertation Abstracts; East European Accessions Index; Engineering Index; Institute of Radio Engineers. Proceedings; Instrument Abstracts; Metallurgical Abstracts; Monthly Index of Russian Accessions (Library of Congress); Nuclear Science Abstracts; Readers Guide to Periodical Literature; Science Abstracts; Semiconductor Abstracts; Technical Abstract Bulletin (ASTIA); Technical Translations; U. S. Government Research Reports (OTS). (See also PB 161 301)

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
EFFECTS OF RADIATION IMPEDANCE VARIATION ON SONAR TRANSDUCER PERFORMANCE IN A LARGE ARRAY, by Ralph S. Woollett. 27 July 59, 25p. 6 refs. USL Research rept. no. 428; AD-226 248.
Order from LC mi$2.70, ph$4.80 PB 150 291

The transducer elements in a large array have different radiation impedances because of the acoustic interaction effects among the elements. The characteristics of the transducer element which are of operational interest, such as power capacity, efficiency, phase shift, and input impedance, depend on radiation impedance and hence are different for different elements. In this report equations relating these performance factors to radiation impedance are given for a simple piezoelectric type of transducer. Numerical results are presented for an array of identical transducer elements of this class, using radiation impedance data which were recently calculated for a large spherical array of pistons. The effects of the radiation impedance variation on array performance were judged moderate enough to be accommodated without much change in conventional practices. (Author).

New York U. Coll. of Engineering, N. Y.
EVALUATION AND OPTIMIZATION OF DIGITAL COMMUNICATION SYSTEMS, by Leonard C. Schwartz. Final rept. on Contract AF 19(604)1964. 14 Feb 60, 13p. 4 refs. AFCRC-TR-60-114; AD-234 741.
Order from LC mi$2.40, ph$3.30 PB 148 249

The work under this contract on the evaluation of digital communication systems and their optimization under practical criteria and constraints is summarized. The topics mentioned are the general theory of digital communication systems with fading and interference in both direct and feedback channels; experimental null reception systems; the extension of null reception to binary communication systems employing envelope detection, including FSK; self-synchronizing systems and; signal-to-noise ratio and channel reliability estimation. Possible future research investigation is also discussed. (Author) (See also PB 142 381)

New York U. Coll. of Engineering, New York
OPTIMUM TRANSMISSION OF CONTINUOUS SIGNAL OVER A SAMPLED DATA LINK, by S. S. L. Chang. Rept. on Contract AF 49(638)586. June 60, 12p. 4 refs. Technical rept. 400-11; AFOSR-TN-60-492; AD-239 440.
Order from LC mi$2.40, ph$3.30 PB 148 945

A method for simultaneous optimization of the presampling filter and post sampling filter in a sampled data link is derived together with an equation for evaluating the mean square error. These equations are simple and easy to use, and the method has been illustrated by applying it to a typical design problem.

New York U. Coll. of Engineering, N. Y.
A REGENERATIVE NON-LINEAR FEEDBACK SYSTEM, by Paul E. Fleischer. Rept. on Contract AF 49(638)586. May 60, 26p. Technical rept. 400-10; AFOSR-TN-60-433. AD-239 439.
Order from LC mi$2.70, ph$4.80 PB 148 944

A feedback system proposed for reducing the effect of a non-linear plant on system performance is investigated. The feedback system operates by comparing the actual output with the desired system output (internally generated) and using this difference as an actuating signal. It is shown that the arrangement, while of novel configuration, is completely equivalent to a single loop feedback system. A typical system is investigated to provide an illustration of the conclusions drawn from this study.

Ordnance Research Lab., Pennsylvania State U., University Park.
A MINIATURE LOW-FREQUENCY SELECTIVE AMPLIFIER, by Wesley Grant Houser. Rept. no. 47 on Contract NOrd-16597. 2 Jan 59, 66p. 11 refs. AD-211 718.
Order from LC mi$3.90, ph$10.80 PB 150 298

Theoretical and experimental investigations reveal that a selective amplifier having a center frequency in the 2 to 15 cps range and a bandwidth less than 10 per cent of the center frequency can be constructed by using a transistor amplifier and a parallel-T feedback network. The circuit, excluding power supply, can be confined to a space measuring 3" by 2 1/4" by 1". The transistor amplifier requires current, as well as voltage, feedback. The parallel-T network is, therefore, required to operate under finite loading. The loading effects are: (a) a positive shift in center frequency, and (b) an increase in bandwidth. The derived equations are able to predict these effects within 2.6 per cent in center frequency and within 16 per cent in bandwidth. (Author)

Pennsylvania State U., University Park.
PROPAGATION-DISTORTION OF BANDS OF LARGE-AMPLITUDE ACOUSTIC NOISE. I. THEORETICAL ANALYSIS OF THE PLANE WAVE CASE, by Wayne A. Burnett and Eugene Ackerman. Rept. on Generation, Propagation, Action, and Control of Acoustic Energy, Contract AF 33(616)2772. May 60, 55p. 6 refs. WADD Technical rept. 60-232.
Order from OTS $1.50 PB 171 021

The problem of the propagation of finite amplitude sound waves from a noise source is considered. After a review of the history of the problem, second order techniques are developed and applied to the problem of narrow bands of noise, less than an octave wide at the generator. Five cases of qualitatively different propagation behavior can be distinguished depending on the ranges of frequencies and sound pressure level. For three of the five cases the second order techniques developed are adequate. Unsuccessful attempts at more general solutions are briefly summarized in the appendix, along with suggestions for extending the analyses and increasing the validity of the final solutions. (Author)

Philco Corp., Lansdale, Pa.
NUCLEAR RADIATION RESISTANT POWER TRANSISTORS, by G. F. Watson. Quarterly progress rept. no. 1, 15 May-15 Aug 59, on Contract DA 36-039-sc-78307. [1959] 38p; AD-229 893.
Order from LC mi$3.00, ph$6.30 PB 149 000

Preparations for nuclear irradiations were made. The nuclear reactor at the MIT reactor center was selected as the radiation source. The surface barrier transistor dosimeter technique was used to calibrate the reactor. It was found that exposure in core tube 3GV6 for periods of 1.8 min and 18 min will provide accumulated dosages of 10^{13} and 10^{14}NVT, respectively. Large-area jet etching techniques advanced to the stage where a cabinet model jet etcher was constructed and put in operation. Emitter pits 95 mils diam and collector pits 115 mils diam were etched with this system. The machine incorporates a new illumination technique. An electrochemical jet plating machine, for the formation of emitter and collector electrodes, is now being constructed. The feasibility of forming emitter and collector electrodes by evaporation techniques is being studied. Indium electrodes as large as 100 mils diam were evaporated onto the surface of large unetched diffused blanks. Satisfactory micro alloying was obtained in units heated to 200°C with an indium pellet placed on the evaporated electrode. (Author)

Philco Corp., Philadelphia, Pa.
RESEARCH ON HIGH-TEMPERATURE SWITCHING DEVICES, by E. Zimmerman. Quarterly status rept. no. 4, 1 Feb-30 Apr 60 (Final technical rept. 1 May-30 Apr 60) on Contract AF 19(604)5719. June 60, 38p. 3 refs. Philco no. H-2227-F; ERD-TR-60-167.
Order from LC mi$3.00, ph$6.30 PB 149 832

The object was to conduct a theoretical and experimental investigation of semiconductor switching devices capable of high-temperature (150°C or more) performance, and comparable or superior at low and medium temperatures to existing devices. The wide-gap material GaAs was used initially in analog type, subsequently in bipolar transistor structures, and finally in tunnel diodes. Single-crystal GaAs was grown by horizontal zone-melt techniques. Two main purification methods were investigated: reaction conditions were held constant while element purification procedures were varied; a standard purification procedure was used to study probable contamination from boat materials. Two diffusion methods - box diffusion and sealed-tube diffusion - were studied as techniques for forming junctions and for converting crystals to the desired type and resistivity. Three bipolar transistor structures were evaluated: the homogeneous base NPN and PNP transistors, and mesa NPN transistor. Techniques were developed that yielded high-frequency GaAs tunnel diodes with an f_{MAX} of 3.5 Gc and a potential f_{MAX} of 10 Gc.

Pickard and Burns, Inc., Needham, Mass.
INTERFEROMETER DEVELOPMENT, by John E. Walsh and Hans E. Band. Final rept. on Contract AF 19(604)5435. 29 Feb 60, 74p. 46 refs. P&B Pub. no. 602; AFCRC-TR-60-120.
Order from LC mi$4.50, ph$12.30 PB 148 952

An investigation has been made of the application of correlation techniques to the controlling of multi-element antenna patterns and the enhancement of the signal-to-noise ratio of signals derived from such systems. The primary objective is the production of single-lobed patterns of high resolution using a minimum number of antenna elements. One of the simplest configurations involves two linear arrays of fixed lengths and phase center spacing. The element spacing of the two arrays differs, but exceeds one wavelength. This results in a loss of gain over that of a closely spaced, non-ambiguous array, but allows reduction of the number of elements. Correlation of the added output of one array with that of the other will reduce all major lobes but one, provided only one signal of a given frequency is incident on the antenna system. The correlator also reduces incident noise especially if an additional fixed time delay is introduced between the additive array signals prior to correlation. An attempt has been made to produce patterns by multiplication of signals from a continuous aperture antenna, with the sum of the outputs of individual array elements. For the purposes of drift-free multiplication, amplitude modulation is imposed on the RF signal, preferably at the transmitter. The multiplier is followed by an audio filter tuned to the modulation frequency, from which the desired product signal is obtained.

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by R. Glicksman. Quarterly rept. no. 1, 15 June-15 Sep 58, on Contract DA 36-039-sc-78048. [1958] 52p. 8 refs.
Order from LC mi$3.60, ph$9.30 PB 150 579

This report released for sale to the public 12 Oct 60.

The performance characteristics of A-size Mg $MgBr_2$ m-dinitrobenzene dry cells are compared with those of comparable size magnesium and zinc-manganese dioxide cells. The m-dinitrobenzene cells give more hours of service to 0.90 volt than the manganese dioxide cells over the entire range of discharge tests. On the basis of watt-minute capacity per unit of volume, they are superior to the zinc-electrolytic MnO_2 cells at all but low power output levels but are inferior to the magnesium-African MnO_2 cells. On a weight basis, the organic cells are superior to the zinc-electrolytic MnO_2 cells over the entire range of power output levels, and have a greater watt-minute/g capacity than the magnesium-MnO_2 cells at power outputs greater than 15 milliwatts. The use of a mercurous bromide inhibitor in AA-size Mg| $MgBr_2$ | m-dinitrobenzene cells has resulted in a 25% improvement in cell capacity at low current drains. Capacities of 75 watt-hours/lb have been obtained from these cells. Half-cell potential studies of various heterocyclic nitro compounds indicate that the nitropyridine compounds show promise for use as cathode materials in primary cells because of their high-cathode potentials and efficiencies. (Author)

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen and R. Glicksman. Quarterly rept. no. 2, 15 Sep-14 Dec 58, on Contract DA 36-039-sc-78048. [1958] 58p. 19 refs.
Order from LC mi$3.60, ph$9.30 PB 150 580

This report released for sale to the public 12 Oct 60.

The effect of various ratios of Cabot and Darco G-60 blacks on the performance of A-size $Mg/MgBr_2$/m-Dinitrobenzene cells was studied. It was found that the maximum theoretical cell capacities were obtained at m-DNB/Cabot ratios of 2.1:1 (218 Amp-Min), and m-DNB/Darco ratios of 1.1:1 (196 Amp-min), assuming a 65% Mg efficiency. Based on actual performance data, optimum experimental capacities were obtained at ratios of 1.5 to 2:1 for the Cabot and 0.3-0.5:1 for the Darco blacks. The effect of mercurous salts in the electrolyte continued to be beneficial especially at low current drains. A-size $Mg/MgBr_2$/m-DNB cells made with this inhibitor gave 15-20% more hours of service on 166 2/3-ohm continuous discharge tests than comparable cells containing only a chromate inhibitor. Shelf-life data obtained from AA- and A-size magnesium dry cells containing various aromatic dinitrobenzene and various nitropyridine and nitroquinoline compounds as cathodes, indicate a favorable three month shelf-life for these dry cells. Electrochemical studies of various dinitropyridine compounds are presented in addition to half-cell potential data for various aromatic hydroxy compounds. For the latter compounds, the effect of such factors as group substitution, aromaticity, and pH on the operating potential and coulombic capacity are discussed. The use of these compounds as anode materials in galvanic cells is also considered. (Author) (See also PB 150 579)

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen and R. Glicksman. Quarterly rept. no. 3, 15 Dec 58-14 Mar 59, on Contract DA 36-039-sc-78048. [1959] 56p. 12 refs.
Order from LC mi$3.60, ph$9.30 PB 150 581

This report released for sale to the public 12 Oct 60.

Studies of the effect of water on cell performance were made with A-size $Mg/MgBr_2$/m-DNB cells wherein the m-DNB/carbon black ratio was held constant while the H_2O/m-DNB ratio was varied. For these cells, the cathode efficiencies were found to increase with increasing H_2O/m-DNB ratios at the low ratios and to assume more constant values at the high H_2O/m-DNB ratios. A comparison of $Mg/MgBr_2$/m-DNB and $Mg/Mg(ClO_4)_2$/m-DNB dry cells indicates that on heavy drain (16 2/3-ohm) tests the perchlorate cells are superior, however on low drain (166 2/3-ohm) tests they do not perform as well as the cells with a magnesium bromide electrolyte. A consideration of alternative designs for the conventional round $Mg/MgBr_2$/m-DNB cell indicates that greater performance gains can be obtained with flat type cells rather than with a round "inside-out" type of cell. Half-cell potential and experimental dry cell data of various nitropyridine compounds are presented in addition to half-cell potential data for various aromatic amine and aminophenol compounds. For the latter compounds, the effect of such

factors as group substitution, aromaticity, and pH on the operating potential and coulombic capacity are discussed. The use of these compounds as anode materials in galvanic cells is also considered. (Author) (See also PB 150 580)

Radio Corp. of America, [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AT THE ACTIVE COMPONENTS, by J. B. Eisen and R. Glicksman. Quarterly rept. no. 4, 15 Mar-14 June 59, on Contract DA 36-039-sc-78048. [1959] 53p. 6 refs. AD-226 587.
Order from LC mi$3.60, ph$9.30 PB 150 582

This report released for sale to the public 13 Oct 60.

A study of the effect of various high overvoltage metal chromates in the cathode mix on the cell performance of $Mg/MgBr_2$/m-DNB cells indicates performance gains may be obtained with the use of Hg_2CrO_4 and $ZnCrO_4$. Additional studies dealing with the use of a $Mg(ClO_4)_2$ electrolyte in organic cells shows the optimum electrolyte concentration in $Mg/Mg(ClO_4)_2$/m-DNB cells to be 0.8 to 1.8 molar. A study of a number of cell variables such as separator materials, blending techniques, and wetting agents is being made with inside-out type $Mg/MgBr_2$/m-DNB flat cells. Thus far organic flat cells have been made which give 68.5 watt-hr/lb at the 31 hr discharge rate. Half-cell potential and experimental dry cell data of nitrofuran, nitrothiophene, and other five membered heterocyclic nitro compounds are presented and their use as cathode materials in primary cells is considered. Performance data for $Mg/MgBr_2$/m-DNB cells in the Signal Corps Radio Set AN/PRC-35 are presented. (Author). (See also PB 150 581).

Radio Corp. of America, Somerville, N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen, R. A. Walck, and R. Glicksman. Quarterly rept. no. 5, 15 June-14 Sep 59, on Contract DA 36-039-sc-78048. [1959] 63p. 21 refs. AD-229 118.
Order from LC mi$3.90, ph$10.80 PB 150 583

This report released for sale to the public 12 Oct 60.

Work is being continued on the design of a practical flat type $Mg/MgBr_2$/m-DNB cell. At the present stage of their development these cells give 50 - 60 watt-hours/lb at discharge rates of 10 to 20 hours. Additional studies of the use of mercuric salt inhibitors in $Mg/MgBr_2$/m-DNB cells indicate performance gains of 15 - 20% at low current drains can be obtained with the use of HgS, HgSe, and HgTe additives. Data on the thermal and vacuum-thermal blending of m-DNB and carbon black indicate performance gains on high rate tests can be obtained with thermal treatments of Darco carbon black. Shelf-life data for A-size $Mg/MgBr_2$/m-DNB cells indicate a favorable six month shelf life for these cells. Impedance measurements of AA-size $Mg/MgBr_2$/m-DNB cells under a variety of conditions show these cells to have greater impedance than the Leclanche cells, especially at low frequencies and light current drains. A study of the electrochemical characteristics of organic hydrazine and hydroxylamine compounds is presented. The data indicate that hydrazine is a more attractive anode material than any of its organic derivatives. (Author) (See also PB 150 582)

Radio Corp. of America, Somerville, N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen, R. A. Walck and others. Quarterly rept. no. 6, 15 Sep-15 Dec 59, on Contract DA 36-039-sc-78048. [1959] 67p. 13 refs. AD-234 156.
Order from LC mi$3.90, ph$10.80 PB 150 584

This report released for sale to the public 12 Oct 60.

$Mg/MgBr_2$/m-DNB flat cells on single cell tests simulating the BA-317 tests have given 12 hours service. The inner-anode and inner-cathode flat cell designs were found to give similar performance. The temperature coefficient for A-size $Mg/MgBr_2$/m-DNB cells was found to be 0.87 watt-hours/lb/°C. Shelf-life data for A-size $Mg/MgBr_2$/m-DNB cells continues to be favorable. Optimum performance for A-size $Mg/MgBr_2$/m-DNB cells using Columbia carbon was obtained from cells using a 3:1 m-DNB to carbon ratio. Experimental half-cell potential discharge data show the nitropyrimidine and nitrosopyrimidine derivatives to have a higher cathode potential than their benzene analogues. (Author) (See also PB 150 583)

Raytheon Co., Newton, Mass.
INVESTIGATION ON CERAMIC SEALS FOR ELECTRON TUBES, by Austin H. King. Final rept. for 9 Apr 59-31 Mar 60 on Contract AF 19(604)5706. 25 Apr 60, 39p. AFCRC-TR-60-151.
Order from LC mi$3.00, ph$6.30 PB 150 190

This report includes a review of the whole program to work out reliable methods for making seals for evaluation. Two types of seals are needed in vacuum tubes: a ductile braze for sub-assembly to accommodate some mismatch of expansion coefficients, and a reactive seal with suitably low vapor pressure and temperature for making the final seal in a vacuum. These requirements are met by a copper braze to a metallized ceramic and a reactive seal of Ni-Ti eutectic for the final seal. Details for making each type of seal are discussed. Figures of tensile strength are in doubt when derived from tests in compression or twisting, or from published values for the ceramics. Measurement of seal strength is here made by direct tensile tests. This method is applicable to the ceramics alone as well as to the seals. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
A PRECISION CONDUCTANCE BRIDGE OF NEW DESIGN, by George J. Janz and James D. E. McIntyre. Technical note no. 12 on Contract AF 49(638)50. June 60, 18p. 10 refs. AFOSR-TN-60-652; AD-240 365.
Order from LC mi$2.40, ph$3.30 PB 149 436

A conductance bridge in which the essential component is a precision impedance comparator and which combines speed, wide range, and high accuracy in measurements is described. While fundamentally similar in design and operation to the precision A. C. conductance bridges known today, the present design has the attractive features of simplicity of construction from unitized

Order from LC mi$2.40, ph$3.30 PB 150 587

This report released for sale to the public 11 Oct 60.

A radar target simulator for quantitative analysis of target noise is described and its correspondence with theory analyzed. The basic idea is the utilization of suitable voltages developed by synchro generators to represent the reflections from a complex target. Experiments to determine target noise characteristics as a function of target reflectivity distribution, target motion, and steady-state tracking error are described. It is shown that the total noise power is independent of target motion, whereas both tracking error and reflectivity distribution and target motion on the noise spectrum is exhibited, increasing rates of target rotation cause the greatest redistribution of the noise power from the low-frequency region to higher frequencies. (Author)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by J. W. Davisson, Joseph Pasternak and others. Status rept. no. 5, Aug 60, 64p. NRL memo. rept. 1059.
Order from OTS $1.75 PB 161 977

Progress continues to be good on thermoelectric materials development. Higher efficiencies continue to be achieved both in materials for Peltier cooling and for power generation, with no indication of reaching a point of diminishing returns. Particularly encouraging are the early results from high energy radiation damage studies. Two studies have progressed to the point where at least preliminary results can be evaluated. The prospects for useful military applications of thermoelectric systems now appear very good. A substantial number of the thermocouple elements exceeded design hopes in efficiency and power output though the average performance of the production runs of elements are considerable lower. Development programs and feasibility studies are in various stages of progress covering a wide range of power levels. The most difficult measurements are those of thermal conductivity, especially at high temperature. In the appendix a discussion on the methods used for measuring thermal conductivity is presented. (See also PB 147 307)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY ABSTRACTS. Bibliography no. 4, Aug 60, 94p. 2092 refs.
Order from OTS $2.25 PB 161 714

This bibliography includes current periodicals and research reports received in the Library of the U. S. Naval Research Laboratory and the following index and abstract journals: Abstracts Journal, Metallurgy (USSR); Applied Mechanics reviews; Applied Science and Technology; ASM Review of Metal Literature; Battelle Technical Review; Bell Telephone Laboratories. Technical Information Libraries. Index to Current Technical Literature; Ceramic Abstracts; Chemical Abstracts; Dissertation Abstracts; East European Accessions Index; Engineering Index; Institute of

Science Abstracts: Semiconductor Abstracts; Technical Abstract Bulletin (ASTIA); Technical Translations; U. S. Government Research Reports (OTS). (See also PB 161 301)

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
EFFECTS OF RADIATION IMPEDANCE VARIATION ON SONAR TRANSDUCER PERFORMANCE IN A LARGE ARRAY, by Ralph Woollett. 2 July 59, 25p. 6 refs. USL Research rept. no. 428. AD-226 248
Order from LC mi$2.70, ph$4.80 PB 150 291

The transducer elements in a large array have different radiation impedances because of the acoustic interaction effects among the elements. The characteristics of the transducer element which are of operational interest, such as power capacity, efficiency, phase shift and input impedance, depend on radiation impedance and hence are different for different elements. In this report equations relating these performance factors to radiation impedance are given for a simple piezoelectric type of transducer. Numerical results are presented for an array of identical transducer elements of this class, using radiation impedance data which were recently calculated for a large spherical array of pistons. The effects of the radiation impedance variation on array performance were judged moderate enough to be accommodated without much change in conventional practices. (Author).

New York U. Coll. of Engineering, N. Y.
EVALUATION AND OPTIMIZATION OF DIGITAL COMMUNICATION SYSTEMS, by Leonard C. Schwartz. Final rept. on Contract AF 19(604)1964. 14 Feb 60, 13p. 4 refs. AFCRC-TR-60-114; AD-234 741.
Order from LC mi$2.40, ph$3.30 PB 148 249

The work under this contract on the evaluation of digital communication systems and their optimization under practical criteria and constraints is summarized. The topics mentioned are the general theory of digital communication systems with fading and interference in both direct and feedback channels; experimental null reception systems; the extension of null reception to binary communication systems employing envelope detection, including FSK; self-synchronizing systems and; signal-to-noise ratio and channel reliability estimation. Possible future research investigation is also discussed. (Author) (See also PB 142 381)

New York U. Coll. of Engineering, New York
OPTIMUM TRANSMISSION OF CONTINUOUS SIGNAL OVER A SAMPLED DATA LINK, by S. S. L. Chang. Rept. on Contract AF 49(638)586. June 60, 12p. 4 refs. Technical rept. 400-11; AFOSR-TN-60-492; AD-239 440.
Order from LC mi$2.40, ph$3.30 PB 148 945

A method for simultaneous optimization of the presampling filter and post sampling filter in a sampled

illustrated by applying it to a typical design problem.

New York U. Coll. of Engineering, N. Y.
A REGENERATIVE NON-LINEAR FEEDBACK SYSTEM, by Paul E. Fleischer. Rept. on Contract AF 49(638)586. May 60, 26p. Technical rept. 400-10; AFOSR-TN-60-433. AD-239 439.
Order from LC mi$2.70, ph$4.80 PB 148 944

A feedback system proposed for [illegible] a non-linear plant on system performance is investigated. The feedback system operates by comparing the actual output with the desired system output (internally generated) and using this difference as an actuating signal. It is shown that the arrangement, while of novel configuration, is completely equivalent to a single loop feedback system. A typical system is investigated to provide an illustration of the conclusions drawn from this study.

Ordnance Research Lab., Pennsylvania State U., University Park.
A MINIATURE LOW-FREQUENCY SELECTIVE AMPLIFIER, by Wesley Grant Houser. Rept. no. 47 on Contract NOrd-16597. 2 Jan 59, 66p. 11 refs. AD-211 718.
Order from LC mi$3.90, ph$10.80 PB 150 298

Theoretical and experimental investigations reveal that a selective amplifier having a center frequency in the 2 to 15 cps range and a bandwidth less than 10 per cent of the center frequency can be constructed by using a transistor amplifier and a parallel-T feedback network. The circuit, excluding power supply, can be confined to a space measuring 3" by 2 1/4" by 1". The transistor amplifier requires current, as well as voltage, feedback. The parallel-T network is, therefore, required to operate under finite loading. The loading effects are: (a) a positive shift in center frequency, and (b) an increase in bandwidth. The derived equations are able to predict these effects within 2.6 per cent in center frequency and within 16 per cent in bandwidth. (Author)

Pennsylvania State U., University Park.
PROPAGATION DISTORTION OF BANDS OF LARGE-AMPLITUDE ACOUSTIC NOISE. I. THEORETICAL ANALYSIS OF THE PLANE WAVE CASE, by Wayne A. Burnett and Eugene Ackerman. Rept. on Generation, Propagation, Action, and Control of Acoustic Energy, Contract AF 33(616)2772. May 60, 55p. 6 refs. WADD Technical rept. 60-232.
Order from OTS $1.50 PB 171 021

The problem of the propagation of finite amplitude sound waves from a noise source is considered. After a review of the history of the problem, second order techniques are developed and applied to the problem of narrow bands of noise, less than an octave wide at the generator. Five cases of qualitatively different propagation behavior can be distinguished depending on the ranges of frequencies and sound pressure level. For three of the five cases the second order techniques developed are adequate. Unsuccessful attempts at more

(Author)

Philco Corp., Lansdale, Pa.
NUCLEAR RADIATION RESISTANT POWER TRANSISTORS, by G. F. Watson. Quarterly progress rept. no. 1, 15 May-15 Aug 59, on Contract DA 36-039-sc-78307. [1959] 38p; AD-229 893.
Order from LC mi$3.00, ph$6.30 PB 149 000

[illegible] nuclear irradiations were made. The nuclear reactor at the MIT reactor center was selected as the radiation source. The surface barrier transistor dosimeter technique was used to calibrate the reactor. It was found that exposure in core tube 3GV6 for periods of 1.8 min and 18 min will provide accumulated dosages of 10^{13} and 10^{14}NVT, respectively. Large-area jet etching techniques advanced to the stage where a cabinet model jet etcher was constructed and put in operation. Emitter pits 95 mils diam and collector pits 115 mils diam were etched with this system. The machine incorporates a new illumination technique. An electrochemical jet plating machine, for the formation of emitter and collector electrodes, is now being constructed. The feasibility of forming emitter and collector electrodes by evaporation techniques is being studied. Indium electrodes as large as 100 mils diam were evaporated onto the surface of large unetched diffused blanks. Satisfactory micro alloying was obtained in units heated to 200°C with an indium pellet placed on the evaporated electrode. (Author)

Philco Corp., Philadelphia, Pa.
RESEARCH ON HIGH-TEMPERATURE SWITCHING DEVICES, by E. Zimmerman. Quarterly status rept. no. 4, 1 Feb-30 Apr 60 (Final technical rept. 1 May-30 Apr 60) on Contract AF 19(604)5719. June 60, 38p. 3 refs. Philco no. H-2227-F; ERD-TR-60-167.
Order from LC mi$3.00, ph$6.30 PB 149 832

The object was to conduct a theoretical and experimental investigation of semiconductor switching devices capable of high-temperature (150°C or more) performance, and comparable or superior at low and medium temperatures to existing devices. The wide-gap material GaAs was used initially in analog type, subsequently in bipolar transistor structures, and finally in tunnel diodes. Single-crystal GaAs was grown by horizontal zone-melt techniques. Two main purification methods were investigated: reaction conditions were held constant while element purification procedures were varied; a standard purification procedure was used to study probable contamination from boat materials. Two diffusion methods - box diffusion and sealed-tube diffusion - were studied as techniques for forming junctions and for converting crystals to the desired type and resistivity. Three bipolar transistor structures were evaluated: the homogeneous base NPN and PNP transistors, and mesa NPN transistor. Techniques were developed that yielded high-frequency GaAs tunnel diodes with an f_{MAX} of 3.5 Gc and a potential f_{MAX} of 10 Gc.

Pickard and Burns, Inc., Needham, Mass.
INTERFEROMETER DEVELOPMENT, by John E. Walsh and Hans E. Band. Final rept. on Contract AF 19(604)5435. 29 Feb 60, 74p. 46 refs. P&B Pub. no. 602; AFCRC-TR-60-120.
Order from LC mi$4.50, ph$12.30 PB 148 952

An investigation has been made of the application of correlation techniques to the controlling of multi-element antenna patterns and the enhancement of the signal-to-noise ratio of signals derived from such systems. The primary objective is the production of single-lobed patterns of high resolution using a minimum number of antenna elements. One of the simplest configurations involves two linear arrays of fixed lengths and phase center spacing. The element spacing of the two arrays differs, but exceeds one wavelength. This results in a loss of gain over that of a closely spaced, non-ambiguous array, but allows reduction of the number of elements. Correlation of the added output of one array with that of the other will reduce all major lobes but one, provided only one signal of a given frequency is incident on the antenna system. The correlator also reduces incident noise especially if an additional fixed time delay is introduced between the additive array signals prior to correlation. An attempt has been made to produce patterns by multiplication of signals from a continuous aperture antenna, with the sum of the outputs of individual array elements. For the purposes of drift-free multiplication, amplitude modulation is imposed on the RF signal, preferably at the transmitter. The multiplier is followed by an audio filter tuned to the modulation frequency, from which the desired product signal is obtained.

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by R. Glicksman. Quarterly rept. no. 1, 15 June-15 Sep 58, on Contract DA 36-039-sc-78048. [1958] 52p. 8 refs.
Order from LC mi$3.60, ph$9.30 PB 150 579

This report released for sale to the public 12 Oct 60.

The performance characteristics of A-size Mg $MgBr_2$ m-dinitrobenzene dry cells are compared with those of comparable size magnesium and zinc-manganese dioxide cells. The m-dinitrobenzene cells give more hours of service to 0.90 volt than the manganese dioxide cells over the entire range of discharge tests. On the basis of watt-minute capacity per unit of volume, they are superior to the zinc-electrolytic MnO_2 cells at all but low power output levels but are inferior to the magnesium-African MnO_2 cells. On a weight basis, the organic cells are superior to the zinc-electrolytic MnO_2 cells over the entire range of power output levels, and have a greater watt-minute/g capacity than the magnesium-MnO_2 cells at power outputs greater than 15 milliwatts. The use of a mercurous bromide inhibitor in AA-size Mg| $MgBr_2$ | m-dinitrobenzene cells has resulted in a 25% improvement in cell capacity at low current drains. Capacities of 75 watt-hours/lb have been obtained from these cells. Half-cell potential studies of various heterocyclic nitro compounds indicate that the nitropyridine compounds show promise for use as cathode materials in primary cells because of their high cathode potentials and efficiencies. (Author)

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen and R. Glicksman. Quarterly rept. no. 2, 15 Sep-14 Dec 58, on Contract DA 36-039-sc-78048. [1958] 58p. 19 refs.
Order from LC mi$3.60, ph$9.30 PB 150 580

This report released for sale to the public 12 Oct 60.

The effect of various ratios of Cabot and Darco G-60 blacks on the performance of A-size Mg/$MgBr_2$/m-Dinitrobenzene cells was studied. It was found that the maximum theoretical cell capacities were obtained at m-DNB/Cabot ratios of 2.1:1 (218 Amp-Min), and m-DNB/Darco ratios of 1.1:1 (196 Amp-min), assuming a 65% Mg efficiency. Based on actual performance data, optimum experimental capacities were obtained at ratios of 1.5 to 2:1 for the Cabot and 0.3-0.5:1 for the Darco blacks. The effect of mercurous salts in the electrolyte continued to be beneficial especially at low current drains. A-size Mg/$MgBr_2$/m-DNB cells made with this inhibitor gave 15-20% more hours of service on 166 2/3-ohm continuous discharge tests than comparable cells containing only a chromate inhibitor. Shelf-life data obtained from AA- and A-size magnesium dry cells containing various aromatic dinitrobenzene and various nitropyridine and nitroquinoline compounds as cathodes, indicate a favorable three month shelf-life for these dry cells. Electrochemical studies of various dinitropyridine compounds are presented in addition to half-cell potential data for various aromatic hydroxy compounds. For the latter compounds, the effect of such factors as group substitution, aromaticity, and pH on the operating potential and coulombic capacity are discussed. The use of these compounds as anode materials in galvanic cells is also considered. (Author) (See also PB 150 579)

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Rensselaer Polytechnic Inst., Troy, N. Y.
A PRECISION CONDUCTANCE BRIDGE OF NEW DESIGN, by George J. Janz and James D. E. McIntyre. Technical note no. 12 on Contract AF 49(638)50. June 60, 18p. 10 refs. AFOSR-TN-60-652; AD-240 365.
Order from LC mi$2.40, ph$3.30 PB 149 436

A conductance bridge in which the essential component is a precision impedance comparator and which combines speed, wide range, and high accuracy in measurements is described. While fundamentally similar in design and operation to the precision A. C. conductance bridges known today, the present design has the attractive features of simplicity of construction from unitized

components available on the market, and provision for use of the "four-leads" cell technique to eliminate connecting lead effects in remote conductance measurements. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
STEP TRANSFORMERS WITH LARGE TRANSFORMATION RATIO, by Edward Malowicki. July 60, 56p. 8 refs. RADC-TR-60-87.
Order from LC mi$3.60, ph$9.30 PB 150 268

This report is concerned with the problem of matching two real impedances whose ratio is large, for example, 36, over a wide band of frequencies, such as 65 to 285 megacycles, in the VHF band. The matching device considered, called a step transformer, is composed of cascaded lengths of transmission lines which may differ from each other in length and characteristic impedance. Results of investigation indicate that for a given maximum ripple, the Tchebyscheff transformer gives the best wideband performance with the least number of sections for the values of ρ and VSWR considered. (Author)

South Carolina U., Columbia.
CYLINDRICAL REFLECTORS FOR DIRECTING AND CONCENTRATING MICROWAVE BEAMS, by R. G. Fellers and F. E. Rouffy, Jr. Rept. on Contract AF 18(603)43. 1 Apr 60, 52p. 18 refs. AFOSR-TN-60-427; AD-237 565.
Order from LC mi$3.60, ph$9.30 PB 148 026

The straight-line transmission performance of a full-paraboloidal microwave antenna transmission system at 35.3 KMc was investigated theoretically and experimentally. To determine if the performance of this free space transmission system could be improved, four cylindrically shaped aluminum-foil-surfaced reflectors were designed, constructed, and placed midway in the transmission path so as to effect a 90° "corner-reflection" of a transmitted beam, and in so doing to concentrate the beam in order to obtain a power gain over straight-line transmission. At the total transmission distances, D^2/λ, $2D^2/\lambda$, $4D^2/\lambda$ (36 ft., 72 ft., 144 ft.), transmission losses with a plane reflector were compared with the straight-line transmission losses; within meter accuracy (±0.2db.) these losses were measured as equal. Power gains resulting from the use of the cylindrically curved reflectors were then measured as gains over plane reflector transmission. Within the discrete range of transmission total distance, the minimum power gain was measured as 2.8 db. at D^2/λ. The maximum power gain was measured as 5.3 db. at $4D^2/\lambda$. Empirical rules were made for estimating the gain produced by the various curved reflectors. Design equations and considerations are presented for the construction of curved reflectors.

Stanford Electronics Labs., Stanford U., Calif.
AN IMPROVED ELECTROLYTIC TANK FOR DESIGNING ELECTRON GUNS, by A. S. Creason and M. D. Hare. Rept. on Contract DA 36-039-sc-73178. 25 Jan 60, 43p. 9 refs. Technical rept. no. 314-1.
Order from LC mi$3.30, ph$7.80 PB 147 912

This paper describes an improved electrolytic tank and circuit for rapidly and conveniently designing the focus electrodes of the Pierce type of electron gun for either solid or hollow beams. The tank has glass-epoxy-resin sides and a plate-glass bottom. It is rigid enough to be supported without distortion on three adjustable legs and light enough to be portable within the laboratory. The potentials from a maximum of twenty-four probes along the edge of the simulated electron beam are measured by a null method. To accommodate the two beam boundaries of a hollow-beam gun, signals from either of two sets of probes can be switched into the circuit. To avoid undesirable capacitance effects, the system uses a high-power, low-impedence signal source and a high-conductivity electrolyte.

Stanford Electronics Labs., Stanford U., Calif.
THE THEORY OF TWO PORTS, by J. G. Linvill. Rept. on Contract Nonr-225(44). 15 Oct 59, 29p. 4 refs. Technical rept. no. 1505-2.
Order from LC mi$2.70, ph$4.80 PB 149 491

The power gains, port immittances, and sensitivities of amplification to parameter variation are functions of the two-port parameters and terminating impedances. Expressions for these functions in terms of the common parameter types and the terminating immittances are necessary in amplifier design. It is simply shown that expressions for these functions in terms of general parameters can be written which are applicable for any particular parameter type. Two-port network theory is generalized here to treat the case of contaminating signals due to noise, temperature variation, or distortion. The form of the present discussion is definition of parameters which characterize the generation of contaminating signals in the two-port. In a subsequent step the transmission is considered of the contaminating signals from their point of origin to the output where they corrupt the desired signal being transmitted. In the final step one can select optimum terminating impedances which minimize corruption of the desired signal by the contaminating ones. (Author)

Stanford Electronics Labs., Stanford U., Calif.
TRANSHORIZON MEASUREMENT TECHNIQUES IN RADIO-WAVE PROPAGATION, by A. T. Waterman, Jr. Rept. on Contract DA 36-039-sc-73151. 15 Aug 58, 14p. Technical rept. no. 770-2.
Order from LC mi$2.40, ph$3.30 PB 149 405

In microwave transmission to distances well beyond the horizon, the received signal generally exhibits a characteristic fading. Measurements made on the received signal, in order to be considered representative, must be averaged over a time interval long compared with the period of the slowest fading component. Alternatively it is possible to perform certain kinds of measurements in a time interval short relative to the fastest fading components. Such a measurement yields an "instantaneous" picture of the effects produced by atmospheric conditions. A critical type of experiment involves the swinging of a narrow beam in order to resolve those signal components whose phase interrelationship determines the fading. This report discusses the information that can be obtained by using phased-array techniques in radio-wave propagation experiments.

Stanford Research Inst., Menlo Park, Calif.
RESEARCH IN MICROELECTRONICS USING ELECTRON-BEAM-ACTIVATED MACHINING TECHNIQUES, by Kenneth R. Shoulders. Interim scientific rept. on Contract Nonr-2887(00). Sep 60, 216p. 85 refs. SRI Proj. 2863.
Order from OTS $3.50 PB 171 027

Investigations into methods for obtaining electronic data processing systems of biological complexity indicate the feasibility of using over 10^{11} one-micron-sized active elements in a one-cubic-inch machine. An active element based upon the quantum mechanical tunneling of electrons from a metal into high vacuum is proposed that has an estimated switching time of 10^{-10} seconds; couples well to similar and accessory components; promises immunity to temperature variations; and seems adaptable to self-forming manufacturing methods giving component uniformity. Light detectors and generators and electrostatically operated electromechanical devices such as relays and filters seem to fulfill the requirements for accessory components so that all electronic functions could be accomplished with this microelectronic system; in addition, a micro document system would allow permanently stored data to be retrieved at a 10^{10} bit-per-second rate. A micromachining method for fabricating film materials is presented in which an electron beam is used to form a chemically resistant film on the material being machined, which is subsequently etched in vacuum by a molecular beam. This high-speed process has resolution capabilities of several hundred angstrom units; can process electronically clean materials with minimum contamination; and may ultimately be suited for the economical production of one-cubic-inch data processing systems having 10^{11} active components. (Author)

Stanford Research Inst., Menlo Park, Calif.
ROUNDED CORNERS IN MICROWAVE HIGH-POWER FILTERS AND COMPONENTS, by Seymour B. Cohn. Technical note no. 1 on Contract AF 30(602)1998. June 60, 41p. 13 refs. RADC-TN-60-148.
Order from LC mi$3.30, ph$7.80 PB 149 983

Various high-power filter configurations of importance are described, and the structural corners at which electric-field concentrations occur are pointed out. A number of simplified geometries are then shown that can represent the essential portions of the practical structures with sufficient accuracy for ordinary purposes. Formulas and graphs for these simplified geometries are presented that give the ratio of the maximum electric field strength on the boundary to a uniform reference field strength at a point sufficiently removed from the corner. In some cases the boundary shape is derived such that the electric field strength along the curve is constant. These constant-field-strength boundaries are optimum shapes from the standpoint of power-handling ability.

Stewart-Warner Electronics Corp., Chicago, Ill.
SYSTEM STUDY OF ATC INTERROGATION PATH SIDE-LOBE SUPPRESSION TECHNIQUES. Final rept. on Contract NOas-56-1013-d. [1959] 96p. 14 refs.
Order from LC mi$5.40, ph$15.30 PB 148 641

This is an engineering study and investigation leading to the development of an interrogation path side-lobe suppression system for use with the Common System Air Traffic Control Radar Beacon System. The three pulse system is proposed whereby the ground antenna is fed through a magic T connection so that the interrogation pattern is normal while the reference pattern which covers the side-lobe region has a notch in the forward direction. A system of pulse spacing for suppression is worked out so that suppression of transponders in the side-lobe region is accomplished with no modification to the airborne transponders now in use.

Technical Development Center, Federal Aviation Agency, Indianapolis, Ind.
THE NAVY ELECTRONICS LABORATORY PILLBOX ANTENNA AND ITS EFFECT UPON ATC RADAR BEACON INTERROGATION, by Joseph E. Herrmann, Jr Owen E. McIntire, and Kenneth Wise. Aug 58, 22p. 2 refs. Technical development rept. no. 361.
Order from LC mi$2.70, ph$4.80 PB 147 942

The NEL Fox II pillbox antenna is an advancement in the state-of-the-art because the side lobes of the radiation pattern are of very low level. The evaluation program was concentrated on a determination of the effects that such an antenna would have on transponder interrogation. The results of the tests clearly indicate that very little improvement in system interrogation characteristics can be gained by use of an antenna having very low side lobes at installations where reflections are equal to, or greater than, those near TDC. Reflected main-lobe signals cancelled the interrogation duty-cycle improvements which were expected. It is felt that a significant improvement could be obtained at better sites. However, results of site surveys completed at some of the major airports indicate that little if any, improvement can be expected. (Author)

Technical Development Center [Federal Aviation Agency] Indianapolis, Ind.
A STUDY OF THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM CHARACTERISTICS, by Joseph E. Herrmann, Jr. Oct 57, 57p. 3 refs. Technical development rept. no. 329.
Order from LC mi$3.60, ph$9.30 PB 147 941

All data presented is based on the premise that this system must be compatible with the military beacon system and discussions are limited to those characteristics that can be changed without affecting the feature of compatibility. Nominal operating frequencies, transmitted powers, pulse lengths, and pulse spacing are accepted as basic system requirements. (Author)

Technische Hochschule, Munich (West Germany).
WAVE PROPAGATION IN A PLASMA CABLE WITH AN IMPRESSED LONGITUDINAL MAGNETIC FIELD, by H. Riedel and J. Thelen. Technical final rept. for 1 Apr 59-31 Mar 60 on Contract AF 61(052)79. 1960, 84p. 13 refs; AD-241 298.
Order from LC mi$4.80, ph$13.80 PB 150 247

A comparison between theory and experiment brings the following final results: In contrary to theory the upper propagation limit of the forward wave is displaced by strong magnetic fields ($\Omega > \omega_0$) to values of

frequency greater than plasma frequency, nearly up to the gyro frequency. Apart from that at least a qualitatively good correlation with theory is obtained in both cases: forward wave and backward wave.

Willow Run Labs., U. of Michigan, Ann Arbor.
ELECTRON-NUCLEAR INTERACTION IN RUBY AND ITS EFFECT ON THE RUBY MASER, by George Makhov, Robert Terhune and others. Memo. on Project Michigan, Contract DA 36-039-sc-78801. July 60, 10p. 5 refs. 2900-175-R.
Order from LC mi$1.80, ph$1.80 PB 149 456

It has been found that changes in the polarization of the Al^{27} and Cr^{53} nuclei in ruby affect markedly the absorption or emission of microwave power associated with the electron-spin resonance of the Cr^{+++} ion. This effect has been used to observe weak nuclear resonances and to change markedly the operating characteristics of the maser. (Author)

Ordnance, Missiles, and Satellite Vehicles

Air Proving Ground Center, Eglin AFB, Fla.
A DISCUSSION OF TWO METHODS OF COMPUTING A FINDING EPHEMERIS FOR A CLOSE EARTH SATELLITE, by P. M. Fitzpatrick and G. B. Findley. May 60, 36p. 10 refs. APGC-TN-60-23; AD-237 628.
Order from LC mi$3.00, ph$6.30 PB 148 096

The instantaneous position of an artificial earth satellite is known when its altitude above the earth's surface and its geographical latitude and longitude are determined. Two procedures for computing a finding ephemeris are discussed: (1) use of the well-known relations of celestial mechanics to determine the geocentric equatorial rectangular coordinates, and (2) use of less familiar vectorial elements to derive similar results. Both methods should be useful for predicting satellite positions during a period of a few days following a satellite fix. The orbital elements are considered to be constant except for secular variations in the longitude of the node and the argument of the perigee arising from the oblateness of the earth. The two methods were used to compute sub-satellite latitudes and longitudes. Results of these computations are presented. (Author)

Air Proving Ground Center, Eglin AFB, Fla.
HYPERVELOCITY IMPACT FACILITY. LIGHT-GAS PROJECTOR. Mar 60, 24p. 4 refs. APGC-TN-60-22; AD-235 295.
Order from LC mi$2.70, ph$4.80 PB 147 817

A review of the Air Proving Ground Center's new hypervelocity projector and impact facility is presented pictorially. At present velocities of greater than 15,000 fps are obtainable at simulated altitudes up to 100,000 ft. Cameras operating at speeds from 1,200,000 to 2,400,000 frames per second record the impact data. Development of the facility is continuing. An improved projector which will provide higher velocities is being fabricated. Equipment to accurately record these high velocities and the impact results is currently in the testing stage. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
EVALUATION OF BALLOON CONDITIONER FOR ARTILLERY, by Ruth M. Welt. 15 Oct 59, 11p. 2 refs. USASRDL Technical rept. 2074; AD-228 447.
Order from LC mi$2.40, ph$3.30 PB 147 826

A simple, improved method of preconditioning meteorological balloons under field conditions is required for artillary use. Laboratory and flight tests were preformed which compared balloons preconditioned by the standard hot water method with balloons preconditioned by pressure cooker, steam generator, and heating mantle method. Results almost as good as with hot water were given by use of the heating mantle (dry heat) and it was recommended for field test by the Artillery Board. Maximum design performance of a particular balloon still requires the use of hot water for preconditioning. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
VARIABILITY OF BALLISTIC DENSITY AND BALLISTIC DENSITY DEPARTURE TABLES, by Marvin Lowenthal. 10 Nov 59, 12p. 5 refs. USASRDL Technical rept. 2079.
Order from LC mi$2.40, ph$3.30 PB 147 827

Based on a series of firings conducted at Fort Sill, Oklahoma, in April 1958, temporal and spatial variations of ballistic density were investigated for periods up to six hours and distances up to 500 miles. Comparisons of these data with the Ballistic Density Departure Tables permit a listing of the various sources of ballistic density in order of preference. It is concluded that the density departure tables should be used only as a backup system when other meteorological data are unavailable. (Author).

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ADVANCES IN THE DYNAMIC ANALYSIS OF RANGE DATA, by Charles H. Murphy. May 60, 40p. 12 refs. Memo. rept. no. 1270; AD-239 402.
Order from LC mi$3.00, ph$6.30 PB 149 091

The usual analysis of the dynamics of motion of a missile fired in a ballistic range is limited to symmetric missiles with constant mass. This analysis was extended by J. D. Nicolaides (AD-26 405) to cover the motion of a symmetric missile with misaligned lifting surfaces and a constant roll rate. Three additional extensions to the analysis of pitching and yawing motions are described: (1) motion of a burning rocket; (2) motion of a slightly asymmetric missile with varying roll rate; and (3) motion of missile with nonlinear aerodynamic moments. These extensions are each illustrated with actual experimental data. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BRL SHOCK TUBE TESTS OF AN AIR FORCE - PAN AMERICAN AIRWAYS SELF-RECORDING, PRESSURE-TIME GAGE, by Charles H. Hoover. June 60, 24p. 1 ref. Memo. rept. no. 1276; AD-240 397.
Order from LC mi$2.70, ph$4.80 PB 150 092

Pan-American Airways built self-recording mechanical pressure-time gages similar to gages employed extensively by the Ballistic Research Laboratories. The PAA gages are used to determine shock-wave overpressures from accidental explosions of missile and space vehicle propulsion units. A gage was sent to Aberdeen for dynamic testing in the BRL 24" Shock Tube. This report gives the results of this test and a comparison of the records from the PAA gage with those from an electronic standard gage. The Pan-American gage compares favorably with the standard gage and with results from the similar BRL gage. (Author)

Bureau of [Naval Weapons] Washington, D. C.
PERT SUMMARY REPORT, PHASE 2. Rept. on Project Pert. [1960] 239p.
Order from LC mi$10.20, ph$36.30 PB 150 672

This report released for sale to the public 12 Oct 60.

The project was directed to the research and development of improved methods for the planning and control of the complex and far-reaching program developing the Fleet Ballistic Missile (FBM). This phase of the project has been essentially the development of detail procedures and mechanics, the modification of concept as experience has proved advisable, and the "prove out" application of the method in several important areas of the FBM program.

Convair, San Diego, Calif.
EFFECTS OF SATELLITES ON THE IONOSPHERE, by S. Rand and R. A. Pappert. Rept. on Contract Nonr-2683(00). 1 Oct 59, 176p. 45 refs. ZPh-(024 - 026, 028, 038-M, 046, and 050-M); AD-233 351.
Order from LC mi$8.10, ph$27.30 PB 149 875

Contents:
Structure of the Satellite Wake, ZPh-028
Damping of the Satellite Wake, ZPh-040
Application of Bohm-Pines Theory to Plasma Motion, ZPh-026
Wake Structure for Highly Supersonic Flow, ZPh-038-M
Non-Linear Plasma Effect, ZPh-050-M
Magnetic Drag on Small Satellites, ZPh-024
Charge Excitation of Plasma Motion in a Magnetic Field, ZPh-025

Convair, San Diego, Calif.
[PHYSICS RESEARCH DIRECTED TOWARD THE ULTIMATE DEVELOPMENT OF A DEFENSE SYSTEM AGAINST BALLISTIC MISSILES]. Scientific rept. no. 3, 1 Dec 59-1 June 60, on Contract AF 19(604)5554, ARPA Order no. 116-60; Scientific rept. no. 2, 1 Dec 59-1 June 60, on Contract DA 04-495-ORD-1660, ARPA Order no. 39-59. 30 June 60, 342p. 95 refs. ZPh-062.
Order from LC mi$11.10, ph$53.10 PB 149 566

Physics research directed toward the ultimate development of a defense system against ballistic missiles. The work has been subdivided into three parts: (1) launch phase, (2) mid-course (with a further breakdown into experimental and theoretical) and (3) re-entry. Detailed discussions of the relationship between the various investigations and ballistic missile defense from the scientific standpoint are given at the beginning of each section.

Diamond Ordnance Fuze Labs., Washington, D. C.
A MISSILE-AIRCRAFT ENCOUNTER SIMULATOR WITH TYPICAL APPLICATIONS, by Richard F. Butler. 21 Dec 59, 41p. 12 refs. TR-757; AD-233 965.
Order from LC mi$3.30, ph$7.80 PB 147 794

The DOFL-developed encounter simulator is used as an aid in estimating fuzing and burst points for fixed-angle fuzed missiles used against various targets. With the methods developed herein, the simulator can be used to (1) evaluate the effectiveness of fuze-warhead systems against arbitrary targets by analyzing data from operational missile test flights and (2) estimate optimum fuze-warhead parameters needed for proposed systems to achieve the desired effectiveness. Three techniques are discussed for finding points of intersection of the light beam, that represents the fuze-antenna beam or the warhead lethal pattern, with a target model.

Diamond Ordnance Fuze Labs., Washington, D. C.
SUMMARY OF HEAT-POWDER CALORIMETRY, by Raymond H. Comyn and Ira R. Marcus. 1 Aug 60, 22p. 9 refs. Technical rept. TR-862.
Order from LC mi$2.70, ph$4.80 PB 149 421

This report summarizes DOFL investigations in the calorimetry of gasless pyrotechnic mixtures which have been published previously in separate reports. These papers outline the development of two instruments: the DOFL quality control calorimeter for production use; and the DOFL microcalorimeter for research studies. The production calorimeter may be used for measuring heat inputs between 800 and 1200 cal with a precision of ±0.32 percent. The microcalorimeter has an accuracy of about 1 percent and may be used for measuring heat inputs of 100 to 300 cal at ambient temperatures between -65°F and +165°F. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
INFLUENCE OF SILVER COATINGS ON IGNITION BEHAVIOR OF COLLOIDAL LEAD AZIDE, by Bruno Reitzner. Aug 60, 14p. 5 refs. Technical rept. FRL TR-2.
Order from LC mi$2.40, ph$3.30 PB 148 915

Colloidal α-lead azide was coated with small amounts of silver (0.25 - 10.0 atom %). The coatings were applied by reducing silver nitrate with hydrazine hydrate in a methanol-water solution in which lead azide was suspended. The metallic silver was found to be predominantly located near the edges of smaller or irregularly shaped lead azide crystals. Ignition tests run between 351°C and 411°C gave ignition times ranging from infinity to 0.035 second. Coating the material with 1 atom % of silver reduced its ignition times by as much as 60%. However, the ignition times of material coated with 10 atom % of silver were up to 1.5 times as high as those of the uncoated material.

The apparent activation energies, E*, were calculated from the Semenov equation at temperatures ranging from 377° to 389°C. Deviations from the Semenov equation were found at both higher and lower temperatures. E* for the uncoated lead azide was found to be 132 ± 10 kcal/mole. Values of 120 ± 10 kcal/mole and 138 ± 5 kcal/mole were found for materials coated with 1 atom % and 10 atom % of silver, respectively. The increase in thermal sensitivity of the material coated with about 1 atom % silver is explained as due to the catalytic action of the silver. (Author)

Frankford Arsenal, Philadelphia, Pa.
RATE OF FIRE IN RECOILLESS RIFLES, by R. Boritz. Sep 59, 26p. 6 refs. Memo. rept. M60-3-1.
Order from LC mi$2.70, ph$4.80 PB 148 661

A method for the calculation of rate of fire for recoilless weapons is described. Rate of fire limitations in recoilless rifles are a result of degradation of material strength with increase of temperature. Based on this, it is possible to calculate maximum permissible sustained rates of fire. The calculation of average system temperatures after firing a specified number of rounds, at specified times, with specified external conditions, is presented for several different assumptions. Cooling methods are discussed and sample calculations are presented.

Frankford Arsenal, Philadelphia, Pa.
ULTRASONIC INSPECTION OF EXPERIMENTAL ALUMINUM ARMOR PLATE, by Helen Smolen. 26 Aug 59, 24p. 5 refs. Test rept. T60-1-1; AD 229 500.
Order from LC mi$2.70, ph$4.80 PB 150 305

Ultrasonic tests were performed to locate areas yielding gradients of ultrasonic response in experimental aluminum armor plate. Representative areas were subjected to tensile impact and metallographic tests. Because it is difficult to determine precisely which portion of a given volume may introduce the ultrasonic gradients observed, no conclusion could be drawn as to the ability of ultrasonics to detect structural deviations other than comparatively gross discrete flaws. Armor plate, portions of which had been subjected to ballistic test, were examined to determine the relationship between ballistic test results and ultrasonic response. The average percentage of noise level, which was characteristic of each plate, did not correlate with ballistic test results, in that a ballistically good plate appeared to be as likely to yield a high average noise level as a ballistically bad plate. No edge cracks were located in the many plates examined during the course of this program. However, results obtained under an earlier study indicate that this type of flaw is easily detected ultrasonically, as are other comparatively gross flaws. Standard immersion techniques introduced problems which may be overcome by use of a modified immersion technique which is described. (Author).

General Electric Co., Schenectady, N. Y.
DISPERSION OF THE HERMES A3 MISSILE: RANGE ERRORS DUE TO VARIATION IN POSITION AND VELOCITY AT THE END OF CONTROL, by R. F. Drenick. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. 30 Aug 48, declassified 17 Nov 58, 34p. 2 refs. Rept. no. 55263.
Order from LC mi$3.00, ph$6.30 PB 149 466

The Hermes A3 missile is a surface-to-surface missile, subject to very stringent requirements concerning the accuracy of hitting. These requirements suggested a study of all factors which might, in the absence of proper control, produce impact errors, and of possible means of reducing these errors. An account is given in this report of the range errors which would result if the missile position or velocity have deviated from the desired standard at the time at which guidance is discontinued. The conclusion is reached that control principles similar to those of the German V-2 in which control ceases at some time before impact, are not likely to insure the specified accuracy. The methods of differential corrections are generalized in this report from the form which they take in conventional ballistics to that form which would apply to guided missile ballistics. (Author)

General Electric Co., Schenectady, N. Y.
GROUND VIBRATION TESTS OF THE HERMES A1 TEST VEHICLE, by E. A. Zeitlin. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. 27 Apr 49, 47p. 5 refs. Rept. no. 55276.
Order from LC mi$3.30, ph$7.80 PB 149 469

The object of the vibration tests was to determine the natural frequencies, the vibration characteristics, and the location of the nodal lines for the significant modes of vibration of the main airframe components of the Hermes A1 test vehicle. The information has been used in (a) flutter analyses, (b) calculations of torsional divergence, (c) study of possible coupling between oscillations of the main airframe components, (d) investigation of possible coupling action between control, guidance, and structural components of the missile viewed as an elastic body.

[General Electric Co., Schenectady, N. Y.]
HERMES A-1. A. MOTORS. B. PROPULSION. C. CONTROL. D. AERODYNAMICS. E. GUIDANCE. F. SCHEDULE. Rept. on [Contract DA 30-115-ORD-23]. [1949] declassified 28 May 58, 14p. Proj. Hermes A-1 Motors rept. 62.
Order from LC mi$2.40, ph$3.30 PB 149 463

General Electric Co., Schenectady, N. Y.
THE HERMES A-3 FLIGHT SIMULATOR, by N. M. Bengston. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. July 49, declassified 17 Mar 58, 22p. Technical Information Series R49A0525.
Order from LC mi$2.70, ph$4.80 PB 149 471

The 50,000:1 variation in dynamic pressure imposed by the Hermes A-3 trajectory creates particular problems in design of autopilot and means for testing it. An electrical integrator type of analogue computer has been designed to simulate the missile equations. Actual componenta complete the remainder of the flight simulation loops. (Author)

General Electric Co., Schenectady, N. Y.
UPWASH FIELD INDUCED BY THE HERMES B-1 WING AT SEVERAL MACH NUMBERS, by H. R. Koenig. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23]. Dec 50, declassified 17 Mar 58. 16p. 4 refs. Technical Information Series rept. no. R50A0525.
Order from LC mi$2.40, ph$3.30 PB 149 205

The upwash field induced by the B-1 wing is presented for several Mach numbers. Since the purpose of this study was to determine the effect of upwash on the tail fin performance, the upwash field is plotted in the plane perpendicular to the free stream direction and passing through the leading edge of the rail fins. (Author)

General Electric Co., Syracuse, N. Y.
S-BAND ATTENUATION IN THE OXYGEN-ALCOHOL ROCKET MOTOR, by R. H. Morrison. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23] June 50, declassified 17 Mar 58. 46p. 8 refs. Technical Information Series rept. no. R49A0535.
Order from LC mi$3.30, ph$7.80 PB 149 203

The attenuation of an S-band beam through the flame of a 16,000-pound thrust oxygen-alcohol motor (Hermes A-1 missile) was measured. No average attenuation was measured; there were transient attenuations of the order of 20 db at the start and shut down and random transient attenuations of 5-10 db during smooth burning period. Some noise attenuation showed on the records. (Author)

Hughes Aircraft Co., Culver City, Calif.
DISPLAY AND CONTROL REQUIREMENTS FOR MANNED SPACE FLIGHT, by Charles O. Hopkins, Donald K. Bauerschmidt, and M. J. Anderson. Rept. on Human Performance in Advanced Systems, Contract AF 33(616)6033. Apr 60, 217p. 175 refs. WADD Technical rept. 60-197.
Order from OTS $3.50 PB 161 987

A study was made of the display and control requirements for a manned orbital vehicle of the "space-ferry" type. The mission included ground launch, rendezvous with a satellite station already in orbit, re-entry into the earth's atmosphere, and landing at a selected base on earth. Display and control requirements were determined for vehicle attitude control while in orbit, orbital plane change, minimum energy transfer between circular orbits at different altitudes, and deorbit for re-entry into the earth's atmosphere. Displays, controls, and control panels were designed to meet these requirements. Representations of these displays and controls were constructed and incorporated into full-scale mockups of cockpits for two alternate display and control systems. (Author)

Institute of Metals and Explosives Research, U. of Utah, Salt Lake City.
FRAMING CAMERA OBSERVATIONS OF ULTRA-HIGH VELOCITY PENETRATION IN TRANSPARENT TARGETS AND A MECHANISM FOR CRATER EXPANSION, by R. W. Bartlett and R. T. Keyes. Rept. on Contract AF 18(603)100. 31 Mar 60, 21p. 5 refs. AFOSR-TN-60-851.
Order from LC mi$2.70, ph$4.80 PB 150 167

A mechanism of cratering in metal targets impacted by shaped charge jets in which the hole diameter is expressed as a function of striking velocity jet diameter, densitites of target and jet, and the yield strength of the target is presented and compared with measured hole diameters in several different metals struck by iron, copper and aluminum jets at various velocities. The same mechanism is expanded to account for the dynamics of crater formation, i.e., the lateral rate of expansion of the crater. Theoretical curves are compared with experimental results obtained by means of microsecond framing camera techniques for steel jets penetrating several transparent substances of different densities. Some additional results pertaining to vaporization in ultra-high velocity impact also are given. (Author)

Naval Ordnance Lab., Corona, Calif.
PRIMARY FACTORS THAT AFFECT THE DESIGN OF GUIDED MISSILE FUZING SYSTEMS, by K. A. Van Orsdel. 8 July 60, 16p. NAVWEPS rept. 5953; NOLC rept. 452.
Order from LC mi$2.40, ph$3.30 PB 149 794

The primary factors that must be taken into consideration preparatory to designing any guided missile fuzing system or fuze component are listed in outline form. Main categories of factors affecting missile fuze design are: Weapon System General Requirements, Tactical Conditions, Target Characteristics, Missile Characteristics, Warhead Characteristics, and Weapon System Logistics and Field Operation. Several factors are listed under each category. (Author)

Naval Ordnance Test Station, China Lake, Calif.
COMPOSITE PROPELLANT PROCESSING. PLASTIC MANDREL FABRICATION. 1 July 59, 15p. NOTS TP 2307.
Order from LC mi$2.40, ph$3.30 PB 150 290

Strong, lightweight plastic mandrels can be fabricated from aluminum-filled epoxy resins very economically and in a very short time. These plastic mandrels are accurate reproductions of aluminum or wooden mandrels.

Naval Ordnance Test Station, China Lake, Calif.
INTERVAL TIMER MARK 5 MOD 1; LATIN-SEQUENCE ENVIRONMENT TEST FOR QUALITY ASSURANCE AND IMPROVEMENT, by K. G. Clemans and R. E. Crescenti. 6 May 59. NOTS TP 2254; NAVORD rept. 6554.
Order from LC mi$3.90, ph$10.80 PB 149 530

This report presents a logical, inexpensive, yet comprehensive, method of qualification testing with application to the Mk 5 Mod 1 Interval Timer. Qualification testing of this type has general application in development as well as procurement programs where the test conditions imposed are presumed non-destructive. (Author)

Naval Weapons Lab., Dahlgren, Va.
EVALUATION OF BLOW-OUT PIPE SYSTEMS FOR USE ON TERRIER MISSILE SHIPS, by A. C. Samuels. 11 Aug 60, 49p. 1 ref. NWL rept. no. 1714.
Order from LC mi$3.30, ph$7.80 PB 150 276

The Naval Weapons Laboratory has conducted two blow-out pipe tests to determine the structural adequacy of the closed blow-out pipe system installed in check-out areas of DLG-9 class TERRIER missile ships and to determine the feasibility of replacing the portable section of blow-out pipe by an inlet funnel installed on the bulkhead in check-out areas on proposed DLG-16 and DLG(N)-25 class TERRIER missile ships. These tests were conducted during the period from 5 May 1960 to 13 May 1960 using TERRIER BT-3 sustainers. The results of the two tests indicate that the closed system as used on the DLG-9 class ships is more effective than the proposed DLG-16 open system in removing the exhaust gases from a burning sustainer. As a result the closed system reduces the hazards to personnel, and is to be preferred. (Author)

North Carolina State Coll., Raleigh.
ON THE THEORY OF MOTION OF A NEAR EARTH SATELLITE, by Raimond A. Struble and William F. Campbell. Technical memo. no. 4 on Contract DA 36-034-ORD-2733. June 60, 5p. 7 refs. OOR rept. no. 2125.9-M; AD-238 904.
Order from LC mi$1.80, ph$1.80 PB 150 400

First and second order solutions of the equations of motion of a near earth satellite were obtained. These solutions are completely general without restrictions on eccentricity or orbital inclination. Though the traditional orbital plane of astronomy is employed, a non-elliptical orbit in this plane displays the basic geometry more readily than would the traditional osculating ellipse. (Author).

Office of Defense Research and Engineering, Washington, D. C.
SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS. PART IV. June 59, 143p. 20 refs. Bulletin no. 27; AD-212 977.
Order from LC mi$7.20, ph$22.80 PB 150 286

This report released for sale to the public 26 Sep 60.

Design and use of vibration test jigs and fixtures: Nature of the vibration testing problem; Design criteria for vibration test jigs and fixtures; Scope of the vibration fixture problem; Vibration fixtures for large test items; Multi-purpose environmental test fixtures; A critical look at vibration fixture performance; Investigation of vibration fixture materials; Comments on seminar on jigs and fixtures; Experimental and theoretical study of an oil film slider; Improved version of the fluid film method of stabilizing an auxiliary vibration table; Oil-film supported table for vibrating large components; Building an inertial guidance facility. Correlation of the effects of laboratory vs service environments on hardware: Real and simulated environment; A specification writer's viewpoint; Damage accumulation in relation to environmental testing; Method of equating long duration-low intensity and short duration-high intensity random vibration; Evaluating the effects of logistic environments on missile reliability; Reliability and mechanical design. Information exchange: National Bureau of Standards calibration service for vibration pickups; Ad Hoc Committee on transportation hazards; Research program on random vibration.

Picatinny [Research Center] Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF DELAY POWDERS, by Burton Werbel and Seymour Lopatin. Apr 58, 37p. 2 refs. Technical rept. 2477; AD-159 055.
Order from LC mi$3.00, ph$6.30 PB 148 991

The effects of the following factors on the burning characteristics of the barium chromate/boron system have been investigated: (a) chemical composition; (b) vapors; (c) external pressure; and (d) temperature.

[Picatinny Research Center] Picatinny Arsenal, Dover, N. J.
THE ROLE OF PARAFORMALDEHYDE IN THE PREPARATION OF HMX BY THE PICATINNY PROCESS, by Thomas C. Castorina, Frederick S. Holahan and others. Feb 58, 40p. 25 refs. Technical rept. 2481; AD-157 692.
Order from LC mi$3.00, ph$6.30 PB 148 992

To find means of further improving the yield of HMX from the Picatinny Arsenal (PA) nitrolysis of hexamine, the role of paraformaldehyde in the reaction was traced with carbon-14. These results demonstrate that both HMX and RDX molecules are derived from chemically equivalent carbon atoms or methylene groups. Thus the role of the $(CH_2O)_x$ is postulated as increasing the concentration of methylene groups in the percursors of HMX/RDX thereby making more efficient use of the nitrogen in the hexamine possible.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
FLUID DYNAMIC MODEL OF INTERIOR BALLISTICS, by S. Jarvis, Jr. Feb 60, 55p. 4 refs. Memo. rept. M60-24-1.
Order from LC mi$3.60, ph$9.30 PB 149 055

Equations are derived for the transient one-dimensional motion of a propellant gas-propellant grain mixture capable of giving, qualitatively, the effect on the interior ballistic process of factors not included in space-mean models. These general equations and certain one-parameter reductions are discussed, and the computing difficulties assessed. A few extreme simplifications, which allow analysis of certain representative features, are made and the results given. (Author)

Remington Arms Co., Inc., Bridgeport, Conn.
DEVELOPMENT AND FABRICATION OF PERCUSSION PRIMER FOR BAG LOADED WEAPONS, by R. A. Sahlin. Monthly progress rept. no. 2, 31 May-30 June 60, on Contract DA 19-020-ORD-5200. 14 July 60. 6p.
Order from LC mi$1.80, ph$1.80 PB 149 831

Approximately one hundred XM-82 primers were made. Product performance tests were conducted with satisfactory performance indicated. Work on the Remington alternate has continued with inner cases processed through drawing and heading. A considerable amount of experimental work of the outer case has been done and is continuing in an attempt to achieve drawing dimensions. (See also PB 149 325)

Rock Island Arsenal Lab., Ill.
DENSITY VERSUS VISCOSITY AS IT INFLUENCES THE ACTION OF A RECOIL MECHANISM, by H. C. Muffley. 11 Mar 60, 27p. 10 refs. Rept. no. 60-598; AD-234 720.
Order from LC mi$2.70, ph$4.80 PB 147 340

The influence of density and viscosity of the hydraulic oil on the functioning of a hydropneumatic recoil mechanism was investigated under firing conditions with a 105 MM Howitzer Recoil Mechanism and three oils varying in density and viscosity. The data indicated that changes in density had a significant effect on the operation of the mechanism. Increasing the density of the oil manifested itself in shorter recoil length and increased pressures. Variations in viscosity, however, did not influence the functioning of the mechanism significantly. (Author)

Solid Propellant Information Agency, Johns Hopkins U., Silver Spring, Md.
JOINT ARMY-NAVY-AIR FORCE IGNITABILITY PANEL. PROCEEDINGS OF THE THIRD MEETING HELD AT APPLIED PHYSICS LABORATORY, SILVER SPRING, MARYLAND, JUNE 19, 1959. Rept. on Contract NOrd 7386. [1959] 81p. 12 refs.
Order from LC mi$4.80, ph$13.80 PB 150 779

This report released for sale to the public 14 Oct 60.

The purpose of the Ad Hoc Panel on Ignitability is to review the existing procedures and equipment for measuring the ignitability of solid propellants and to standardize on one of these techniques if at all possible. The primary purpose of the third meeting was to review the results obtained from a round-robin ignitability testing of four standard propellants and to utilize conclusion drawn from this review to formulate recommendations for a standard ignitability apparatus. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
A METHOD FOR CALCULATING THE THERMAL IRRADIANCE UPON A SPACE VEHICLE AND DETERMINING ITS TEMPERATURE, by Thomas L. Altshuler. Rept. on Contract AF 04(647)269. Aug 60, 59p. 15 refs. Technical Information Series R60SD386.
Order from LC mi$3.60, ph$9.30 PB 149 846

A method is presented for determining the thermal irradiance upon a space vehicle due to direct solar radiation, planetary thermal radiation, and planetary albedo. From this information the temperature of a space vehicle can be obtained. Calculations can be made for various space vehicle altitudes above a planet and for various solar angles with respect to both the planet and space vehicle. The planets and natural satellites considered are the Earth, Moon, Mars and Venus. (Author)

Springfield Armory, Mass.
DEVELOPMENT OF THE PERMETRON GAGE FOR THE MEASUREMENT OF 20MM BARREL BORE PLATING THICKNESS, by H. P. Hatch and C. N. Julian. Rept. on Engineering of Application of Non-destructive or Simulated Testing Methods and Equipment to Small Arms Weapon Items. 3 Apr 60, 19p. SA-TR20-6003; AD-238 004.
Order from LC mi$2.40, ph$3.30 PB 150 017

The Permetron operates on the principle that the coupling between two windings linked by a magnetic circuit varies with the permeability of the magnetic circuit. The magnetic circuit consists of the core carrying the two windings, the barrel steel, and the interposed chromium. If the magnetic characteristics of the barrel steel and core are held constant, then the magnetic circuit variable affecting permeability will be the thickness of chromium. In this instrument, coupling is indicated in terms of a secondary output voltage with controlled primary input current. This output voltage varies directly with the permeability of the magnetic circuit and therefore is a function of the thickness of the chromium plate. A low frequency, 60 cps, is employed to reduce eddy currents, and to minimize the effect of variation in the magnetic properties of both the barrel steel and the deposited chromium. The maximum error in thickness measurement is 0.33×10^{-3} inches. (Author)

Stanford Research Inst., Menlo Park, Calif.
VOLTAGE BREAKDOWN OF ANTENNAS AT HIGH ALTITUDES, by W. E. Scharfman and T. Morita. Technical rept. 69 on Contract AF 19(604)3458. Apr 60, 100p. 16 refs. AFCRC-TN-60-750
Order from LC mi$5.40, ph$15.30 PB 149 897

The signal received from electronic systems on various missiles has contained evidence of voltage breakdown on antennas at altitudes from 50,000 to 300,000 feet at VHF, UHF, and microwave frequencies. Since continuous telemetry and tracking information is often necessary to determine impact position and system performance, an experimental investigation has been made of the power-handling capabilities of antennas at high altitude. The principal aims of the study are (1) to determine the physical mechanisms involved, (2) to measure and tabulate experimental data on breakdown field strength for various antenna types, and (3) to study methods for improving the power-handling capabilities of antennas.

Watervliet Arsenal, N. Y.
FIRING TESTS ON T42E1 AND T32E1 IGNITERS IN THE 105MM T254E2 TANK GUN, by F. J. Dashnaw and K. C. Stotz. Feb 60, 26p. Technical rept. WVTRR-6002.
Order from LC mi$2.70, ph$4.80 PB 145 817

A number of igniters were test fired in a 105MM, T254E2 gun tube and breech ring assembly in addition to insulation tests. It was determined that the gun would perform satisfactorily, from an electric firing standpoint, using either a capacitive discharge power source or a 24 volt battery, under normal room conditions. The direct battery power source is recommended because of lower space requirements and fewer possible difficulties. (Author)

Watervliet Arsenal, N. Y.
AN OPTICAL METHOD FOR MEASURING STRAIGHTNESS OF GUN TUBE BORES, by D. Bisceglia and P. M. Casey. Dec 59, 27p. Technical rept. WVT RI 5906.
Order from LC mi$2.70, ph$4.80 PB 146 478

This project was initiated to provide a telltale system which would be more accurate and require less skill of the operator. Using optical principles, bore inspection can be accomplished in a reasonable time by using a machine in which the tube can be indicated to a common center line of machine spindle and instrument optical axis. This system is the most precise technique available for process and acceptance inspection of finished and semi-finished bores. However, the use of this technique for determining the axis of rough cored holes is not recommended for medium size cannon since the benefits derived do not offset the increased time required to perform this operation. The equipment developed is applicable to machine alignment and the telltale record sheet designed is applicable to either optical or mechanical telltale readings. (Author)

Watervliet Arsenal, N. Y.
TRANSIENT THERMAL STRESSES IN GUN TUBES, PART I, by C. C. Mow, M. J. Pascual, and J. J. Pascual. Mar 60, 104p. 8 refs. Technical rept. WVT RR-6003.
Order from OTS $2.50 PB 161 475

The study was made to determine the temperature field and thermal stress distribution in a gun tube (hollow cylinder) assumed for simplicity to be infinitely long. The boundary conditions considered were independent of axial distance, and dependent only upon time. Various functions of time were considered in fixing the temperature at the inner wall. The choice of these functions was determined by the data obtained in the actual firing of a gun. All quantities are in dimensionless form. The dimensionless temperature fields were determined in a closed form, while the thermal stresses were left in an integral form and solved by numerical integration using an IBM 650 digital computer. Numerical results were obtained for various parameters which cover most of those of interest to the Ordnance Corps. (Author).

Sanitation and Safety Engineering

Arctic Aeromedical Lab., Ladd AFB, Alaska.
PRELIMINARY STUDIES ON ELECTRIC INCINERATOR TOILETS FOR USE UNDER REMOTE ARCTIC CONDITIONS, by Jack D. Douglas. May 60, 12p. Technical note AAL-TN-60-7.
Order from LC mi$2.40, ph$3.30 PB 150 027

It is felt that electric incineration would be an effective and satisfactory means of human waste disposal at remote arctic sites. An electric incinerator toilet, which had originally been developed for use aboard aircraft, was modified and field tested for possible ground use. Numerous difficulties inherent in the unit manifested themselves during the period of the tests. However, results of the tests did indicate that electric incineration would be a feasible means of human waste disposal. Recommendations were made for the construction of an electric incinerator toilet designed for ground use. (Author)

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DECONTAMINATION OF WATER CONTAMINATED WITH PLUTONIUM, by Maurice Pressman and Don C. Lindsten. Rept. for 24 Feb-3 Apr 59 on Removal of CBR Contaminants from Water. 12 Jan 60, 91p. 26 refs Research rept. 1613-RR; AD-234 603.
Order from LC mi$5.40, ph$15.30 PB 147 816

The report concludes that: (a) The Army Mobile Water Purification Unit is capable of removing essentially all particulate plutonium from water by the standard processes of coagulation with ferric chloride and limestone disinfection, and diatomite filtration; (b) the Army Mobile Water Purification Unit is capable of removing 72% of the plutonium from contaminated tap water in which most of the plutonium is in soluble form. The percentage is increased to 89 by the addition of 600 ppm activated carbon and 97.5 percent by the addition of 100 ppm activated carbon and 97.5 percent by the addition of 100 ppm of clay to clear raw water and by raising pH to 11.4; (c) mixed-bed ion-exchange resin and high-capacity cation-exchange resin on the hydrogen cycle are both capable of removing over 99% soluble plutonium from contaminated water; (d) a proposed Army squad method of removing CBR agents from water is capable of removing over 99.9 percent plutonium activity even when in the soluble form; (e) cation-exchange water-softening unit is ineffective; (f) alum coagulation and sand filtration is 95% effective; (g) activated carbon in high dosage is an effective adsorbent; and (h) lime-soda softening is 97% effective. (Author)

Communicable Disease Center [Atlanta] Ga.
COMPOSTING OF ORGANIC WASTES. AN ANNOTATED BIBLIOGRAPHY, Supplement 2, ed. by John S. Wiley. Apr 60, 65p. 102 refs.
Order from LC mi$3.90, ph$10.80 PB 148 097

This bibliography includes author, geographical and subject indexes. (See also PB 147 220)

Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPARTMENT-TYPE AIR LOCK STUDIES, by Ernest N. Hellberg. Final rept. 28 June 60, 38p. 8 refs. Technical rept. 036.
Order from LC mi$3.00, ph$6.30 PB 149 230

A portable, prefabricated, interior air lock has been developed and compared against the BUDOCKS standard, exterior one. Extensive tests under various building-pressures, air flows, and environments revealed that both locks operated satisfactorily when airflow exceeded 300 cfm; that the NCEL lock had inadequate air-flow regulation; and that the BUDOCKS lock was unwieldy. NCEL redesigned its air lock to incorporate the best features of both the BUDOCKS and the NCEL prototype, and to eliminate their shortcomings. Considering the final NCEL lock suitable for interior use is recommended. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
SPECIFICATIONS AND COSTS OF A STANDARDIZED SERIES OF FALLOUT SHELTERS, by W. E. Strope, L. G. Porteous, and A. L. Greig. 6 Oct 59, 153p. 29 refs. Research and development technical rept. USNRDL-TR-366.
Order from OTS $3.00 PB 161 973

Basic performance specifications are developed to govern the design of personnel shelters to provide protection against radioactive fallout. Consideration is also given to protection against blast, heat, and fires. Design specifications and cost estimates are prepared for a shelter based on a 25 ft by 48 ft ammunition storage magazine. Provision is made for 14-day occupancy by 100 people. The cost differentials of various choices of performance characteristics are estimated. The design is in sufficient detail to permit construction. Shelters of this type may have wide application in residential areas, industrial plants, and military installations. (Author)

Northwestern Technological Inst., Evanston, Ill.
THE DYADIC COMPUTATION OF A GENERALIZED NETWORK MODEL OF A SEWAGE TREATMENT SYSTEM, by W. R. Lynn (U. of Miami) and A. Charnes. ONR Research Memo no. 19 on Temporal Planning and Management Decisions under Risk and Uncertainty [and] Systems Analysis of Municipal Sewage Treatment, Contract Nonr-1228(10). Oct 59, 23p. 5 refs. AD-230 198.
Order from LC mi$2.70, ph$4.80 PB 149 500

A computational method is presented and demonstrated for the analysis of a problem involved in the determination of the most economical sewage treatment system by which certain impressed effluent standards of quality can be attained. A sewage treatment system was considered as a combination of unit operations which may be employed in series or parallel. Each of the unit operations has the capacity for effecting some change (e.g., a reduction) in the quantity of the waste which utilizes the operation. The cost of each operation per unit of sewage treated varies from operation to operation as does the effect of each operation on the quality of the waste. (Author)

Ship Building

Bureau of Ships, Washington, D. C.
SHOP PRACTICE SUGGESTIONS NO. 2. Nov 60, 24p.
Order from OTS $0.50 PB 171 024

The suggestions included are for fitting brushes; multiple gasket cutter; compressor linear extractor; segmented anode pencils; coaming around fuel tanks; gas test holes; stuffing tube area templates; reworked stellite bushings; plate-stretching bars; ammeter records shaft trepanning; blueprint machine roller cover; gas holes in doubler plates; welding electrode holder; hole cutter for aluminum plate; undercut gage; adjusting SPS-8 potentiometer; toggle switch guard; deck drain sleeves; photographs of electronic wiring; boat gripes; lifeboat equipment air-freed; ventilation spools; SASS bridge crane; repairing uptakes; LST bow ramp gaskets; casting tin-bronze manifolds; purge plug for pipe; microswitch checker; valve seat grinder; soldering tips modified; jet cable reel rims; metal photo process; metallic splice gear; cold storage space; jet blast deflector alignment; bomb elevator hatch; crane radiator petcock; pipes through aluminum; penetration reinforcements; hydraulic control valves; torpedo tube gage; steam catapult cylinders; surplus STS plating; roller grip couplings; battery cell handling case; battery cell test plug; cable marking; catapult winch frame racks; cutting torch tips reconditioned; bilge keel installation; sea chest blank; globe stop-lift-check valve; brake applicator valve; steam catapult jack; fuel status chart. (See also PB 161 715)

David Taylor Model Basin, Washington, D. C.
STRUCTURAL EVALUATION OF HYDROFOILS OF GIBBS AND COX BOAT SEA LEGS, by Louis A. Becker. July 60, 24p. 5 refs. Rept. no. 1401.
Order from LC mi$2.70, ph$4.80 PB 152 019

This report released for sale to the public 11 Oct 60.

Strains were measured in the hydrofoils and struts of the Gibbs & Cox boat SEA LEGS for known static loads, for operation in calm water under steady-state conditions and forced maneuvers, and for operation in 5-ft waves. Underway loads and load factors were determined. Experimental and theoretical stresses were compared. Motions and accelerations of the boat were also measured during the underway trials. It is concluded that the hydrofoil system is adequate to withstand the stresses resulting from operation in waves up to 5 ft in height at speeds up to 23 knots. (Author)

David Taylor Model Basin, Washington, D. C.
TMB 3-BLADED SUPERCAVITATING PROPELLER SERIES, by E. B. Caster. Aug 59, 29p. 5 refs. Rept. 1245.
Order from LC mi$2.70, ph$4.80 PB 150 676

This report released for sale to the public 11 Oct 60.

A theoretical series of 3-bladed supercavitating propellers, having a hub radius of 0.2 of the propeller radius and an expanded area ratio of 0.5, is presented. The design parameters for these propellers are plotted in the form of nondimensional coefficients which enable a complete design to be obtained. (Author)

Hamburg U. (Germany).
ROLL RESONANCE IN A TRANSVERSE SWELL, by Hellmut H. E. Baumann. Technical rept. on Contract no. 62558-1544/2237. May 59, 100p. 14 refs.
Order from LC mi$5.40, ph$15.30 PB 150 011

The roll oscillations of a ship in a seaway are generated by both horizontal and vertical accelerations. The two types of stationary roll states due to these different components are considered for the general case of nonlinear restoring moments and damping. With a suitable assumption for the exciting function (wave profile), analytical expressions are devised for the dependence of the amplitude and periods of the roll oscillation on

those of the swell. The response curves and the stability limit of the forced oscillations can be evaluated if the phase integral and period of the undamped oscillation in calm water are known. (Approximate methods of evaluating these as functions of the roll amplitude are given). The method is illustrated for two different cases of righting arm curves. (Author)

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Air Research and Development Command, Washington, D. C.
FOOD FOR SPACE TRAVEL: AN EXAMINATION OF CURRENT CAPABILITIES AND FUTURE NEEDS, by Albert A. Taylor, Beatrice Fintelstein and Robert E. Hayes. July 60, 71p. 67 refs. ARDC-TR-60-8.
Order from LC mi$4.50, ph$12.30 PB 150 234

The state of progress and present capabilities in nutrition, food technology, and food service supporting equipment for manned space flight are described and evaluated in terms of future needs. The study is broad in scope. It describes feeding in very short to very long space missions. Preflight feeding provisions are described as well as partially regenerative systems and, finally, the requirements of a closed ecology are considered. A section is devoted to permissable preflight foods. Varied menus are offered for flights of short, medium, and long duration in an ascending order of variety, consumer acceptance, and support equipment. (Author)

Packaging

Arctic Aeromedical Lab., Ladd AFB, Alaska.
DETERMINATION OF PROTECTION AFFORDED BY PERISHABLE PRODUCE SHIPPING CONTAINERS, by Jack D. Douglas. June 60, 9p. Technical note AAL-TN-60-10.
Order from OTS $0.50 PB 161 975

Studies were conducted on the Federal Electric type, perishable produce shipping containers to determine the amount of protection afforded against subzero environmental temperatures. Results of the studies indicated that the containers afforded protection from ambient air temperatures as low as -40° F for periods as long as 1 hour. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SUITABLE INSULATED CONTAINERS FOR TRANSPORT OF MATERIALS HAVING CRITICAL THERMAL TOLERANCES TO HEAT, by John R. Cavanaugh. July 57, 9p. Technical note AAL-TN-57-44.
Order from OTS $0.50 PB 161 974

The container, "Chest, Plastic, Field, Insulated," Stock No. 6545 NSL, manufactured by Koch Mfg. Company was selected as the most feasible container investigated. This container and its test contents were subjected to internal temperatures ranging from +69° F. to -88° F. (estimated). During the evaluation of the "Chest, Plastic, Field" a specimen temperature below -70° F. was maintained for a period of 66 hours and 30 minutes, when the test was concluded. At conclusion of the test only 20% of the dry ice in the inner chest had sublimed. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
STABILITY OF EXTERNALLY PRESSURIZED GAS JOURNAL BEARINGS, by Lazar Licht. Rept. on Contract Nonr-2342(00). Oct 59, 36p. 8 refs. I-A2049-8; AD-228 299.
Order from LC mi$3.00, ph$6.30 PB 149 489

A stability analysis is developed for gas journal bearings having externally pressurized pads, symmetrically spaced along the circumference. Simplifying assumptions are made and equations of flow and motion are stated in terms of perturbation quantities. The case considered is when the journal, initially in an eccentric equilibrium position, begins to move in an arbitrary direction under the influences of a small, random disturbance. Methods of factorizing and simplifying the characteristic determinants are shown, with the objective of reducing the work of examining the roots of characteristic equations. Special cases, such as the bidirectional thrust bearing and that of the journal initially in concentric position are discussed. Numerical and semi-experimental procedures of determining the coefficients of characteristic equations are outlined. Stability tests are suggested. A simple numerical example is included. Bearing parameters affecting stability are discussed. (Author)

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
PRESSURE DISTRIBUTION, STABILITY, AND RESTORING TORQUE OF AN EXTERNALLY PRESSURIZED BEARING, by R. A. Greenberg. Master's thesis. Rept. on Contract AF 19(604)5200. 2 Feb 59, 20p. 3 refs. Technical rept. no. 198; AD-212 979.
Order from LC mi$2.40, ph$3.30 PB 147 587

A theoretical analysis of an externally pressurized bearing consisting of an annular disc nearly parallel to an infinite plate is conducted. The results are presented in the form of dimensionless graphs of the pressure distribution, load capacity and flow requirements of the bearing. Also, a dimensionless graph of the restoring torque of the bearing for small deflections is presented. These results indicate that maximum stability is attained for a ratio of inner diameter to outer diameter of the annulus in the range of 0.2 to 0.3. (Author)

Engines and Propulsion Systems

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE LINEAR ACCELERATION OF LARGE MASSES BY ELECTRICAL MEANS, by Knox Millsaps and Karl Pohlhausen. June 60, 28p. 6 refs. AFMDC-TR-60-11.
Order from LC mi$2.70, ph$4.80 PB 150 046

The non-linear mathematical problem that is involved in the design of linear accelerators for large masses by electrodynamical reactions is discussed for the cases of battery and capacitor power sources. The influence of critical changes in the design parameters is examined by numerical and analogical integration of the equations. (Author)

Naval Weapons Lab., Dahlgren, Va.
PRESSURE, TEMPERATURE, AND NOISE MEASUREMENTS IN THE SUBSONIC REGION OF THE TERRIER GUIDED MISSILE BOOSTER MK 12 MOD O (X-240) EXHAUST STREAM, by J. F. South, R. F. Goodhart, and T. I. Dodson. 29 July 60, 46p. 2 refs. NWL rept. no. 1712.
Order from LC mi$3.30, ph$7.80 PB 149 968

The experimental results of the pressure and temperature measurements are in the form of profile and contour plots which show the pressure and temperature distributions throughout the subsonic exhaust stream region. The results of the noise level measurements are for one quadrant of a circle and show the sound pressure levels of the noise at various locations therein. (Author)

Manufacturing Equipment and Processes

Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF ELECTROPOLISHING AS A TECHNIQUE FOR PRODUCING TAPERED WIRE, by Dan B. Darden. Technical note no. 2, 1 Dec 59-29 Feb 60, on Contract AF 08(635)391. 10 Mar 60, 17p. APGC-TN-60-44.
Order from LC mi$2.40, ph$3.30 PB 149 848

Previous tests on carbon steel music wire had shown no deterioration of tensile strength after electropolishing. Further investigation has shown that the electropolished wire has fatigue strength slightly superior to the unpolished wire. Metallurgical examination of polished and unpolished wires showed some structural differences, but these could not be definitely attributed to electropolishing. Photographs of specimens are included. A schematic of a production facility for tapered wire is shown. The cost of producing the first 40,000-foot tapered wire is estimated to be about $5000. Production wires could possibly be produced for as little as $100, plus the cost of material. No further experimental work under this contract is contemplated. (Author) (See also PB 144 573)

Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF ELECTROPOLISHING AS A TECHNIQUE FOR PRODUCING TAPERED WIRE, by Dan B. Darden. Final technical rept. for 1 May 59-1 Mar 60 on Contract AF 08(635)391. 6 May 60, 48p. 6 refs. APGC-TR-60-28.
Order from LC mi$3.30, ph$7.80 PB 149 353

Tests were run on carbon steel music wire and Type 302 stainless steel wire to determine what change in unit strength would result from electropolishing 0.050- and 0.030-inch-diameter wire down to 0.020 inch. This was to evaluate electropolishing as a technique for manufacturing a continuously tapered tow cable for aerial targets. The stainless steel wire increased in unit strength from 276,000 psi at 0.0495-inch diameter to 374,000 psi at 0.023-inch diameter. The carbon steel music wire unit strength remained substantially constant. The flexural fatique strength of the electropolised carbon steel wire was found to be slightly superior to unpolished wire. Metallurgical examination of polished and unpolished carbon steel specimens showed some structural differences, but these could not be definitely attributed to electropolishing. It is estimated that a single 40,000-foot tapered wire could be produced for about $5000, with subsequent wires for about $100 each, exclusive of materials. (Author) (See also PB 149 848)

Transport, Traction and Hoist Facilities

Airborne Instruments Lab., Inc., Mineola, N. Y.
DATA ON NEW YORK AREA AIR TRAFFIC DENSITIES, by James S. Perry. Rept. on Contract NOas-56-678-c. Jan 57, 71p. 2 refs. Rept. no. 3803-1; AD-141 226.
Order from LC mi$4.50, ph$12.30 PB 147 956

The main purpose of this report has been to examine some of the aspects of air traffic in the New York area; utilizing the air-route radar display as a data-gathering tool. The parameters explored have been: total airborne traffic counts (with category breakdowns added), relation of total airborne traffic to movement data, density distributions and track composites, sector counts, separation data, airway load rates, accuracy of fix reporting, and holding-pattern sizes.

Land Locomotion [Lab.] Ordnance Tank-Automotive Command, Center Line, Mich.
A SOIL VALUE SYSTEM FOR LAND LOCOMOTION MECHANICS, by W. L. Harrison, T. Czako and others. Dec 58, 100p. 72 refs. Research rept. no. 5; AD-218 323.
Order from LC mi$5.40, ph$15.30 PB 149 277

Contents:
Physical soil and snow values for the determination of vehicle thrust
Physical soil and snow values for the determination of vehicle motion resistance
Geometrical terrain values for the determination of vehicle's operational speed
OTAC instruments for the measurement of physical soil values
The Caterpillar Corp. instruments for the measurement of physical soil values
Instrumentation for the measurement of terrain geometry
Techniques of soil measurement
Practical significance and applications of the physical soil value system
- Rigid wheel performance
- Prediction of rigid wheel sinkage
- Rolling resistance of pneumatic tires in soft soils
- Drawbar pull of tracked vehicles
- Wheels in viscous mud

Physical soil values in relation to moisture content and soil composition

Soil values and a definition of soil trafficability and vehicle mobility
Prediction of the WES Cone Index by means of land locomotion soil values.
Classification of soils and the significance of their parameters in land locomotion
Soil values and their measurements in the Soviet block

MATERIALS

Aeronautical Materials Lab., Naval Air Material Center, Johnsville, Pa.
INVESTIGATION OF THE EFFECTS OF VOLATILE CORROSION INHIBITORS ON MIL-B131C BARRIER MATERIALS, by D. Minuti and I. H. Custis. Final rept. on Proj. TED NAM AE 42144. 29 Jan 60, 13p. 3 refs. Rept. no. NAMC ANL AE 1105; AD-234 825L.
Order from LC mi$2.40, ph$3.30 PB 149 525

Investigation of the compatability of MIL-B-131C barrier materials with volatile corrosion inhibitors revealed that Type I volatile corrosion inhibitor-treated carriers had little or no effect on the water vapor transmission rate of MIL-B-131C barriers, although the resealability of some vinyl-faced barriers was affected. Type II materials caused delamination of all the polyethylene as well as a vinyl-faced barrier with resultant higher water vapor transmission rates. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
MATERIALS REVIEW NO. 7, by Arthur Lyem. May 60, 101p. 330 refs. CWL Special Publication 4-18.
Order from OTS $2.50 PB 161 971

Three hundred and thirty articles from various journals have been abstracted. The review is broken down into five major headings: (1) high polymers, (2) plastic materials, (3) synthetic fibers, (4) metals and inorganic materials, and (5) miscellaneous and new concepts. (Author) (See also PB 161 463)

[Army] Signal [Research and Development Lab.] Fort Monmouth, N. J.
THE DEVELOPMENT OF SNOW MANUFACTURING TECHNIQUES BY USE OF CLIMATIC TEST COLD ROOMS, by Alexander J. Brickler. Rept. on Operation Snowflake. 4 Dec 48, 22p. 5 refs. Engineering rept. no. 1032.
Order from LC mi$2.70, ph$4.80 PB 150 685

This report released for sale to the public 11 Oct 60.

Snow can be made in limited quantity in the cold rooms of the Climatic Test Laboratory by the chilling of moisture clouds formed from steam injected into the rooms. The process can be made continuous so that a snow fall of approximately 3 inches can be produced by a 36 hour run. (Author)

Massachusetts U., Amherst.
SOME MECHANICAL AND OPTICAL PROPERTIES OF CFN POLYMERS, by H. Kawai and R. S. Stein. Technical rept. no. 16 on Contract Nonr-2151(00). 15 Oct 59, 19p. 12 refs. AD-232 563.
Order from LC mi$2.40, ph$3.30 PB 149 482

SC-CFN-GBV polymer, prepared from single sublimed R_f butyro amidine and R_f glutaro imidine obtained from doubly distilled R_f glutaro nitrile, was heat-treated and hot-pressed between aluminum foil and cellophane. The starting mole ratio was 1.3 butyro amidine to 1 glutaro imidine. A continuous and translucent circular film of the polymer laminate was obtained by a special casting technique. The diameter and thickness of the film was about 5 and 0.02 cm, respectively. The mechanical and optical properties of the polymer film were measured simultaneously at various temperatures, the former being measured by a modified instron tensile tester and the latter by an optical system which crosses the polymer film at various angles of 90° to 45°. Data indicated that the stress relaxation at 33°C was small and reached an equilibrium beyond about 10 min. The equilibrium stress was proportional to the applied strain at least within 20% strain. A check was made on the ideal rubber elasticity behavior. The number of cross links/cc, N_C, calculated from the inclination of the straight line portion (within the strain of 9%) was 2.58×10^{19}/cc. The apparent value of N_C was determined as 2.02×10^{19}/cc, indicating that the number of effective cross-links decreases slightly beyond the strain of 10%. The birefringence change decreased in an earlier stage and then increased. The increase appeared earlier when the strain was greater.

Minnesota U., Minneapolis.
RHEOLOGICAL PROPERTIES OF ADHESIVES CONSIDERED FOR INTERFACE DAMPING, by J. S. Whittier. Rept. for June 57-Dec 59 on Metallic Materials, Contract AF 33(616)6828. June 60, 70p. 10 refs. WADD Technical rept. 60-280.
Order from OTS $1.75 PB 171 023

Machines for testing soft adhesives under static compression and shear and under dynamic shear are described. Static creep data in compression and shear are reported for Minnesota Mining and Manufacturing Company's 3M Tape #466. At a given compressive load this material deforms, after sufficient time has elapsed, to an "equilibrium" thickness. Dynamic shear data for 3M Tape #466 are reported for frequencies from 0.1 to 120 cps and for shear strain amplitudes from zero to unity and greater. Stress history and fatigue effects are also mentioned. This material is found to dissipate large amounts of specific damping energy when undergoing safe dynamic shear strains. Spot checks on the dynamic shear properties of three other materials at 11.5 cps are also presented. The terms used for data presentation are explained in the report by giving data reduction formulas. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
CORAL AND CORAL CONCRETE, by William R. Lorman. Final rept. 13 Apr 60, 57p. 22 refs. Technical rept. 068.
Order from LC mi$3.60, ph$9.30 PB 149 232

This manual describes and defines coral reefs, beaches, and elevated formation; presents salient features relative to prospecting for suitable coral deposits, extracting coralline limestone, and processing and stockpiling the aggregate; summarizes findings concerning such physical properties of coral aggregate as bulk density, specific gravity, and absorption; furnishes typical coral concrete mix-proportion data together with anticipated strength values. (Author)

Rodman Lab., Watertown Arsenal, Mass.
APPLICATION OF THE DIGITAL COMPUTER TO MICROHARDNESS DETERMINATION, by K. D. Holmes, E. Deluca, and G. D. Pinching. Apr 60, 9p. 2 refs. Rept. no. RPL 10/24.
Order from LC mi$1.80, ph$1.80 PB 149 571

A simplified method for determining Knoop or Diamond Pyramid microhardness numbers is established by using the digital computer to convert the measured length of the microhardness impression directly to its corresponding hardness number. Numerical tables are set up which eliminate operator calculations, thereby considerably reducing the time and effort necessary for obtaining a microhardness number. (Author)

Ceramics and Refractories

Battelle Memorial Inst., Columbus, Ohio.
CHARACTERISTICS GOVERNING THE FRICTION AND WEAR BEHAVIOR OF REFRACTORY MATERIALS FOR HIGH-TEMPERATURE SEALS AND BEARINGS, by Lewis B. Sibley, Arthur E. Mace and others. Rept. for 1 Mar 58-31 May 59 on Ceramic and Cermet Materials, Contract AF 33(616)3995. May 60, 54p. 4 refs. WADD Technical rept. 60-54.
Order from OTS $1.50 PB 171 010

Various ceramic and cermet materials have been evaluated for unlubricated wear resistance at high sliding speed (100 to 200 fps) and low unit load (5 to 50 psi) in 1000 to 1800°F air. A statistical correlation was obtained between the measured wear rates under these conditions and the coefficient of friction, the thermal-stress-resistance, and the thermal diffusivity of the mated materials on which wear predominated. A mechanism of wear has been evolved based on the above correlation and on the experimental study of friction and wear surface-temperature fluctuations using special transducers and color-motion-picture photography. During high-speed sliding wear appears to be induced by the inability of ceramic and cermet materials to resist thermal stresses produced by temperature gradients within each rubbing surface between small asperities or hot spots in frictional contact and the body of the respective materials. In this situation, the wear rate is influenced both by the configuration of the rubbing parts and by the thermal-stress-resistance properties of the materials. Promising materials for high-temperature high-speed sliding bearings and seals include Al_2O_3-Cr-Mo cermets, SiC ceramics, and TiC-Ni-Mo cermets. (Author)

Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF METHODS AND INSTRUMENTS FOR MECHANICAL EVALUATION OF REFRACTORY MATERIALS AT VERY HIGH TEMPERATURES, by D. H. Fisher, D. N. Gideon and others. Rept. for 1 Feb 59-31 Mar 60 on Metallic Materials, Contract AF 33(616)6155. June 60, 82p. 79 refs. WADD Technical rept. 60-155.
Order from OTS $2.25 PB 171 012

A mechanical-testing system has been established which is capable of providing tensile and compressive stress-strain data and shear-strength data up to 400 F in vacuum. The results of an evaluation of the system using a molybdenum-0.5 percent titanium alloy in the bar form are presented. Tension, compression, shear and bearing tests were conducted at temperatures up to 3500 F. A detailed description of the testing system and specimen designs is presented. An optical strain-measurement system which permits displacements to be measured directly in the gage section is described. The state-of-the-art report on the development of equipment and techniques of mechanical-properties measurement is based on a survey of literature and discussions with researchers at Battelle and other laboratories. With the objective of developing equipment and technique for use to 6000°F or higher problems to be solved in order that accurate data will be obtained are considered. Recommendations are made concerning furnace design, temperature and strain measurement, and specimen, grip and loading design. In particular, the probable advantages of graphite heaters coated with tantalum carbide are pointed out. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STRAIN AGING OF REFRACTORY METALS, by A. G. Imgram. Rept. on Contract AF 18(600)1375. 12 Aug 60, 64p. 47 refs. DMIC rept. no. 134.
Order from OTS $1.75 PB 151 092

The available data on strain-aging behavior of 12 refractory metals (V, Cb, Ta, Cr, Mo, W, Ru, Rh, Pd, Os, Ir, and Pt) are reviewed and interpreted in terms of dislocation models. (Author).

Fuels, Lubricants, and Hydraulic Fluids

Aerojet-General Corp., Azusa, Calif.
THE ROLE OF BINDER IN COMPOSITE PROPELLANT COMBUSTION, by R. F. Chaiken and W. H. Andersen. Rept. on Contract AF 49(638)566. July 59, 26p. 16 refs. Aerojet rept. no. TN-30; ARPA Order no. 24-59, Task 2; AFOSR TN-59-540; AD-228 340.
Order from LC mi$2.70, ph$4.80 PB 149 772

The interrelation of binder (fuel) and oxidizer during burning of conventional types of solid composite propellants is discussed in terms of the mechanism of the

combustion process. A major feature of most contemporary theories of composite propellant combustion is that diffusion processes are involved in the chemical reactions between the gaseous pyrolysis products of the oxidizer and binder. However, the importance of these diffusion processes in affecting the propellant-burning characteristics depends upon the relative rates of reaction between the oxidizer-binder pyrolysis products and the oxidizer pyrolysis products alone. Utilizing the recently developed "Two-Temperature" and "Thermal Layer" theories of combustion, it is possible to delineate the various effects of these gaseous reactions on the propellant burning rate. These theories have been extended semi-quantitatively to include the effects of dilution, diffusion, and fast chemical reaction of the gasified binder. The combustion of ammonium nitrate and ammonium perchlorate propellants is discussed in terms of the described concepts, and compared with experimental data where possible. Evidence is presented which suggests that the "order-of-magnitude" burning rates of most ammonium-nitrate-based propellants should be determined largely by the chemical decomposition behavior of the oxidizer, with the binder decomposition playing a secondary role. It is not clear that the same situation holds for ammonium-perchlorate-based propellants. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
A TRACER METHOD FOR BURNING RATE MEASUREMENT IN SOLID-PROPELLANT MOTORS, by F. G. Penzig. Aug 60, 24p. 5 refs. AFMDC-TN-60-8.
Order from LC mi$2.70, ph$4.80 PB 150 045

Problems associated with the development of large, solid-propellant rockets are discussed. A new diagnostic method is proposed whereby tracers are imbedded into the grain and are released when the burning zone has reached their particular location. The release is recorded by spectroscopic monitoring of the exhaust flame of the rocket. Consequently, the method permits measurement of the actual burning rate of the propellant in a rocket motor. Research is proposed on the selection of suitable elements and compounds as tracers measurement of the line or band intensity as a function of temperature and concentration, and the ability of spectroscopic signals at low temperature and against background radiation. This study concentrates on the applicability of the method. A number of readily available tracer substances are discussed, including applicability of the method to advanced propellants with high background radiation. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
INTRODUCTION TO SOLID-PROPELLANT THERMAL PROPERTY SCALING THEORY, by Ralph D. Doner. 12 Oct 59, 12p. 4 refs. ARGMA TN 1 G4N; AD-227 628.
Order from LC mi$2.40, ph$3.30 PB 149 440

Some implied scaling relations between solid symmetric bodies found in the literature on heat transfer are analyzed and exhibited. A suggested approach to the task of establishing a scaling theory for solid-propellant grain configurations is to extend the theory for solid bodies to include hollow cylinders, and then, by computation and physical tests, find the hollow cylinder equivalent for each type of configuration. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EVALUATION OF PROPELLANT STABILITY BY OXYGEN TALIANI TEST AND CHEMICAL ANALYSIS, by L. DeAngelis and G. F. Gardin. Aug 59, 14p. 11 refs. Memo. rept. no. 1129; AD-228 834.
Order from LC mi$2.40, ph$3.30 PB 150 297

The oxygen Taliani Test has been extended to measure the chemical stability of single base propellants. The results correlate well with chemical analysis of propellant stabilizer and stabilizer reaction products. The findings were made by aging propellant samples at 80°C, a temperature previously considered too high for obtaining reliable stability data. However, evidence is presented to show that the principal chemical reactions between propellant and stabilizer at this temperature can be considered similar to those occurring at ambient temperatures. Accelerated aging at 80°C and the Oxygen Taliani Test have been used to make quantitative measurements of chemical stability for single base propellants. (Author)

Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE TITANIUM-LIQUID OXYGEN PYROPHORIC REACTION, by J. D. Jackson, P. D. Miller and others. Rept. for 1 June 59-15 Feb 60 on Metallic Materials, Contract AF 33(616)6345. June 60, 59p. 29 refs. WADD Technical rept. 60-258.
Order from OTS $1.50 PB 171 017

A review of the literature indicates that titanium is impact sensitive under liquid oxygen below the acceptable limit for other metals. An experimental program was begun to determine the mechanism of the titanium-LOX reaction. Several factors were investigated singly in a controlled manner using unalloyed titanium (75A) and an alloy (6Al-4V) that were carefully cleaned. The factors were: (1) Exposure of a fresh surface by fracture and tearing (2) Deformation by impact using steel balls (3) Impact of smooth specially cleaned flat surfaces (4) LOX pressure and velocity (5) Galling. The results from this program indicate that no one of the above, per se, is a primary cause of this reaction. A proposed mechanism is that heat generated by impact produces gaseous oxygen, which is compressed at local sites. A fresh surface exposed by the impact reacts with the high-pressure gaseous oxygen. Propagation is dependent on the amount of heat generated and the rate of heat loss from the affected area. (Author)

Bureau of Mines, Washington, D. C.
THE FISCHER-TROPSCH SYNTHESIS ON THE OIL-CIRCULATION PROCESS: EXPERIMENTS WITH A NITRIDED FUSED-IRON CATALYST, by D. Bienstock, J. H. Field and others. [1960] 37p. 23 refs. Rept. of Investigations 5603.
Order from LC mi$3.00, ph$6.30 PB 146 767

Using a nitrided fused-iron catalyst, the Bureau of Mines investigated the Fischer-Tropsch reaction in the oil-circulation process. The nitrided iron was

quite stable and permitted the longest run obtained thus far in the oil-circulation process without the need for reactivating the catalyst--3,700 hours of operation. The effects of several operating variables--temperature, pressure, gas-recycle ratio, space velocity, synthesis-gas composition, and synthesis with and without reflux of oil to the reactor--on the production of oxygenates were studied. The importance of removing reflux oil and of high gas recycle in increasing the oxygenate content was shown. A finished gasoline containing 28 percent by weight alcohols was produced. The research octane number (RON) was 92.9 clear, increasing to 98.5 with the addition of one milliliter of tetraethyl lead (TEL). (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
FLAME PROPAGATION IN LIQUID-FUEL DROPLET ARRAYS, by R. Reichenbach, D. Squires, and S. S. Penner. Technical note no. 30 on Contract DA 04-495-ORD-1634; Continuation of Contract DA 04-495-ORD-446. June 60, 18p. 2 refs. OOR rept. no. no. 834.43-C.
Order from LC mi$2.40, ph$3.30 PB 150 402

Flame propagation rates have been determined in one-dimensional arrays of liquid octane droplets burning in air without forced convection. Schlieren photographs of the burning array show the importance of immersion depth in the heated gas region for ignition and flame propagation. The measured flame propagation times for various droplet sizes and droplet spacings are proportional to (immersion depth)$^{-1.5}$. A tentative explanation is proposed for these results. (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
RADIATION AND BURNING VELOCITIES OF PROPANE-OXYGEN-NITROGEN MIXTURES, by R. Reichenbach. Technical rept. no. 31 on Contract DA 04-495-ORD-1634. June 60, 30p. 20 refs. OOR rept. no. 834-42-C. AD-239 907.
Order from LC mi$2.70, ph$4.80 PB 150 397

Experiments have been conducted with inert diluent contents (by mass) of 50, 60, 70 and 80 percent nitrogen and with equivalence ratios of 0.6, 0.8, 1.2, 1.4 and 1.6. The spectral intensity ratio was found to be a function not only of the equivalence ratio but also of the percentage of inert diluent. Hence it is not possible, in general, to use spectral intensity ratios as a measure of mixture composition, a procedure that has been used erroneously by a numer of investigators. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
OPTIMUM PROGRAMMING OF PROPELLANTS TO OBTAIN MAXIMUM VELOCITY FROM A TWO-STAGE ROCKET, by Jean Parks and R. H. Olds. Technical rept. Nov 59, 49p. 4 refs. LMSD-288047; AD-231 037.
Order from LC mi$3.30, ph$7.80 PB 148 942

Previous studies have shown that certain combinations of two propellants with significantly different densities and specific impulses will propel a given single-stage rocket to a final velocity greater than that obtainable from the use of either propellant alone. This report extends the investigation to the treatment of a two-stage rocket employing four different propellants, two different propellants in each stage. A method is presented for determining the optimum mode of varying the propellant mixture ration during burning so as to achieve the maximum possible velocity from the two-stage rocket.

Massachusetts Inst. of Tech., Cambridge.
INTERACTIONS AMONG BURNING FUEL DROPLETS. I. A SINGLE FUEL PLATE, by Tau-Yi Toong. Rept. on Contract AF 49(638)629. 31 May 60, 26p. 7 refs. Technical rept. no. 8227-1; AFOSR-TN-60-516; AD-239 513.
Order from LC mi$2.70, ph$4.80 PB 149 461

This is the first of a series of papers, intended to discuss the basic causes and mechanisms of the interactions among burning fuel droplets and their effects on over-all burning rate and combustion stability and roughness in a combustor employing fuel sprays. The boundary-layer equations governing the flow of an oxidizer over a flat plate covered with fuel are solved for a special case, where the flame front can be treated as a discontinuity. The results presented include the profiles of velocity, composition and temperature in the boundary layer adjacent to the fuel plate as well as the evaporation or sublimation rate at the fuel surface and the combustion rate at the flame front. For a given fuel-oxidizer combination and for a given heat transfer required to evaporate (or sublime) one unit mass of fuel, both the evaporation (or sublimation) and the combustion rates per unit plate area and per unit mass velocity of the oxidizer in the free stream are inversely proportional to the square root of the length Reynolds number. With increasing values of the heat ratio, they both increase at a given length Reynolds number, although the ratio of the combustion to evaporation (or sublimation) rates decreases. This latter observation indicates the possibility of a long over-ventilated flame near the wake of a burning fuel droplet. (Author)

Massachusetts Inst. of Tech., Cambridge.
INTERACTIONS AMONG BURNING FUEL DROPLETS. II. TWO PARALLEL FUEL PLATES, by Tau-Yi Toong. Rept. on Contract AF 49(638)629. 31 May 59, 20p. 4 refs. Technical rept. no. 8227-2; AFOSR-TN-60-517; AD-239 669.
Order from LC mi$2.40, ph$3.30 PB 149 462

The interactions between two parallel fuel plates burning in an oxidizer stream are studied by the use of an integral method. Within the region of validity of this method, where the flames adjacent to the plates are separated from each other, the evaporation or sublimation rate at the fuel surface increases with decreasing spacing between the plates, while, in the meantime, the combustion rate at the flame front decreases. These interactions become less important with decreasing value of the heat ratio. Applying the results obtained in this work to the case of two fuel droplets burning side by side, one would predict an increase in both the burning rate and the flame length with decreasing droplet spacing, as long as the flames surrounding the droplets are separated from each

other. These predictions are found to agree well with the experimental results, which will be presented in the third paper of this series. (Author) (See also PB 149 461)

Naval Research Lab., Washington, D. C.
THE STABILIZATION OF SILICONE LUBRICATING LIQUIDS ABOVE 200°C. PART 2. IRON, COPPER, CERIUM, AND OTHER METAL COMPOUNDS, by H. R. Baker and C. R. Singleterry. Interim rept. 12 Aug 60, 27p. 5 refs. NRL rept. 5474.
Order from OTS $0.75 PB 161 449

Silicone liquids have been stabilized against oxidation and gelation so that the useful life at 325°C or below is lengthened 30- to 500-fold over the original oil. The stabilization is accomplished by treating the silicone oil with a cerium soap in the presence of disalicylalpropylenediamine, or a related chelating compound, at 285°C. Similar but less effective stabilization occurs when the cerium soap is replaced by suitable iron, copper, chromium, praseodymium, or europium compounds. This treatment is effective with dimethyl silicones and also with phenyl-substituted types. The percentage improvement obtainable with the phenylated oils decreases with increasing aromatic content; after inhibition the lightly phenylated oils, which have excellent viscosity-temperature characteristics, have as long a life as the highly phenylated oils, heretofore found most stable in high-temperature service. Also, the volatile products of silicone oxidation at 300°C promote premature gelation if they are returned to the liquid under test.

Nonmetallic Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
HIGH TEMPERATURE HYDRAULIC FLUIDS. PART I. CHEMICAL DEGRADATION IN A HIGH TEMPERATURE, HIGH PRESSURE CIRCULATION LOOP, by Leslie R. Drane, Jr. and R. J. Benzing. Rept. on Power Transmission Technology. May 60, 20p. 6 refs. WADD Technical rept. 60-250, Part I.
Order from OTS $0.50 PB 161 965

A study was made to observe the nature and intensity of chemical degradation resulting from severe mechanical shearing stresses at elevated (400°F) temperature. The degradation of these four fluids (two silicones, a silane, and an alkoxy disiloxane) were also studied under static thermal conditions. The physical and chemical properties, particularly viscosity, neutralization number, and flash point showed changes in direction of values with time. Possible mechanisms of break-down to explain observed differences between the static and dynamic tests are discussed. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
EVAPORATION AND BREAKUP OF FUEL DROPLETS IN ONE-DIMENSIONAL GAS FLOW IN A COMBUSTION CHAMBER, by Leonard M. Naphtali and Samuel Z. Burstein. Rept. on Contract AF 49(638)165. Jan 60, 21p. 6 refs. PRL-60-2; AFOSR-TN-60-229; AD-233 498.
Order from LC mi$2.70, ph$4.80 PB 148 999

A mathematical model was formulated of combustion in a rocket motor as controlled by the evaporation process of an arbitrary number of droplets of injected fuel. It was assumed that interaction between single droplets was negligible and that evaporation rates of a distribution of droplets were additive. The results of the evaporation of the fuel droplets were weighed to yield a mass rate flow which was consistent with the conditions in a combustion chamber producing a thrust of about 25,000 lb. The model was programmed as a Fortran II subroutine for the IBM 704. Computations revealed that under a wide range of conditions a cooperative breakup occurred, in which the increased velocity of gases caused droplet breakup, which further increased evaporation. As a result, the overall evaporation occurred suddenly in a narrow zone in the combustion chamber where the velocity gradient was high. It was concluded that droplet breakup was the most important single parameter in spray combustion. The combustion zone tended to be narrow and relatively insensitive to size distribution, mass drop size, velocity, or temperature of the liquid.

Research Inst., Temple U. Philadelphia, Pa.
RESEARCH STUDY OF THE OXYGEN FLUORIDES, O_2F_2, O_3F_2 AND O_4F_2, INCLUDING THE HEATS OF FORMATION OF O_2F_2 AND O_3F_2, by A. D. Kirshenbaum, J. G. Aston, and A. V. Grosse. Final rept. on Contract DA 36-034-ORD-2250. 18 Nov 58, 51p; 33 refs; AD-212 168.
Order from LC mi$3.60, ph$9.30 PB 149 443

Contents:
Physical and chemical properties of the oxygen fluorides
Heat of formation of O_3F_2 and O_2F_2
Discussion of possible structures of O_2F_2 and O_3F_2
Infrared analysis of O_2F_2

Rocketdyne, Canoga Park, Calif.
DISPLACEMENT AND SHATTERING OF PROPELLANT DROPLETS, by E. Rabin, A. R. Schallenmuller, and R. B. Lawhead. Rept. on Contract AF 18(603)98. Mar 60, 124p. 20 refs. R-2431; AFOSR-TR-60-75.
Order from LC mi$6.30, ph$19.80 PB 150 143

Studies in shock tubes have been conducted to determine the effect of shock waves on the shattering and drag of burning and nonburning liquid fuel droplets. The effect of flow velocity, flow duration, surface tension, and chamber pressure on the breakup characteristics were studied. The critical velocity that would just cause droplet breakup (burning or not) for short-duration flow was found to agree with the equation: $We\ Re^{-1/2} \simeq 0.45$. The drag coefficient for burning and nonburning drops was found to be approximately $C_D = 1.0$.

Leather and Textiles

Fabric Research Labs., Inc. [Dedham, Mass.]
A POSSIBLE APPLICATION OF ORGANIC FIBERS IN HIGH TEMPERATURE ENVIRONMENT, by Myron J. Coplan, Donald H. Powers, Jr. and others. Rept. for Mar-Dec 59 on Air Force Textile Materials, Contract AF 33(616) 6234. June 60, 137p. 90 refs. WADD Technical rept. 60-9.
Order from OTS $2.75 PB 171 020

It is taken as a premise that fabrics used in re-entry drag parachutes (1) require typical textile properties up to deployment but (2) that they need not survive in their original chemical state subsequent to deployment provided the decay occasioned by re-entry conditions (heat, active oxygen, irradiation) does not interfere with the deceleration function. The possible utility of linear organic polymers as the principal chemical species in such materials is examined. Typical organic, metallic and ceramic materials are contracted and the advantages of organic materials are defined. Recognizing that the principal deficiencies of organic polymer fibers are their thermal and thermochemical sensitivity, a survey of their causes is given. A means of employing materials by taking advantage of their thermal degeneration is proposed. A number of specific thermo-chemical reaction schemes and polymer systems are proposed. More experimental effort is required to assure the feasibility of any of the specific schemes proposed. (Author)

Naval Supply Research and Development Facility, Bayonne, N. J.
REFLECTIVE INSULATION IN FABRIC SYSTEMS, by John J. Anderson and George Higginbottom. Sep 59, 21p. 5 refs. Clothing and Textile Div. rept. no. 44.
Order from LC mi$2.70, ph$4.80 PB 146 975

Several fabric systems employing thin metal films which act as far infra-red barriers were tested for conductance and compared against the conductance of the fabric system used in Navy extreme cold weather clothing. Conductance was measured at sea level, 20,000 and 40,000 feet simulated altitude. Metallized fabrics separated by an open mesh spacer provide good insulation comparable to conventional fibrous systems of equal thickness and are lighter in weight. (Author)

Quartermaster Research and Engineering Center, [Natick, Mass.]
DEVELOPMENT OF SHADE STANDARDS AND TOLERANCES FOR SILVER TAN 193, by Frank J. Rizzo, Constantine J. Megas and others. Rept. for 9 Apr 53-15 Apr 58 on Air Force Textile Materials, Contracts AF 33(616)53-221 and AF 33(616)54-107. June 60, 123p. 25 refs. WADD Technical rept. 60-151.
Order from OTS $2.75 PB 171 011

Shade standards and tolerances have been developed for tropical and gabardine weave fabrics in all wool, wool/polyester and polyester/rayon blends. Tolerance spacing is such as to permit interchange of uniform components made for the blend fabrics with components made of all wool so long as the weave construction is common. The limiting factor to such usage is considered to be differences in appearance originating with the gloss of the fibers and not the chromatic and lightness deviations of the tolerance range. Colorfastness is good at 50 Standard Fading Hours for all fabrics, except for the polyester/rayon tropical where the vat dyed rayon permits a rating of good at 120 Standard Fading Hours. Dye formulations selected are practical for routine application and stable to finishing factors. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
EFFECT OF PICKS PER INCH AND FINISHING PROCEDURES ON THE PROPERTIES OF 1.1-OUNCE NYLON RIPSTOP PARACHUTE FABRIC, by Harold H. Brandt and Leo Linden (Warwick Mills). June 60, 54p. 18 refs. Textile Series rept. no. 113.
Order from LC mi$3.60, ph$9.30 PB 150 265

This report presents the production and laboratory evaluation of 1.1-ounce nylon ripstop fabrics produced with different picks and finished by two different sequences of the finishing operations. It is believed that the information contained in this report will be of value to the textile industry as well as to the military in the production of a nylon canopy fabric which will possess an adequate air permeability during the life of the parachute. (Author)

Paints and Finishes

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
ANALYSIS OF AUTOMOTIVE METHACRYLATE LACQUERS, by M. H. Swann. 20 June 60, 8p. 2 refs. CCL #95.
Order from LC mi$1.80, ph$1.80 PB 149 961

The basic resinous portion of the new acrylic automotive lacquers is an alkyl ester of methacrylic acid. They are blended with nitrocellulose and suitable plasticizers in the approximate ratio of 12:4:1 parts by weight. Procedures for measuring the methacrylate resins in typical mixtures of this type have not been available. Use is made of the difference in resistance to saponification to isolate the methacrylate resins. (Author)

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
GEL-TYPE, VERTICAL ADHERENCE PAINT REMOVERS, by A. Mankowich. Rept. no. 1, 20 July 60, 13p. 1 ref. CCL #94.
Order from LC mi$2.40, ph$3.30 PB 149 420

A heavy duty, single phase, alkaline-organic solvent paint remover, formulated during the development of medium pH strippers suitable for use on missile component parts of aluminum, can be converted into stable, vertical adherence strippers by gelling with metallic soaps. A method of preparing the gels has been devised. While such removers are transformed into two liquid layers at 155° F and frozen solid at -40°F, they regain their original consistency and adhesiveness at room temperature. Low alkalinity compositions of this type, suitable for use on aluminum basis metals from the non-corrosivity standpoint, are unsuitable because of almost zero stripping efficiency.

Plastics

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DETERMINATION OF LONG TERM BEHAVIOR OF EXTRUDED PLASTIC PIPE FROM BURST STRENGTH TESTS, by S. Goldfein. 29 July 59, 28p. 11 refs. Rept. 1590-TR; AD-226 688.
Order from LC mi$2.70, ph$4.80 PB 150 199

Four types of thermoplastic pipe were investigated. These included high-density polyethylene, acrylonitrile-butadiene-styrene, high-impact polyvinyl chloride, and normal polyvinyl chloride pipe. Master rupture curves were obtained by plotting hoop stress versus the parameter. The master curves so obtained were then used to predict rupture properties for periods of time from 0.1 hour to 45,000 hours. Good accuracy was obtained by this method. It is concluded that: (a) The parameter $K = \frac{T_o T}{T_o - T}(20 + \log t)$, where T_o = zero strength temperature (degrees R), and t = time (hours), may be used to determine long-term operating pressures of thermo-plastic pipe using burst strength tests at elevated temperatures. (b) The value of zero strength temperature may be determined from molding temperature data or extrapolation of strength-temperature curves, whichever is more feasible. (Author)

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DEVELOPMENT OF NONDESTRUCTIVE TEST FOR PLASTICS, by S. Goldfein. 16 May 60, 49p. 2 refs. Technical rept. 1633-TR.
Order from LC mi$3.30, ph$7.80 PB 150 231

An investigation was made to determine whether a penetration type test could be developed as a nondestructive test for determining the strength of plastic materials and items fabricated from plastics. A penetrator having a circular cross section .130 in. in diameter was forced into 17 different plastic materials. The characteristics of the penetration load-penetration depth curves were studied, as well as the progressive damage to the plastics. Many useful relationships were established, including a relationship between penetration index (a property easily determined with no mark or effect on the material) and the following properties: tensile, shear, and compressive strengths, and tensile modulus. The method is limited to materials and items under which a steel backup plate can be placed. It is concluded that: (a) a mechanical, nondestructive test method based on a penetration test has been developed for use with all types of plastics; (b) new properties designated as penetration proportional limit, penetration strength, and penetration index may be useful in characterizing plastic materials for design or inspection purposes; (c) the test may presently be performed in the laboratory rapidly and with little cost. (Author)

Army Prosthetics Research Lab., Washington, D. C.
A METHOD FOR THE DETERMINATION OF SOIL RESISTANCE OF POROUS LAMINATES, by William C. Wiedman and James T. Hill. June 59, 11p. 1 ref. Technical rept. no. 5932; AD-220 610.
Order from LC mi$2.40, ph$3.30 PB 147 818

A preliminary investigation is described of a method for soiling and cleaning porous laminates. The process consists of blowing finely powdered charcoal on the surface of a laminate sample, measuring its reflectance value on a Color Difference Meter and then cleaning the sample with a stream of air. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
ULTRA-HIGH RESISTANCE MEASUREMENTS OF PLASTICS, by Andrew R. Blanck. Aug 60, 14p. 4 refs. Technical rept. FRL TR-6.
Order from OTS $0.50 PB 161 784

A method has been developed for measuring resistances greater than 10^{16} ohms. This method is based on the use of a voltage divider integrating circuit in conjunction with commercially available high-input impedance electrometers. Accuracy of the technique was confirmed by testing a resistor with a certified value of 10^{13} ohms. The ability to measure these extremely high resistance values is necessary for determining the resistivities of low-loss dielectrics such as Teflon, polystyrene, Mylar, and some epoxies and for determining the insulation resistance and leakage of components and electrical equipment. Teflon was found to have a volume resistivity of 5×10^{19} ohm-cm at a potential gradient of 5 volts/mil and 5×10^{20} ohm-cm at .05 volt/mil. (Author)

Naval Research Lab., Washington, D. C.
PHOTODEGRADATION OF HIGH POLYMERS. PART I. THE HOMOGENEOUS IONIC POLYMERIZATION OF α-METHYLSTYRENE, by R. B. Fox and L. Isaacs. 19 Aug 60, 11p. 30 refs. NRL rept. 5518.
Order from LC mi$2.40, ph$3.30 PB 147 965

A practical method has been developed for the laboratory preparation of poly-α-methylstyrene. The procedure involves the reaction of α-methylstyrene with sodium in tetrahydrofuran solution at a temperature above the ceiling temperature for the monomer concentration used and propagation by cooling to -78°C. All operations are conducted under helium. Optical densities of the solutions just prior to cooling are related empirically to the intrinsic viscosities of the polymers produced, and viscosities are given as a function of polymerization time for a fixed solution optical density. Relatively mono-disperse polymers with predictable molecular weights in the range of 50,000 to 1 million were prepared. Their molecular weight distributions were compared qualitatively by sedimentation methods with those obtained by heterogeneous sodium initiation and boron trifluoride etherate initiation. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE PYROLYSIS OF PLASTICS IN A HIGH VACUUM ARC IMAGE FURNACE, by Henry L. Friedman. Rept. on Contract AF 04(647)269. May 60, 39p. 7 refs. Technical Information Series R60SD380.
Order from LC mi$3.00, ph$6.30 PB 150 288

An apparatus is described for high vacuum pyrolysis of plastics in an arc-image furnace. A fractionation and analysis scheme is presented, whereby the complex mixture of pyrolysis products may be analyzed accurately. The design of a new gas chromatography valve is included. This experimental approach is able to yield a very complete picture of the chemical composition of pyrolysis products. The rate data were not as accurate as the chemical analyses. The data which may be obtained from such experiments will be useful for ablation studies and for gaining insights to the mechanism of thermal degradation of plastics. (Author)

MATHEMATICS

Applied Mathematics and Statistics Labs., Stanford U., Calif.
BANACH ALGEBRAS WITH SCATTERED STRUCTURE SPACES, by Irving Glicksberg. Technical note no. 13 on Contract AF 49(638)294. 11 Aug 60, 16p. 14 refs. AFOSR-TN-60-805.
Order from LC mi$2.40, ph$3.30 PB 150 107

Applied Mathematics and Statistics Labs., Stanford U., Calif.
CRITERIA FOR THE RECURRENCE OR TRANSIENCE OF STOCHASTIC PROCESSES. I, by John Lamperti. Technical rept. no. 16 on Contract Nonr-225(28). 14 Oct 59, 28p. 8 refs. AD-227 372.
Order from LC mi$2.70, ph$4.80 PB 149 949

Applied Mathematics and Statistics Labs., Stanford U., Calif.
PREDICTION REGIONS FOR SEVERAL PREDICTIONS FROM A SINGLE REGRESSION LINE, by Gerald J. Lieberman. Technical rept. no. 42 on Contract N6onr-25126. 10 Oct 59, 14p. 1 ref; AD-227 879.
Order from LC mi $2.40, ph$3.30 PB 149 942

Two methods, the exact method and the approximate method, are given for obtaining a prediction region for future observations based upon the same estimated linear regression given the values of the independent variables. (Author)

Applied Mathematics and Statistics [Labs.] Stanford U., Calif.
THE RECURRENCE OF REAL MARKOV PROCESSES, by John Lamperti. Technical rept. no. 27 on Contract Nonr-225(21). 8 June 59, 23p. 5 refs. AD-217 647.
Order from LC mi$2.70, ph$4.80 PB 147 895

Markov processes are considered which have the non-negative reals as their state space, and the property that the transitions made by the process are uniformly bounded. If $\{X_n\}$ are the random variables comprising the process, then for some constant $M < \infty$, $|X_{n+1} - X_n| \leq M$ a. s., $n = 0, 1, 2, \ldots$. Conditions are found under which $X_n \to \infty$ a. s. ($\{X_n\}$ is transient), and also under which $\{X_n\}$ is recurrent. These conditions are in terms of the behavior of the function $F(x, y) = \Pr(X_{n+1} \leq y \mid X_n = x)$ for large values of x. (Author)

California U., Los Angeles.
INCREMENTAL PHASE PLANE ANALYSIS OF NONLINEAR SECOND ORDER DIFFERENCE EQUATIONS, by Richard A. Nesbit. Rept. on Contract AF 49(638)438. Feb 60, 36p. 13 refs. Dept. of Engineering rept. no. 60-28; AFOSR-TN-60-616.
Order from LC mi$3.00, ph$6.30 PB 150 251

The use of the incremental phase plane in the analysis of nonlinear difference equations is discussed. The variable and its first difference are the coordinates of this plane; for each point in the plane there is a unique solution to a second order difference equation. The relation between the trajectories in the incremental phase plane and in the ordinary phase plane is shown for linear paired equations. An isocline method of graphically obtaining the solution to the difference equation is developed. An extension of the isocline method gives a set of curves tangent to the solution path, called path tangent curves. These curves allow convenient description of difference equation switching. Criteria for the determination of the stability of singular points in the incremental phase plane are given for both forms of the difference equation. For continuity of development, a synopsis of related material is presented. It is intended that these techniques may be applied to aid the design of nonlinear sample data systems. (Author)

California U., Berkeley.
LOWER BOUNDS FOR THE FIRST EIGENVALUE OF ELLIPTIC EQUATIONS OF ORDERS TWO AND FOUR by William W. Hooker. Technical rept. no. 10 on Contract AF 49(638)398. Aug 60, 51p. 24 refs. AFOSR-TN-60-806.
Order from LC mi$3.60, ph$9.30 PB 150 237

This dissertation is concerned with the analytic and numerical study of a new method of obtaining lower bounds for the first eigenvalue of elliptic differential equations. The basic feature of this method was developed by M. H. Protter from an idea due originally to Picard.

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
LINEAR PROGRAMMING AND DISCRETE DYNAMIC PROBLEMS, by John F. Muth. ONR memo. no. 67 on Planning and Control of Industrial Operations, Contract [Nonr-760(01)] Oct 59, 11p. 2 refs. AD-227 319.
Order from LC mi$2.40, ph$3.30 PB 149 878

A system is assumed to possess a finite number of states, the probability of being in any particular one depending on the previous state of the system, as well as the process chosen by the decision-maker. The probabilities and the short-run profits for each transition and process constitute the data. The problem is to find the policies leading to maximum profits in the long run. The purpose of this paper is to show that the problem may be handled with extreme point methods of linear programming. By recasting the problem in such terms a variety of efficient algorithms and computing routines are available for practical use.

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
OPTIMAL PROCESS MEANS AND THE DISTRIBUTION OF COMPLETION TIMES, by John F. Muth. ONR Research memo. no. 66 on The Planning and Control of Industrial Operations, Contract [Nonr-760(01)]. Sep 59, 18p. 4 refs. AD-227 318.
Order from LC mi$2.40, ph$3.30 PB 148 603

Quality control theory is concerned with accepting a batch of a product or detecting when a production process starts to wander or get out of control with

minimal sampling costs for a specified degree of precision. Problems on the optimal design of the process are examined. One of these is choosing the mean of a process to minimize the costs of scrapping and reworking an item. The problem is stated as follows: suppose a single dimension of a part is being machined; for a unit to be acceptable, this dimension must lie between the lower tolerance limit, L, and the upper limit, U. If the relevant dimension is less than L, the item must be scrapped and replaced at an extra cost of S; if greater than U, it may be reworked at an extra cost of R. (Author)

Chicago U., Ill.
NOTE ON COHOMOLOGY ALGEBRAS OF SYMMETRIC GROUPS, by Minoru Nakaoka. Technical note on Contract AF 18(600)1383. June 60, 19p. 5 refs. AFOSR-TN-60-757.
Order from LC mi$2.40, ph$3.30 PB 150 059

This is a continuation of a previous paper, and deals with the mod p cohomology algebra $H^*(S(m); Z_p)$ of the symmetric group S(m) of degree m, where $1 \leq m \leq \infty$ and p is a prime.

[Colorado U., Boulder]
INFINITE RADICALS IN THE COMPLEX PLANE, by Georgellen Schuske and W. J. Thron. Rept. on Contract AF 49(638)100. [1960] 11p. 8 refs. AFOSR-TN-60-909.
Order from LC mi$2.40, ph$3.30 PB 150 195

The purpose of this paper is to determine conditional convergence regions for sequences $\{u_n\}$ with complex elements. The Stieltjes-Vitali Theorem for normal families of functions is used, together with Herschfeld's criterion for infinite radicals with positive real elements. This method is similar to that used previously in the case of continued fractions.

Columbia U., New York.
ON SOME NON-ORTHOGONAL FACTORIAL DESIGNS, by Gideon Schwarz. Rept. on Contract Nonr-266(59). June 59, 21p. 3 refs. CU-6-59-Nonr-266(59)MS; AD-217 622.
Order from LC mi$2.70, ph$4.80 PB 147 892

A class of multifactorial designs are defined and analyzed. The designs considered have each a total number of observations that can not be divided equally among the cells of the designs. By distributing the observations in a way that is in a certain sense symmetrical, the equations that determine the least squares estimates of the parameters become explicitly solvable. The case of 2 non-interacting factors with arbitrary numbers of levels is treated. In the n-factor case, factors having equal numbers of levels are considered. After defining the designs, the estimates and their variances and covariances are computed. Some general discussions are included of the symmetries and algebraic properties involved. (Author)

Columbia U. School of Engineering, New York.
SURVEILLANCE SAMPLING PLANS WITH RANDOM TIMES OF INSPECTION, by P. Frank. Technical rept. no. 4 on Contract Nonr-266(55). 10 June 59, 12p. 4 refs. AD-217 623.
Order from LC mi$2.40, ph$3.30 PB 147 894

An analysis is presented of a situation whereby the times of inspection are not fixed in advance, but are chance quantities with continuous distributions. The principal effect is to make the proportion defective a continuous function of time which approaches a constant after a long time has elapsed. The procedure is considered as an approximation to the fixed surveillance sampling plans. The principal mathematical tool is the renewal theory. Age in a renewal process has a stationary distribtuion depending on the replacement policy. The steady state proportion defective becomes a definite integral instead of the infinite sum, which are evaluated in special cases. Consideration is also given to replacement policies which lead to exponential holding times. These results lead to a simple evaluation of speeding up inspection.

Diamond Ordnance Fuze Labs., Washington, D. C.
A GENERAL THEORY FOR ASYMMETRICAL CONFOUNDED, FACTORIAL EXPERIMENTS, by Badrig Kurkjian. Doctoral thesis. 21 Apr 60, 96p. 24 refs. Technical rept. TR-829.
Order from LC mi$5.40, ph$15.30 PB 150 019

A general theory is developed for the analysis of factorial experiments involving an arbitrary number of factors each at an arbitrary number of levels. The general case is treated where the treatment-combinations are assigned to an appropriate incomplete block design. New resulfs are given for obtaining the best linear estimates (and the associated var-cov matrix) of the various main effect and interaction terms. A large class of partially balanced incomplete block (PBIB) designs with an arbitrary number of associate classes is described which can be treated by the methods of this paper. The theory is applied to two PBIB designs with three associate classes. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
A FABER-KRAHN INEQUALITY FOR WEDGE-LIKE MEMBRANES, by L. E. Payne and H. F. Weinberger. Rept. on Contract AF 49(638)288. Mar 60, 17p. 12 refs. Technical note BN-202; AFOSR-TN-60-416; AD-235 626.
Order from LC mi$2.40, ph$3.30 PB 148 997

Among all membranes lying in a wedge $0 \leq \Theta \leq \pi/\alpha$, $\alpha \geq 1$ and having given value of $\iint r^{2\alpha} \sin^2 \alpha\Theta r\, dr\, d\Theta$, the circular sector of angle π/α is shown to have the lowest fundamental mode. This leads to lower bounds for the fundamental frequency of any membrane, (Author)

Institute of Mathematical Sciences, New York U., N. Y.
ASYMPTOTIC SOLUTION OF SYSTEMS OF LINEAR ORDINARY DIFFERENTIAL EQUATIONS WITH DISCONTINUOUS COEFFICIENTS, by Clive R. Chester and Joseph B. Keller, Rept. on Contract AF 19(604)5238. Dec 59, 20p. 2 refs. Research rept. no. EM-150; AFCRC-TN-60-111; AD-233 308.
Order from LC mi$2.40, ph$3.30 PB 148 988

A system of linear first order ordinary differential equations is considered in which the coefficient matrix depends upon a parameter k. The asymptotic

form of the solutions of this system are determined for large values of k when the coefficient matrix or some of its derivatives have finite jump discontinuities. The asymptotic form contains terms beyond those previously known. These new terms have discontinuous coefficients, whereas the previously known terms are continuous. The results are applied to the one dimensional propagation of time-harmonic waves.

Institute of Mathematical Sciences, New York U., N. Y.
AN ISOSPECTRAL FAMILY OF RANDOM PROCESSES, by R. A. Silverman. Rept. on Contract AF 19(604)5238. Jan 60, 19p. 7 refs. Research rept. no. EM-151; AFCRC-TN-60-129; AD-233 309.
Order from LC mi$2.40, ph$3.30 PB 148 989

A family of random step functions $\{x_n(t)\}$ is constructed whose members all have the same power spectrum and such that as $n \to \infty$, $x_n(t)$ converges to $x_\infty(t)$, the Gaussian process with the same spectrum. The procedure for calculating the general multivariate distribution of the processes $\{x_n(t)\}$ is illustrated by calculating the univariate, bivariate and trivariate distributions. Also shown is how a suitably constructed univariate entropy can serve as an index of the extent to which $x_n(t)$ has approached the Gaussian limit $x_\infty(t)$. (Author)

Institute of Statistics, U. of North Carolina, Chapel Hill.
ON SUFFICIENCY AND INVARIANCE WITH APPLICATIONS IN SEQUENTIAL ANALYSIS, by William Jackson Hall. Rept. on Contract AF 49(638)261. June 59, 22p. 18 refs. Mimeograph Series no. 228; [AFOSR] TN-59-794; AD-235 091.
Order from LC mi$2.70, ph$4.80 PB 148 239

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Invariantly sufficient statistics
Application to sequential tests of composite hypotheses
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Invariance and subfields

Israel Inst. of Applied Social Research.
A CONSTRUCTIVE FORMULA FOR COMMUNALITIES by Louis Guttman. Technical note no. 4 on Contract AF 61(502)121. Feb 60, 37p. 14 refs. AFOSR-TN-60-1006.
Order from LC mi$3.00, ph$6.30 PB 150 360

Let R be a Gramian matrix of order n. The communality problem of factor analysis is to find a real diagonal matrix U such that $R - U^2$ satisfies two conditions. One condition is that $R - U^2$ be Gramian; a second condition is that U be optimal in some sense. A rather general formula is provided for constructing matrices U for which $R - U^2$ is always Gramian. Given the class of matrices so constructed, one can then go on to impose an optimality condition and yet be assured that the Gramian condition is also maintained.

Kansas U., Lawrence.
PROJECTIONS ONTO SOME FUNCTION SPACES, by B. Grünbaum. Technical rept. no. 23 on Studies in Eigenvalue Problems, Contract Nonr-58304. 1959, 15p. 10 refs. AD-227 298.
Order from LC mi$2.40, ph$3.30 PB 149 941

Estimates are considered for norms of projections onto subspaces (of a special kind) of the Banach spaces of all bounded functions defined on infinite sets. The results obtained generalize those of Sobczyk [Bull. Am. Math. Soc. 47:938-947, 1941] and McWilliams [Notices Am. Math. Soc. 5:838, 1958] that any separable Banach space containing (c_0) [resp. (c)] as a subspace may be projected onto (c_0) [resp. (c)] by a projection P with $\|P\| \leq 2$ [resp. $\|P\| \leq 3$]. For a (real, or complex) Banach space X and a (finite, or infinite) cardinal, k, the projection constant $P_X(X)$ is defined as follows: $P_X(X)$ is the greatest lower bound of reals p which have the property: If Y is a Banach space, if $X \subset Y$, and if the quotient-space Y/X contains a dense set of cardinality less than or equal to k, then there exists a projection P of Y onto X such that $\|P\| \leq p$. If $P_k(X)$ is not only the greatest lower bound but the minimum of the numbers p, the projection constant is called exact. (Author)

Liège U. (Belgium).
A TAUBERIAN THEOREM, by F. J. Bureau. Technical scientific note no. 3 on Contract AF 61(052)86. Mar 60, 39p. 9 refs. AFOSR-TN-60-392.
Order from LC mi$3.00, ph$6.30 PB 150 040

Maryland U., College Park.
ON A THEOREM OF CALDERÓN AND ZYGMUNG ON THE FOURIER INVERSION IN E^n AND TWO FOURIER TRANSFORMS, by David A. Sprecher. Rept. on Contract AF 49(638)590. July 60, 12p. 8 refs. AFOSR-TN-60-870; AD-242 311.
Order from LC mi$2.40, ph$3.30 PB 150 272

Two Fourier integrals, evaluated hitherto by using the Fourier Inversion Theorem, are evaluated directly by elementary means. In the second part of the paper, a theorem of Calderón and Zygmund on the Fourier inversion in Euclidean space, E^n, is generalized and extended to Euclidean spaces of arbitrary dimensions. (Author)

Missouri U. [Columbia]
PROPERTIES OF THE SOLUTIONS OF $u''+g(t)u^{2n-1}=0$ by W. R. Utz. Rept. on Contract AF 49(638)754. July 60, 11p. 5 refs. AFOSR-TN-60-810.
Order from LC mi$2.40, ph$3.30 PB 150 194

Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPILATION OF EXPONENTIAL FUNCTIONS FOR ARGUMENTS FROM .2 THROUGH 50, by J. C. LeDoux and L. K. Donovan. Final rept. 25 July 60, 103p. 3 refs. Technical Compilation C-003.
Order from LC mi$5.70, ph$16.80 PB 150 889

Expressing mathematically the attenuation of nuclear radiation through various materials requires exponential functions. This compilation provides functions e^{-x}, e^{-x}/x, and $E_1(x)$ for arguments from 2.00 to 50.99 with a maximum error of $\pm$ 3 in the sixth significant figure. (Author).

Naval Weapons Lab., Dahlgren, Va.
INTEGRATION OF THE GENERAL BIVARIATE GAUSSIAN DISTRIBUTION OVER AN OFFSET ELLIPSE, by A. R. DiDonato and M. P. Jarnigan. 11 Aug 60, 68p. 7 refs. NWL rept. no. 1710.
Order from LC mi$3.90, ph$10.80 PB 150 275

This paper describes an efficient method for the numerical evaluation by a high-speed digital computer of the integral of any correlated or uncorrelated elliptical Gaussian distribution over the area of any arbitrarily centered and oriented ellipse in the plane. The NORC program will yield results correct to three or six decimal digits, as selected with an average computing time of 0.1 and 0.2 of a second, respectively. A useful table (10,080 entries) is included. (Author)

North Carolina U., Chapel Hill.
A NON-PARAMETRIC COMPARISON OF TWO SAMPLES ONE OF WHICH IS CENSORED, by John G. Saw. Technical rept. no. 12 on Estimation and Testing of Parameters by Order Statistics, Contract DA 36-034-ORD-2184. 1 June 60, 27p. 4 refs. OOR rept. no. 1597.16; AD-240 054.
Order from LC mi$2.70, ph$4.80 PB 150 395

Suppose x and y are random variables with continuous cumulative distribution functions F(x) and G(y). A null hypothesis of the form H_0: F = G is tested. Standard parametric and non-parametric tests are well established when a complete sample is taken from both populations. The assumption is made that a complete sample $x_1, x_2, \ldots, x_n$ is taken from F(x), but that of a sample of size m, taken from G(y), the smallest (r-1) and the largest (m-s) observations are not available for statistical purposes. The properties are investigated of a statistic T, defined (as for the Mann-Whitney U-statistic for complete samples) to be the total number of times an x-observation is less in magnitude than a y-observation. The distribution of T, its consistency against alternatives of the form H_1: F$\neq$G and its asymptotic power, relative to U are also considered. (Author)

North Carolina U., Chapel Hill.
A NOTE ON THE ERROR AFTER A NUMBER OF TERMS OF THE DAVID AND JOHNSON SERIES FOR THE EXPECTED VALUE OF THE r-TH SMALLEST OF n ORDERED NORMAL VARIATES, by John G. Saw. Technical rept. no. 13 on Estimation and Testing of Parameters by Order Statistics, Contract DA 36-034-ORD-2184. 15 July 60, 18p. 4 refs. OOR rept. no. 1597.17-M; AD-240 427.
Order from LC mi$2.40, ph$3.30 PB 150 410

Bounds are derived for the error which results in using only a finite number of terms of the David and Johnson series (Biometrica 41:228-40, 1954). The method of Plackett (Ann. Math. Statist. 29:131-42, 1954) and the method of David and Johnson are compared by applying these techniques in a particular case. The convergence of the Plackett series is found to be faster than the David and Johnson series, and the bounds which Plackett gives are found to be sharper than those which are derived for the David and Johnson series. These slight differences are negligible in the light of the computational advantages to the David and Johnson technique over that of Plackett.

Princeton U., N. J.
ANALYTIC SPACES. PART II, by Hugo Rossi. rept. on Contract AF 49(638)692. July 60, 111p. 8 refs. AFOSR-TR-60-100.
Order from LC mi$6.00, ph$18.30 PB 150 048

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Removable singularities
Analytic covers and ringed spaces
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Rensselaer Polytechnic Inst., Troy, N. Y.
THE CONSTRAINED GRADIENT METHOD OF LINEAR PROGRAMMING, by C. E. Lemke. Rept. on Contract Nonr-591(13). 1 Oct 59, 32p. 12 refs. RPI MathRep. no. 27; AD-228 403.
Order from LC mi$3.00, ph$6.30 PB 149 857

An efficient algorithm is presented for solving the general linear programming problem whereby, from a point on the boundary of the feasible point set, the steepest or constrained gradient direction from the point is found. Moving as far in this direction as feasibility permits, the next feasible point is obtained etc. The process ends in a finite number of such steps. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
PERIODIC RESPONSES AND SUPERPOSITION IN A NONLINEAR CONTROL SYSTEM, by B. A. Fleishman. Rept. on Contract AF 49(638)514. 19 May 60, 24p. 4 refs. RPI MathRep. no. 34; AFOSR-TN-60-477.
Order from LC mi$2.70, ph$4.80 PB 150 262

A simple relay servomechanism (or on-off control system) is subjected to arbitrary periodic input signals, and various periodic responses are studied. Two types of results are obtained. First of all, exact analytical expressions for periodic responses, of harmonic and subharmonic type, and derived in a formal manner, and conditions are established for their validity. Secondly, it is shown that for certain classes of periodic inputs various superposition properties hold; in particular, that the average of the periodic responses to a set of inputs is just the response to the average input. It is thus seen that on-off control systems may display both nonlinear features (subharmonic oscillations) and linear features. (superposition). (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
AN INTRODUCTION TO PROBABILITY THEORY: CONTINUOUS SCHEMES, by F. M. Reza. July 60, 97p. 8 refs. RADC-TN-60-67.
Order from LC mi$5.40, ph$15.30 PB 150 241

This report, an extension of RADC-TN-59-129 (PB 144 485), is a survey of the modern theory of probability where the random variable is allowed to assume a continuum of values. With particular attention to those aspects of theory of interest to the Electrical Engineer. The density and distribution function are introduced, and several common distribution functions are discussed. The concept of expected value is introduced and extends to the expectation of finite sums and products of independent random variables. Bivariate and multivariate random variables and linear combinations are discussed. (Author)

Statistical Techniques Research Group, Princeton U., N. J.
AUTOMATIC OPTIMIZATION OF CONTINUOUS PROCESSES, by J. Chanmugam and G. E. P. Box. Technical rept. no. 38 on Contract DA 36-034-ORD-2297. July 60, 78p. 10 refs. [OOR rept. 1715:35]
Order from LC mi$4.50, ph$12.30 PB 150 404

Contents:
Introduction: the process function; conventional control for optimization; evolutionary operation
Basis for automatic optimization of continuous processes: discrete and continuous changes of process variables, no dynamic effects; effect of noise; continuous changes of process variables with dynamic effects
A simple reaction system
Extension of theoretical model: multicomponent first order sequential reactions; analysis in terms of phase shifted components; analysis when order of reactions in multicomponent system are not necessarily unity; optimizing with respect to temperature
Notes on design of self optimizing reactor
Analysis of multicomponent first order sequential reaction system
Analysis of multicomponent reaction sequence with kinetics not necessarily first order

Washington U., Seattle.
INTEGRATION OF SUBSPACES DERIVED FROM A LINEAR TRANSFORMATION FIELD, by Edward T. Kobayashi. Technical rept. no. 8 on Contract Nonr-477(15). 30 June 59, 35p. 8 refs. AD-220 536.
Order from LC mi$3.00, ph$6.30 PB 147 890

The integrability is investigated of the distribution of θ of vector subspaces θ_p of the tangent spaces T_p to a manifold M, $p \in M$, when θ_p is intrinsically related to a given field h on M, of linear transformations h_p on T_p. (Author)

Wayne State U., Detroit, Mich.
AN AXIOMATIC APPROACH TO HOMOTOPY THEORY WITHOUT USING THE RELATIVE GROUPS, by Sze-Tsen Hu. Technical note no. 9 on Contract AF 49(638)179. June 60, 12p. 3 refs. AFOSR-TN-60-641.
Order from LC mi$2.40, ph$3.30 PB 150 058

The existing axiomatic approach to homotopy theory is formulated in terms of the relative homotopy groups, the boundary homomorphisms, and the induced homomorphisms. In the present note, an axiomatic approach is introduced without using the relative homotopy groups. (Author)

Computing Devices

Michigan U., Ann Arbor.
COMPUTATION, BEHAVIOR, AND STRUCTURE IN FIXED AND GROWING AUTOMATA, by Arthur W. Burks. Technical rept. on Contract Nonr-1224(21). Oct 59, 40p. 48 refs. AD-227 665.
Order from LC mi$3.00, ph$6.30 PB 149 486

Contents:
Structure, behavior, and computation in fixed automata and generalized Turing machines
Analysis and synthesis of automata
Growing automata
Some problems with growing automata

Michigan U. [Research Inst.] Ann Arbor.
SPINNING DISK RANDOM SELECTORS, by G. A. Roberts. Technical memo. no. 39 on Contract DA 36-039-sc-63203. Apr 57, 35p. 2262-151-T; AD-155 366.
Order from LC mi$3.00, ph$6.30 PB 149 364

A three decade spinning disk electronic random selector or number generator is described. The number selections are equally likely and the modulus is adjustable from 10 to 1000 in increments of 10. (Author)

Remington Rand Univac Div., Sperry Rand Corp., Philadelphia, Pa.
THE PREPARATION AND CHARACTERISTICS OF THIN FERROMAGNETIC FILMS. Scientific rept. no. 1, 1 Jan 59-1 Feb 60, on Contract AF 19(604)4978, continuation of Contract AF 19(604)2659. May 60, 39p. 8 refs. AFCRC-TN-60-572.
Order from LC mi$3.00, ph$6.30 PB 150 211

The results are given of an experimental study of the magnetic properties of thin films prepared by chemical methods. Electro-deposition in aqueous solutions and thermal decomposition of carbonyl vapors have shown very encouraging results. Electrodeposited ferromagnetic nickel-iron films having thicknesses in the range 2500 to 3000 Å give reproducible results when a glass substrate is used onto which a conductive layer of gold is sputtered. Films deposited on Mylar having a conductive layer of evaporated chromium and copper also give good magnetic properties. Such films exhibit an average coercive force of about 1.2 oersteds and H_k on 3 to 5 oersteds depending on their composition. Switching constants of 0.05 to 0.20 oersted-microsecond are obtained by application of crossfields of about 0.25 H_k. Films produced by thermal decomposition of carbonyl mixtures do not as yet show comparable magnetic or switching properties. Control of this process is quite difficult, but fairly reproducible results can be obtained by depositing the films on glass substrates and subsequently annealing them in a hydrogen atmosphere. The average values of coercive force obtained after annealing for films of about 3000 Å are 2.5 oersteds. (Author)

Sibley School of Mechanical Engineering, Cornell U. Ithaca, N. Y.
SOME PROBLEMS OF DIGITAL SYSTEMS SIMULATION, by R. W. Conway, B. M. Johnson and W. L. Maxwell. Rept. on Contract Nonr-401(32). [1959] 40p. 12 refs.
Order from LC mi$3.00, ph$6.30 PB 148 791

This paper consists of three sections. The first is an attempt to describe characteristics common to many system simulations; the second is a discussion of some problems involved in the construction of a digital simulator; and the third concerns problems that arise in the use of such a simulator.

Washington U., Seattle. Div. of Counseling and Testing Services.
A PERCENTILE PROGRAM WITH RELOADABLE OUTPUT FOR THE IBM TYPE 650, by August Dvorak and George R. Burket. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-744(04). Nov 59, 7p. 2 refs. AD-237 251.
Order from LC mi$1.80, ph$1.80 PB 147 773

A modified version is given of a previously reported percentile program by Dvorak & Burket [An IBM Type 650 program to calculate percentile scores, ONR T.R., July 1959]. The program permits adding or subtracting previous output tallies from tallies already on the drum. The load hub feature is used for this purpose so that no additional read wiring is required. Through the use of control cards, it is possible to perform the following operations as many times as desired and in any sequence: (a) clear accumulation areas, (b) read and tally case cards, (c) add previous output tallies, (d) subtract previous output tallies, and (e) punch tallies currently on drum, along with individual percents and percentile values. (Author)

MECHANICS

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
SNAPPING OF SHALLOW SPHERICAL SHELLS UNDER STATIC AND DYNAMIC LOADINGS, by Jiro Suhara. Rept. on Contract AF 49(638)160. June 60, 77p. 15 refs. AFOSR-TN-60-831; ASRL TR-76-4.
Order from LC mi$4.50, ph$12.30 PB 150 245

A study of finite deformations of clamped shallow spherical shells subjected to static and dynamic loadings is presented in this report. The solutions of the static problem are obtained by means of both the variational method and the method of expansion in the series of combined Legendre's polynomials. The results are compared with those obtained by Keller and Reiss. Fairly good agreements of both results are obtained for unbuckled branch in the static cases. Dynamic behavior of shallow spherical shells which undergo suddenly applied uniform pressure of infinite duration are investigated using two different methods. In the first a simple trial function for the deformation mode is assumed and the dynamic equation is obtained by variational method; the equation is then solved by means of an electronic analogue computer. Other trials are made to estimate the dynamic maximum deformations due to a given dynamic load. Principle of conservation of energy is used in this case. The analyses involve two sets of solutions. In the first a simple trial function is used while in the other the Legendre's polynomials solutions that were obtained previously for the static problem are used. Estimations of the dynamic snapping loads are given for shells of two kinds of shallowness. (Author)

Brown U. Div. of Engineering, Providence, R. I.
STUDY OF FRACTURE STRENGTHS OF SINTERED CARBIDES, by D. E. Gucer and J. Gurland. Final rept on Contract DA 19-020-ORD-4888. June 60, 10p. DA-4888/5; OOR rept. 2060.5-Met.
Order from LC mi$1.80, ph$1.80 PB 150 399

A summary of the four technical reports prepared on this contract. (See also PB 150 398)

Fritz Engineering Lab., Lehigh U., Bethlehem, Pa.
RESTRAINED COLUMNS, by Morris Ojalvo. Progress rept. no. 38 on Welded Continuous Frames and Their Components, Contract Nonr-610(03). Sep 59, 17p. 12 refs. Fritz Engineering Lab. Rept. no. 278.2; AD-228 395.
Order from LC mi$2.40, ph$3.30 PB 148 605

A method for determining the carrying capacity of restrained columns of constant cross section is described. The type of column failure considered is that due to bending about one of the principal axes of the cross section. The plane of bending is also the plane of the thrust, applied moments and the restraining moments. The method is applicable when the loads are applied to the columns with equal or unequal end eccentricities and can be used for cases where the restraining moments are not linear functions of the end rotations of the column. It also takes into account the inelastic action of the column and thus leads to a solution of the true ultimate carrying capacity of such members. It is shown how convenient nomographs may be developed for columns with one end hinged and for columns with equal applied end moments and with equal rotational restraints at the ends. The availability of nomographs for the latter two cases reduces the effort involved in designing restrained columns to a point where it would be appropriate for design office use. (Author)

Illinois Inst. of Tech., Chicago.
PLASTIC INTERACTION CURVES FOR ANNULAR PLATES IN TENSION AND BENDING, by Philip G. Hodge, Jr. and R. Sankaranarayanan. Rept. on Contract Nonr-140604. Oct 59, 21p. 5 refs. DOMIIT rept. no. 1-9.
Order from LC mi$2.70, ph$4.80 PB 149 513

An annular plate made of a perfectly plastic material is subjected to a uniform normal load P over its surface and a constant tensile load T around its outer edge. Close bounds on the interaction curve are found for all values of the inner radius under various support conditions at the inner edge. (Author)

Institute for Fluid Dynamics and Applied Mathematics, Maryland U., College Park.
ON THE CONTINUATION OF SOLUTIONS FOR THE EQUATIONS OF ELASTICITY BY REFLECTION, by J. H. Bramble and L. E. Payne. Rept. on Contract AF 49(638)228. Aug 60, 10p. 5 refs. Technical note BN-217; AFOSR-TN-60-903.
Order from LC mi$1.80, ph$1.80 PB 150 037

It is shown that solutions of the equations of elasticity may be continued by reflection across a spherical boundary whenever an arbitrary linear combination of the normal displacement and normal surface traction and an arbitrary linear combination of tangential displacements and tangential surface tractions vanish on the spherical surface. (Author)

Institute of Flight Structures, Columbia U., New York.
EXCITATION OF DISTRIBUTED SYSTEMS, by H. H. Bleich. Technical rept. no. 23 on Contract Nonr-266(08) and Technical rept. no. 1 on Contract Nonr-266(67). Oct 59, 15p. CU-2-59-ONR-266(08)-CE; CU-1-59-ONR(67)-CE.
Order from LC mi$2.40, ph$3.30 PB 149 488

A vibration analysis of very complex distributed systems by exact methods is usually impracticable, and numerical methods using the large computers now available are indicated. The use of numerical methods is roughly equivalent to using a lumped system, but in problems of acoustical fatigue the relatively high frequencies involved may require a rather large number of masses. The purpose of the presentation is a discussion of the appropriate number of masses (or subdivisions of the structure) necessary to obtain a sufficient approximation of the structural response. The matter will be considered for longitudinal and bending vibrations (including shear effects) of linear elastic and viscoelastic members.

Lockheed Aircraft Corp., Sunnyvale, Calif.
INFLUENCE COEFFICIENTS FOR SPHERICAL SHELLS, by B. R. Baker and G. B. Cline, Jr. Technical note on Contract NOrd-17017. June 60, 45p. 12 refs. LMSD-480 817.
Order from LC mi$3.30, ph$7.80 PB 149 969

The differential equations governing the symmetric bending of spherical shells of constant thickness subjected to edge loads are transformed into a form suitable for asymptotic integration. The asymptotic solutions, although obtained in a slightly different manner, are those given previously. These solutions are used to obtain expressions for the influence coefficients of both a spherical cap and the complementary portion of the sphere. The influence coefficients are valid for either shallow or nonshallow spherical shells provided the shells are sufficiently thin. The coefficients are tabulated and the nature of the tables discussed. (Author)

Minnesota U., Minneapolis.
STEADY STATE RESPONSE OF BEAMS WITH TRANSLATIONAL AND ROTATIONAL DAMPING MOTIONS AT THE SUPPORTS, by C. C. Fu and T. J. Mentel. Rept. for Jan-Nov 59 on Materials Analysis and Evaluation Techniques, Contract A AF 33(616)5426. May 60, 52p. 8 refs. WADD Technical rept. 60-60.
Order from OTS $1.50 PB 161 957

Two methods of analysis are presented for the steady state response of beams with translational and rotational damping motions at the supports. The first of these methods uses a continuous model and the second uses a discrete (three-degree-of-freedom) model. Both cases are characterized by non-linear equations and approximate solutions are produced for each. Numerical results are presented giving comparisons and optimum damping configurations. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A NOTE ON THE IMPACT PRESSURE LOADING OF A RIGID PLASTIC SPHERICAL SHELL, by R. Sankaranarayanan. Rept. on Contract AF 49(638)302. May 60, 12p. 2 refs. PIBAL rept. no. 564; AFOSR-TN-60-639.
Order from LC mi$2.40, ph$3.30 PB 149 164

The behavior of a rigid perfectly-plastic, complete spherical shell under impulsive loading by a uniform radial pressure is discussed. The ensuing radial displacement of the shell is obtained as a function of the load and is presented graphically. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
VIBRATIONS OF ELASTIC SANDWICH CYLINDRICAL SHELLS, by Yi-Yuan Yu. Technical note no. 7 on Contract AF 49(638)453. Jan 60, 33p. 7 refs. AFOSR TN-60-324; AD-235 026.
Order from LC mi$3.00, ph$6.30 PB 149 662

Previous treatment of vibration of elastic sandwich plates is extended to the vibration study of sandwich cylindrical shells. General theory is developed. Simplified equations are applied to the investigation of axially symmetric and torsional vibrations. (Author)

University Coll., Cork (Eire).
ELASTIC BEAM THEORY FOR THE ELECTRONIC COMPUTER: A RECURRENCE APPROACH, by Patrick M. Quinlan. Technical note no. 9 on Contract AF 61(514)1163. June 60, 42p. 11 refs. AFOSR-TN-60-936.
Order from LC mi$3.30, ph$7.80 PB 150 350

A new comprehensive approach to elastic beam theory is presented based on the use of generalized step functions. The paper is divided into two parts, the first dealing with uniform beams and the second with non-uniform beams. Uniform beam on continuous supports, whether rigid or elastic, is solved using a new formulation of the three-moment equation in conjunction with a shear-recurrence formula - called the three-supports equation. An alternative solution for continuous uniform beams on elastic supports is given using generalized step-functions. Part two, dealing with non-uniform

beams, is based entirely on recurrence formulae obtained from generalized step-function approximations to the deflection and slope equations by differencing. Solutions are obtained for all loading conditions, including concentrated moments and end thrust, or end tension. In all cases the solution is reduced to a number of simultaneous equations and is especially geared to the coming decade, when the solution of such equations on the electronic computer should be regular office routine. (Author)

Watervliet Arsenal, N. Y.
INVESTIGATION OF THE BUCKLING AND LARGE DEFLECTIONS OF A SPHERICAL SHELL UNDER THE INFLUENCE OF TORQUES APPLIED AT ITS POLES. PART III. DETERMINATION OF THE CRITICAL TORQUE INDUCING BUCKLING IN A TWISTED SPHERICAL SHELL SUBJECT TO INTERNAL OR EXTERNAL PRESSURE, by C. C. Mow and M. A. Sadowsky. May 60, 39p. Technical rept. WVTRR-6009.
Order from LC mi$3.00, ph$6.30 PB 147 308

The problem of determining the critical value of the torque T inducing buckling in a pressurized twisted spherical shell has been solved under assumption of local non-analytic buckling. The critical relation between the values of the torque T and pressure p has been explicitly determined. (Author)

Aerodynamics and Pneumatics

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
PROCEDURES FOR INCLUDING TEMPERATURE EFFECTS IN STRUCTURAL ANALYSES OF ELASTIC WINGS. PART II. A DIGITAL COMPUTER SOLUTION FOR THE EQUIVALENT PLATE METHOD OF THERMOELASTIC ANALYSIS, by Lucien A. Schmidt and Hans A. Balmer. Rept. on Contract AF 33(616)3517. May 59, 173p. 7 refs. WADC Technical rept. 57-754, Pt. II; AD-230 981.
Order from LC mi$8.10, ph$27.30 PB 149 624

A general procedure, employing the IBM 704 EDPM, based on the equivalent plate method of structural analysis for elevated temperature structures previously presented [PB 131 989] has been developed. The program provides a rational method for analyzing the static aeroelastic behavior of thin, low aspect ratio wings subject to elevated temperatures and high wing loadings. The formulation includes coupling between aerodynamic pressures and the thermoelastic distortions, and also coupling between the bending and stretching of the plate. Using the variational principle of Reissner [J. Math. and Phys., 32:1953] and expanding the deflection and the stress function in terms of assumed modes, two coupled nonlinear matrix equations are obtained and solved by successive linearization. The IBM 704 program is used not only to carry out the matrix operations but, of greater importance, to carry out the considerable number of partial differentiations, double integrations, and algebraic operations required to form the matrix elements. Illustrative numerical examples of the use of the generalized digital computer program are given. A discussion of the limitations of the present program as well as suggestions for improvements and extensions conclude the report. (Author)

Arnold Engineering Development Center, Tullahoma, Tenn.
A SUMMARY OF PERFORATED WALL WIND TUNNEL STUDIES AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER, by M. Pindzola and W. L. Chew. Rept. on ARO, Contract AF 40(600)800 S/A 11(60-110). Aug 60, 36p. 21 refs. AEDC TR-60-9.
Order from LC mi$3.00, ph$6.30 PB 150 165

A summary of the work done at AEDC in the development of perforated walls for application to transonic and supersonic wind tunnels is presented. Results are summarized for normal, slanted, and slotted hole walls in the Mach number range from 0.90 to 2.50. The slotted hole data, presented for the first time, indicate that the characteristics of a perforated wall can be determined independently of the free-stream Mach number. (Author).

Avco-Everett Research Lab., Mass.
RELAXATION PROCESSES AND REACTION RATES BEHIND SHOCK FRONTS IN AIR AND COMPONENT GASES, by K. Wray, J. D. Teare and others. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. Dec 59, 31p. 25 refs. Research rept. 83; AFBMD-TR-60-26; AD-234 034.
Order from LC mi$3.00, ph$6.30 PB 147 829

Non-equilibrium phenomena in normal shocks is summarized. Three classes of experiments are described: (1) absorption of ultra-violet radiation, (2) emission of optical radiation, and (3) microwave absorption and reflection. The use of these measurement techniques in unraveling the complex phenomena that occur in the non-equilibrium region of normal shocks is outlined. The current values used to correlate the experimental data for the chemical and electronic rate constants are quoted. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BALLISTIC RESEARCH LABORATORIES' NEW HYPERSONIC TUNNEL, by J. Sternberg. Jan 60, 22p. 6 refs. BRL rept. no. 1076; AD-237 577.
Order from LC mi$2.70, ph$4.80 PB 148 511

The B.R.L. hypersonic wind tunnel, now under construction, is designed to cover the range M = 5 to 10, and will be capable of continuous flow, variable density operation. Full use will be made of the compressor plant for existing supersonic wind tunnels. Three new centrifugal compressors were added to reach a maximum supply pressure of 2200 psi. The tunnel air will be heated to a maximum temperature of 2000°R, using a combustion heater and an electric heater arranged in series. Some of the complications in hypersonic flight at high altitudes are discussed. Departures from a continuum, low Reynolds number effects, and oxygen dissociation in the atmosphere are all important above 250,000 ft. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A DIRECT METHOD OF MEASURING DENSITY BEHIND SHOCK WAVES, by D. B. Sleator and M. R. Lewis. Dec 59, 19p. 6 refs. Rept. no. 1087; AD-233 901.
Order from LC mi$2.40, ph$3.30 PB 147 789

A direct method of measuring velocity and density behind a shock wave in a shock tube is described which uses the N-like slip region resulting from the interaction of the shock and a small disturbance. The velocity of the slip region along the axis of the shock tube is shown to be the flow velocity. A description of the interaction of a shock wave and a small disturbance is given. Still and streak schlieren photographs and an interferogram of the phenomenon are presented along with a plot of experimental results versus theory showing an error of about 1 per cent. (Author)

Gas Dynamics Lab., Northwestern U., Evanston, Ill.
DISSOCIATION AND IONIZATION EFFECTS IN THE LAMINAR MIXING OF PARALLEL STREAMS, by Richard Frank Hoglund. Rept. on Contract AF 40(600)748. July 60, 132p. 76 refs. AEDC-TN-60-141.
Order from LC mi$6.90, ph$21.30 PB 149 319

The boundary layer approximation is applied to the equations governing the mixing zone between two parallel semi-infinite streams. The two streams differ in composition and temperature, but they are not necessarily in chemical equilibrium. Closed form solutions are obtained for the approach to equilibrium in the mixing zone in the case of equal velocities of the two streams. Frozen flow and equilibrium flow appear as limiting cases of the general solution. A linearized reaction rate law is used for the non-equilibrium situations. These solutions indicate that the major factor contribution to non-equilibrium effects in the constant velocity mixing zone is the presence of non-equilibrium conditions outside of the mixing zone. An approximate solution to the case of unequal free stream velocities is obtained using an equilibrium condition found to be applicable in the constant velocity case. The results of these studies are used to provide a qualitative indication of the effects of dissociation and ionization reactions on the flow field immediately behind a hypersonic body. It is found that the presence of reactions in various regions of this flow field causes individual and discernible change in the wake expansion angle and in the base pressure. (Author)

General Atomic, San Diego, Calif.
THE USE OF MODULATED ATOMIC-BEAM TECHNIQUES FOR THE STUDY OF SPACE-FLIGHT PROBLEMS, by Geoffrey S. Holister, R. T. Brackmann, and Wade L. Fite. Rept. on Contract AF 49(638)356. 14 Oct 59, 20p. 4 refs. GA-1024; AFOSR-TN-59-1033; AD-229 282.
Order from LC mi$2.40, ph$3.30 PB 150 065

In order to investigate atom-surface interactions which affect drag on objects flying in atmospheres where the gas is dissociated (e.g., above 100 km), modulated-atomic-beam techniques were used, with both atomic-oxygen and atomic-hydrogen collisions at common laboratory surfaces being studied. Two types of experiments are discussed. In the first, an incident beam impinges on a surface and the particles leaving the surface are examined with a mass spectrometer. By varying the incident beam and/or surface temperature, thermal accommodation coefficients are determined for a variety of surfaces and gases. Using an incident atomic beam, the probability that an atom will rebound from the surface as a free atom is measured; from examination of the reflected molecular signal, information on the probability of reassociation at the surface is obtained. In the second, the atomic beam, which is monitored mass-spectrometrically, is allowed to strike a surface placed on a torsion balance, and momentum transfer is measured directly. In these experiments, the atomic-beam apparatus is used as an atomic wind tunnel; when a hydrogen-atom beam from a furnace source operating at 3000°K is used, the case of a high-altitude satellite is fairly closely duplicated. Results of a number of experiments using these techniques are presented. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
MODIFIED CROCCO-LEES MIXING THEORY FOR SUPERSONIC SEPARATED AND REATTACHING FLOWS, by Herbert S. Glick. Rept. on Hypersonic Research Project, Contract DA 04-495-ORD-1960. 2 May 60, 118p. 34 refs. Memo. no. 53; AD-239 560.
Order from LC mi$6.00, ph$18.30 PB 149 361

Re-examination of the Crocco-Lees method has shown that the previous quantitative disagreement between theory and experiment in the region of flow up to separation was caused primarily by the improper C(K) relation assumed. A new C(K) correlation, based on low-speed theoretical and experimental data and on supersonic experimental results, has been developed and found to be satisfactory for accurate calculation of two-dimensional laminar supersonic flows up to separation. A study of separated and reattaching regions of flow has led to a physical model which incorporates the concept of the "dividing" streamline and the results of experiment. According to this physical model, viscous momentum transport is the essential mechanism in the zone between separation and the beginning of reattachment, while the reattachment process is, on the contrary, an essentially inviscid process. This physical model has been translated into Crocco-Lees language using a semi-empirical approach, and approximate C(K) and F(K) relations have been determined for the separated and reattaching regions. The results of this analysis have been applied to the problem of shock wave-laminar boundary layer interaction, and satisfactory quantitative agreement with experiment has been achieved. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
A SUMMARY OF THE THEORIES AND EXPERIMENTS ON PANEL FLUTTER, by Y. C. B. Fung. Rept. on AGARD Manual on Aero-Elasticity, Contract [AF 49(638)220.] May 60, 81p. 74 refs. AFOSR-TN-60-224.
Order from LC mi$4.80, ph$13.80 PB 149 764

In recent years a sizable literature has grown out of the field of panel flutter. Much effort was spent in resolving several theoretical difficulties which arise one way or another when one tries to simplify the analytical problem by introducing various limiting cases and approximations. These difficulties are now fairly well understood. In the meantime, a considerable amount

of numerical evaluation has been done so that the technical significance of the problem can be better appreciated. The present article gives a review of various theories, and a summary of the panel-thickness requirements for the prevention of flutter under various circumstances. At the present time, available information on supersonic panel flutter is still incomplete. It is hoped that the present article may provide a guide to the existing literature; and, in projecting the known areas in clear relief, may serve to suggest areas for future research. (Author).

Heat Transfer Lab., U. of Minnesota, Minneapolis.
EFFECT OF BUOYANCY FORCES ON MASS TRANSFER COOLING, by R. Eichhorn. Technical rept. no. 25 on Contract AF 18(600)1226. Feb 60, 16p. 3 refs. AFOSR-TN-60-64.
Order from LC mi$2.40, ph$3.30 PB 149 083

Consideration is given to the constant property laminar boundary layer equations with free convection and mass transfer. It is shown that similar solutions are possible for blowing rate distributions varying as the distance from the leading edge raised to the power $\frac{n-1}{4}$ where n is the exponent in a power law surface temperature distribution. Solutions to the equations in the form of skin friction and heat transfer parameters, and velocity and temperature profiles are presented for the constant wall temperature case for a fluid with Pr = 0.73. The cases considered range from strong suction to strong blowing. Mass transfer has a pronounced effect on the heat transfer but only a slight effect on the skin friction. In light of the solutions presented these effects are shown to be physically rational. (Author)

Küssner, H. G.
RESEARCH ON THE OSCILLATING ELLIPTIC LIFTING SURFACE IN SUBSONIC FLOW, by H. G. Küssner. Technical final rept. on Contract AF 61(052)215. June 60, 75p. 13 refs. AFOSR-TR-60-71.
Order from LC mi$4.50, ph$12.30 PB 150 333

Starting from the linearized Euler equations an integral representation of the pressure of the oscillating elliptic lifting surface in subsonic flow is given for arbitrary downwash distributions and arbitrary yaw angles. The kernel of this integral representation is contructed by means of the Green function of the elliptic plate oscillating in still air. Two methods of determination of the Green function are given. The first one uses infinite series of products of ellipsoidal surface harmonics and Lamè functions. The second method only holds for incompressible flow but gives results in a closed form. This form has been used in order to solve the integral equation for the weight function of the leading edge singularity of the lifting surface. According to this method the special cases of the elliptic lifting surface with infinite aspect ratio and of the circular lifting surface have been treated. Numerical values of the weight functions and of the aerodynamic derivatives have been calculated for a bilinear downwash distribution. The results of this method have been used to check the accuracy of the current collocation method of the three-dimensional lifting surface theory. (Author)

Maryland U., College Park.
ON CONDUCTING FLOW PAST A MAGNETIZED CIRCULAR CYLINDER, by Lan-Keh Chi. Interim technical rept. no. 46 on Fundamental Research in Applied Mathematics, Contract DA 36-034-ORD-1486. June 60, 46p. 4 refs. OOR rept. no. 407:55; AD-239 906.
Order from LC mi$3.30, ph$7.80 PB 150 396

The flow of a conducting fluid past a magnetized sphere was considered by Ludford and Murray. It is of interest to know what will happen if the finite sphere is replaced by an infinitely long circular cylinder. A steady incompressible and inviscid fluid is considered. Results are obtained first for a two-dimensional magnetic dipole, pointing downstream, at the center of the cylinder and then for a general magnetic distribution inside the cylinder. Only the first-order effects of the weak magnetic field are considered. The discussion is valid for arbitrary conductivity of the cylinder, as long as it is finite. The situation when the magnetic dipole field is frozen into the cylinder is also discussed. A matching between the Stokes and the Oseen small R_m expansions for the flow past the cylinder with a dipole inside is carried out explicitly to a certain number of terms. It is found that a new perturbation series whose leading term is of order $R_m^2 \log R_m$, should be introduced into the Stokes expansion. (Author).

Mississippi State U., State College.
THE APPLICATION OF SUCTION TO A TWO-DIMENSIONAL LAMINAR SEPARATION BUBBLE, by F. M. Burrows and B. G. Newman (U. of Cambridge). Research rept. no. 27 on Contract Nonr-978(01). 1 Oct 59, 67p. 11 refs. AD-228 532.
Order from LC mi$3.90, ph$10.80 PB 149 858

The effect of suction or blowing through a perforated surface in the vicinity of a laminar separation bubble was investigated. The bubble was produced at a sharp corner on one wall of a small wind tunnel and the tests were made at a low Mach number under effectively 2-dimensional conditions. It was found that the size of the bubble and the thickness of the boundary layer downstream were reduced by increasing the suction and were similarly increased by much smaller amounts of blowing. Five different distributions of transpiration were tested and the various parameters describing the turbulent boundary layer downstream of reattachment were found to depend on the total quantity of flow removed and to be very nearly independent of the distribution itself. The measured values of pressure rise in the region of reattachment were roughly in agreement with a simple momentum analysis which includes the effect of transpiration. It is concluded that the application of suction near a short bubble on a high-lift wing will in general be beneficial unless the possible forward movement of the separation point leads to the formation of a long bubble. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
PRESSURE AND LAMINAR HEAT TRANSFER DISTRIBUTION AT THE NOSE REGION OF A SEMI-CIRCULAR TOROID AT M_∞ = 3 AND 8, by Victor Zakkay and Marian Visich, Jr. Rept. on Contract AF 33(616)6118. July 60, 47p. 10 refs. ARL Technical note 60-127; PIBAL Rept. no. 547; AD-240 120.
Order from LC mi$3.30, ph$7.80 PB 149 749

The experimental results of the pressure and heat transfer measurements about a semicircular toroid having a ratio of minor to major radius equal to 0.255 are presented. Pressure distributions have been measured at M_∞ = 3 for several angles of attack and at zero angle of attack for M_∞ = 8. Heat transfer measurements were obtained at zero and 10° angles of attack at M_∞ = 8. The experimental pressure distribution over the body for all the conditions presented here is predicted satisfactorily by the modified Newtonian pressure distribution followed by a Prandtl-Meyer expansion. The experimental heat transfer results along the plane of symmetry are in good agreement with a theoretical two-dimensional analysis. Good agreement between experimental values and the two-dimensional analysis is also obtained for the heat transfer outside of the plane of symmetry by taking into account the effect of crossflow.

Polytechnic Inst. of Brooklyn, N. Y.
SOME ASPECTS OF DRAG REDUCTION FOR LIFTING WING-BODY COMBINATIONS AT SUPERSONIC SPEED, by Lu Ting. Rept. on Contract AF 18(600)694. May 58, 29p. 3 refs. PIBAL rept. no. 445; AFOSR-TN-58-423; AD-158 226.
Order from LC mi$2.70, ph$4.80 PB 147 804

It has been shown that favorable antisymmetric modifications of the fuselage near the mid-wing can provide significant drag reductions in lifting wing-body combinations. The investigation of the present report shows that for a prismatic body of rectangular cross section with given volume (or cross section area) mounted on a mid-wing of given span and swept back, the lift-drag ratio of the wing-body combination with the favorable antisymmetric modifications will be higher if the basic body has a lower height-width ratio.

Princeton U., N. J.
AN ANALYSIS OF THE EFFECTS OF PERFECT GAS PARAMETERS ON GAS TURBINE PERFORMANCE, by Andrew G. Hammitt. Rept. on Contract AF 49(638)465. Dec 59, 31p. 5 refs. Aeronautical Engineering rept. 500; AFOSR-TN-60-225.
Order from LC mi$3.00, ph$6.30 PB 149 755

The effect of different gases on the performance of a gas turbine cycle has been considered. If the gas is perfect, three parameters: specific heat ratio, speed of sound, and viscosity are sufficient to characterize its properties. The effects of specific heat ratio and speed of sound are more significant unless the viscosity exhibits very large variations. A gas of low specific heat ratio and high speed of sound is advantageous for the operation of the heat exchangers while a high specific heat ratio and low speed of sound makes the turbo machinery simpler. The best gas would depend on the relative cost of the different types of equipment. (Author)

Princeton U., N. J.
FREE MOLECULE FLOW OVER NON-CONVEX BODIES, by Ira M. Cohen. Rept. on Contract AF 49(638)465. Feb 60, 42p. 19 refs. Aeronautical Engineering rept. no. 497; AFOSR-TN-60-190.
Order from LC mi$3.30, ph$7.80 PB 149 754

The problem considered in this report is the determination of the velocity distribution function f and the heat transfer rate at any point on a surface of arbitrary shape immersed in a free molecule flow field. A theory is developed in which the mass flux incident on the surface of a non-convex body is expressed as the solution of an integral equation. Then, the fundamental transport properties at the surface are given in terms of appropriate integrals over velocity space. As an example, a hemisphere in an infinite speed ratio flow is considered. (Author)

Princeton U., N. J.
ON THE LIMITING STRUCTURE OF THE EDGE OF A HYPERSONIC BOUNDARY LAYER WITH VERY COLD FREE STREAMS, by N. C. Freeman, S. H. Lam. Rept. on Contract AF 49(638)465. May 59, 27p. 3 refs. Aeronautical Engineering rept. no. 468; AFOSR TN 59-690; AD-240 233.
Order from LC mi$2.70, ph$4.80 PB 149 753

The structure of the edge of a hypersonic boundary layer in the limit of zero free stream temperature is analyzed with conventional boundary layer approximations for a gas with arbitrary Prandtl number Pr and viscosity law $\mu \alpha T^s$. It is shown that for certain combinations of Pr and s the velocity profile has a discontinuity in slope at the edge of the boundary layer. The boundary layer thickness in this limit is always finite for $S > -1$. For $S < -1$ no limiting solution exists for any Pr. (Author)

Royal Coll. of Science and Tech., Glasgow (Scotland).
THE HODOGRAPH METHOD APPLIED TO FLOW PAST PROFILES AND IN JETS, by D. C. Pack. Technical final rept. on Contract AF 61(514)1170. Apr 60, 61p. 23 refs. AFOSR-[TR]-60-61.
Order from LC mi$3.90, ph$10.80 PB 150 038

A study of the two-dimensional, steady flow of a gas at sonic and near-sonic speed, and in particular, the flow past wedge-shaped bodies of finite length, placed in either an infinite stream, a jet or a (two-dimensional) wind-tunnel with parallel walls, has been made by using the equations of motion expressed in terms of hodograph variables.

Stanford U., Calif.
DEVELOPMENT OF A FINITE-DIFFERENCE METHOD FOR COMPUTING A COMPRESSIBLE LAMINAR BOUNDARY LAYER WITH INTERACTION, by I. Flügge-Lotz and Er-Yung Yu. Rept. on Contracts AF 18(600)1488 and AF 49(638)550. 15 May 60, 143p. 27 refs. Div. of Engineering Mechanics technical rept. no. 127; AFOSR-TN-60-577; AD-242 421.
Order from LC mi$7.20, ph$22.80 PB 150 340

The compressible laminar boundary layer equations in their original form, i.e., with u, v, i as dependent variables and x, y as independent variables, have been solved numerically by employing the explicit finite-difference method. The physical problems that have been treated are the two-dimensional boundary layer flows along a constant temperature wall with or without pressure variation. For each of the flow models considered the numerical solutions were obtained for the

following four different cases: (1) $M_\infty = 0.5$, $T_w/T_{ad} = 0.5$ (isothermal cooled wall); (2) $M_\infty = 0.5$, $T_w/T_{ad} = 2.0$ (isothermal heated wall); (3) $M_\infty = 3.0$, $T_w/T_{ad} = 0.5$; and (4) $M_\infty = 3.0$, $T_w/T_{ad} = 2.0$. In each case, flows with zero pressure gradient and those with positive ramp pressure gradient have been separately investigated. It is found that the explicit difference scheme works very satisfactorily for case (1). For cases (2) and (3) the difference scheme is found somewhat unstable in a narrow region next to the wall. Case (4), i.e., $M_\infty = 3.0$ and heated wall, is the worst condition so far encountered.

Stanford U., Calif.
STRUCTURES AND MATERIALS FOR FINITE LIFETIME, by N. J. Hoff. Technical rept. no. 1 on Contract Nonr-225(30). Aug 58, 60p. 25 refs. SUDAER no. 81.
Order from LC mi$3.60, ph$9.30 PB 150 052

The aerodynamic heating accompanying supersonic and hypersonic flight renders design for infinite lifetime impossible. At moderately high temperatures creep sets in and causes rupture in tension and buckling in compression even under relatively small loads if they act for a sufficiently long time. At extremely high temperatures the structural material, or its protective covering, melts, vaporizes, sublimes or burns. The analyst must be able to calculate the lifetime of the structural elements in order to ensure the safety of the structure. A few simple methods of analysis are presented in the report with the aid of which approximate calculations of the lifetime can be carried out. (Author)

Tiltman Langley, Ltd. (Gt. Brit.)
AN ITERATIVE ANALOGUE COMPUTOR FOR STUDY OF THE TURBULENT FLAME PROPERTIES OF ELEMENTARY COMBUSTION CHAMBERS, by A. J. Cooper and L. C. Hutcheon. Technical (scientific) note no. 3 on Contract AF 61(514)1213. 30 Nov 59, 35p. 11 refs. AFOSR-TN-60-993.
Order from LC mi$3.00, ph$6.30 PB 150 354

An iterative analogue computor has been designed and built for solving up to 20 simultaneous equations of the form $\tau_j = \frac{1}{L} \sum_k b_{jk} \psi(\tau_k)$ where L is an adjustable parameter (eigenvalue). b_{jk} is a set of up to 20 x 20 coefficients and ψ is a linear or non-linear relationship. Equations of this form arise in the study of turbulent flame patterns in combustion chambers. b_{jk} is then a set of influence coefficients which relate the local temperature τ_j at any point j to the rates of heat generation at k points throughout the flame, and ψ is a reaction rate function which relates the heat generated at any one point to its own temperature. The coefficients are measured by argon tracer methods using a flow of air through a model combustion chamber, and the computor has been used to predict extinction points for different combustion chamber configurations on the assumption of a theoretical reaction rate function. The computor operates in an iterative manner, approaching the correct solution by a series of successive approximations. The whole system is described, and operating and maintenance instructions are given.

University of Southern California. Engineering Center, Los Angeles.
OPERATION AND CALIBRATION OF THE LOW DENSITY WIND TUNNEL, by Raymond L. Chuan, Lee M. Springer, and Serge A. Waiter. Technical note on Contract AF 18(603)95. 15 July 60, 43p. 7 refs. USCEC rept. 56-215; AFOSR-TN-60-649.
Order from LC mi$3.30, ph$7.80 PB 149 959

For the experimental investigation of rarefied gasdynamics a low density wind tunnel has been developed which is capable of producing flows at lower density, higher Mach number, higher temperature, and with a larger flow field than has been possible in the past, in order that slip, transitional and free molecule flows can be studied with large regions of interest susceptible to probing with appropriate instruments, and with flow durations sufficiently long to ensure equilibrium conditions in all measurements.

University of Southern California. Engineering Center, Los Angeles.
STUDIES IN THE HEATING OF A SUPERSONIC GAS STREAM BY A RADIO FREQUENCY DISCHARGE, by Frederick O. Smetana. Technical note on Contract AF 18(603)95. 15 July 60, 103p. 24 refs. USCEC rept. 56-214; AFOSR-TN-60-648.
Order from LC mi$5.70, ph$16.80 PB 149 958

The background and problem areas of the application of radio frequency discharge to heating a supersonic gas stream are discussed. An apparatus was constructed to permit the effectiveness of this technique to be studied by calorimetry. Results indicate that about 10% of the power taken from the a. c. line appeared as heat in the gas. Through modifications in the electrical circuitry this probably can be increased to 15%. This technique introduces a negligible percentage of unwanted contaminants. On the other hand, small quantities of C_4F_8 mixed with N_2 were found to decrease the N_2 recombination time substantially. Tests were also made using argon alone and mixed with nitrogen. Maximum gas temperatures at the end of the nozzle were obtained with argon alone, being 660°K. Limited spectroscopic and microwave interferometer investigations were also conducted. (Author)

Watervliet Arsenal, N. Y.
ELASTIC-PLASTIC ANALYSIS OF A CYLINDRICAL TUBE, by R. E. Weigle. Mar 60, 21p. 5 refs. Technical rept. WVTRR-6007.
Order from LC mi$2.70, ph$4.80 PB 146 396

This report contains an elastic-plastic analysis of a cylindrical tube subjected to an internal pressure P of sufficient magnitude to cause plastic deformation. Results are presented in graphical form for the open-end tube. Comparison with the plane strain case is made for a wall ratio $\frac{b}{a} = 2$.

Hydrodynamics, Hydraulics, and Hydrostatics

Avco-Everett Research Lab., Mass.
END EFFECTS IN MAGNETOHYDRODYNAMIC CHANNEL FLOW, by Frank Fishman. Rept. on Contract AF 04(647)278. June 59, 16p. 1 ref. Research rept. 78; formerly Research note 135; AFBMD-TN-59-5; AD-227 866.
Order from LC mi$2.40, ph$3.30 PB 147 828

Some effects associated with the termination of electrodes and magnetic field in an otherwise uniform magnetohydrodynamic channel flow are investigated theoretically. Because of the end effects, the electrodes may carry more, or less, current than the same length of electrode in the middle of a long channel; this leads to the definition of a length representing the end correction for current. Similarly a difference in the total force on the working fluid leads to a length representing the end correction for force. These lengths are calculated for various geometries. The electrical efficiency of a channel acting as a generator is computed for these same conditions. It is shown that the end effects decrease generator efficiency least if the magnetic field extends at least one-half a channel height beyond the end of the electrodes (for generators of high nominal efficiency). Under these conditions, and if the electrodes are not less than 1% of the channel height long, they have an effective length for current about 0.4 channel heights greater than their actual length. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
INVISCID MODES OF INSTABILITY OF FLOW, by W. H. Reid. Scientific rept. no. 1 on Contract AF 19(604)7236. May 60, 20p. 11 refs. AFCRC-TN-60-443.
Order from LC mi$2.40, ph$3.30 PB 149 804

The inviscid modes of instability in flow over a slightly concave wall are studied and it is shown that if $UdU/d\eta > 0$, where $U(\eta)$ is the unperturbed velocity distribution, then oscillatory solutions do not occur. For a velocity distribution in the form of two straight lines the problem can be solved exactly, and detailed results are given for the first two convective modes of instability. If the fluid is considered to be a perfect electrical conductor, then this flow can be completely stabilized by a transverse magnetic field of magnitude $\mu H^2/4\pi\rho = 0.5752\ U_0^2(\delta/R)$, the numerical coefficient here being not too sensitive to the form chosen for the mean velocity distribution. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
A LIOUVILLE THEOREM FOR SHALLOW-WATER WAVES, by R. E. Meyer. Technical rept. no. 21 on Contract Nonr-562(07). Oct 59, 39p. 11 refs. AD-227 828.
Order from LC mi$3.00, ph$6.30 PB 149 937

The non-linear equations governing 2-dimensional gravity waves on shallow water to the first approximation are shown not to possess any solutions free of limit lines at all points and times, except for the solution representing uniform motion. The proof involves a generalisation of the usual concept of solution, and a corresponding existence theorem is given by means of an explicit representation. An important part of the argument is based on a dual set of invariance concepts, but some new results concerning a singular partial differential equation are also required for the proof. (Author)

California Inst. of Tech., Pasadena.
ON CATHODIC PROTECTION IN CAVITATION DAMAGE, by Milton S. Plesset. Rept. on Contract Nonr-220(28). July 59, 35p. 8 refs. Engineering Div. rept. no. 85-12; AD-226 971.
Order from LC mi$3.00, ph$6.30 PB 147 793

An experimental procedure has been developed which makes possible accurate and reproducible determinations of cavitation damage. This procedure has been applied to a study of the effect of cathodic currents on cavitation damage. A series of experiments in which the test liquid was a solution of salt in water showed a reduction in cavitation weight loss for all of the materials examined when the test specimen was made the cathode of an electrolytic cell and when the conditions were such that gas was evolved at the specimen surface. This protective effect against cavitation damage increased with increasing magnitude of the cathodic current. These observations support the view that the protective effect was due to the layer of hydrogen gas evolved on the surface of the specimen. A similar protective effect was observed when the specimen was made the anode in a test liquid which was buffered distilled water; in this situation the gas evolved at the specimen surface is oxygen. Additional evidence for this protective mechanism of a gas layer on the specimen surface was found in a series of experiments in which voltage applied to the cell was reduced to a level at which no gas was evolved on the surface. There was no protective effect with the specimen cathodic or anodic. (Author)

California Inst. of Tech., Pasadena.
REMARKS ON CAVITATION IN TURBOMACHINES, by A. J. Acosta and A. Hollander. Rept. on Contract Nonr-220(24). Oct 59, 42p. 32 refs. Engineering Div. rept. no. 79.3.
Order from LC mi$3.30, ph$7.80 PB 149 514

Starting with the occurrence and discussion of the importance of cavitation in turbomachines, the development of the various stages of cavitation in a machine is reviewed, followed by a discussion of the various dimensionless parameters used to describe cavitating performance in a turbomachine. The calculations of optimum inlet diameter are carried out in terms of assumed acceptable cavitation parameters. Various methods of determining the minimum cavitation number before cavitation breakdown are explored, and a free streamline model of the flow in a simplified impeller is used to obtain theoretical estimates of the extent of cavitation as a function of blade geometry and angle of attack. Some recent work of the effect of the thermodynamic properties of the fluid on the cavitation performance is examined and the various assumptions used in these theories are criticized. (Author)

David Taylor Model Basin, Washington, D. C.
TRIPPING OF T-SHAPED STIFFENING RINGS ON CYLINDERS UNDER EXTERNAL PRESSURE, by E. H. Kennard. Nov 59, 37p. 6 refs. Rept. 1079; AD-229 825.
Order from LC mi$3.00, ph$6.30 PB 150 292

An approximate theory is developed for estimating the additional stresses caused by an initial tilt of a T-shaped stiffening ring located either inside or outside of a cylinder under uniform pressure and the buckling load for an ideal ring, without restriction to axisymmetric symmetry. In practical cases the results appear not to differ markedly from those of the axisymmetric case. (Author)

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
DYNAMIC PERFORMANCE OF SCALED SURFACE-PIERCING HYDROFOIL CRAFT IN WAVES, by Paul Kaplan and Winifred R. Jacobs. Rept. on Contract Nonr-263(14). June 59, 121p. 21 refs. Rept. no. 704.
Order from LC mi$6.30, ph$19.80 PB 147 887

This report describes a study of the motions in waves of a group of hydrofoil craft when the geometric size parameters are changed, assuming a constant forward speed. The purpose of the study is to determine how to change craft size in order to obtain sustained motion in the largest possible following sea. Four different methods of changing size (scaling the physical dimensions of the system) are considered, and a simplified analysis is carried out on the basis of the effects of the damping and natural frequency of the free-vibration mode (resonance considerations) and the variation of the wave forcing functions as functions of wave length for different values of the scale ratio.

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
LONGITUDINAL STABILITY OF SURFACE-PIERCING HYDROFOIL SYSTEMS FOR WATER-BASED AIRCRAFT, by Gerard Fridsma. Rept. on Contract Nonr-263(20). Oct 59, 42p. 12 refs. Rept. no. 732; AD-227 478.
Order from LC mi$3.30, ph$7.80 PB 149 866

A theoretical investigation was conducted on tandem surface-piercing hydrofoil configurations to define qualitatively the importance of geometric and hydrodynamic parameters which influence a system's longitudinal stability in smooth water. The hydrofoil system was analyzed on the basis of the linear theory of small disturbances without the presence of controls. A wide range of parameters including lift curve slope, dihedral, foil spacing, load, speed, equilibrium lift coefficient and chord and area distributions was investigated to determine their effect on the regions of stability. The results of this analysis are put in the form of design charts which illustrate the regions of stability and instability. These regions are bounded by an upper limit curve which is indicative of oscillatory divergent motions and a lower limit curve indicative of a continuously divergent motion. The results presented are applicable to hydrofoil equipped aircraft as well as hydrofoil equipped seacraft. (Author)

Institute of Engineering Research, U. of California, Berkeley.
WATER WAVES. I, by John V. Wehausen. Rept. on Contract Nonr-222(30). Aug 58, rev. July 59, 155p. Series no. 82, issue no. 6; AD-227 275.
Order from LC mi$7.50, ph$24.30 PB 148 165

Contents:
Mathematical formulation
  Coordinate systems and conventions
  Equations of motion
  Boundary conditions at an interface
  Boundary conditions on rigid surfaces
Preliminary remarks and developments
  Classification of problems
  Progressive waves and wave velocity; standing waves
  Energy
  Momentum
  Expansion of solutions in powers of a parameter
Theory of infinitesimal waves
  The fundamental equations; use of complex variables
  Other boundary conditions
  Some mathematical solutions
  Some simple physical solutions
  Group velocity and the propagation of disturbances and of energy

Institute of Engineering Research, U. of California, Berkeley.
WATER WAVES. II, by John V. Wehausen. Rept. on Contract Nonr-222(30). Sep 58, 174p. Series no. 82, issue no. 7; AD-227 274.
Order from LC mi$8.10, ph$27.30 PB 148 618

Contents:
The solution of special boundary problems
Two-dimensional progressive and standing waves in unbounded regions with fixed boundaries
Three-dimensional progressive and standing waves in unbounded regions with fixed boundaries
Problems with steadily oscillating boundaries
Motions which may be treated as steady flows
Waves resulting from pressure distributions
(See also PB 148 165)

Institute of Mathematical Sciences, New York U., N. Y.
EQUATION OF STATE AND PHASE TRANSITION OF THE SPHERICAL LATTICE GAS, by Walter Pressman and Joseph B. Keller. Rept. on Contract AF 49(638)341. Feb 60, 34p. 5 refs. Research rept. no. HT-5; AFOSR-TN-60-297; AD-235 375.
Order from LC mi$3.00, ph$6.30 PB 148 985

The spherical lattice gas is a modification of the ordinary lattice gas in which the occupation number of each cell is permitted to be any real number rather than ±1. However the sum of squares of the occupation numbers is required to equal the number of cells. This permits one to evaluate the partition function by integrating over the surface of a certain sphere rather than by summing over lattice points on that surface. The partition function and the equation of state of the gas are evaluated in this way. It is found that in 3 dimensions the gas condenses, but not in 1 or 2 dimensions. Graphs of the phase transition curve and of the isotherms in 3, 2 and 1 dimensions are presented. The analytical work is simplified by taking advantage of the relationship between the properties of the lattice gas and of the Ising model of a ferromagnet. This relationship, demonstrated by C. N. Yang and T. D. Lee [Phys. Rev. 87:410-419, 1952] for the ordinary lattice gas and Ising model, also applies to the spherical lattice gas and the spherical model of a ferromagnet. The properties of the latter were evaluated by T. H. Berlin and M. Kac [Phys. Rev. 86:821-835, 1952]. Graphs of the isotherms of the spherical model of the magnet, which were found in the course of the work, are also presented. (Author)

Laboratoire de Physique Théorique et Hautes Energies, Faculté des Sciences, Orsay (France).
ON THE THEORY OF CLASSICAL FLUIDS, by Loup Verlet. Technical note no. 18 on Contract AF 61(052)173. [1959] 35p. 16 refs. AFOSR-TN-60-689; AD-240 348.
Order from LC mi$3.00, ph$6.30 PB 149 589

An integral equation is established for the three-body correlation function in classical fluids. This equation contains a main equation which is very simple and correction terms. The solution of the main equation appears at first rather easy, but it is a highly non linear equation.

Princeton U., N. J.
CONCENTRATION DISTRIBUTION IN TWO-PHASE PIPE FLOW, by S. L. Soo and J. A. Regalbuto. Rept. on Project Squid, Contract Nonr-1858(25). Nov 59, 30p. 10 refs. Technical rept. PR-101-P; AD-229 223.
Order from LC mi$2.70, ph$4.80 PB 149 495

Concentration distribution of solid particles in 2 phase turbulence pipe flow was studied. Analytical consideration of momentum transport from the wall suggests a force field toward the center of the pipe opposing the mechanism of turbulent diffusion of solid particles. This gives rise to a nonuniform distribution of solid particles in steady and fully developed turbulent pipe flow. Experimental determination of concentration distribution was made with an impact disk particle counter system. (Author)

Princeton U., N. J.
SOME EFFECTS OF PARTICLE-PARTICLE AND PARTICLE-FLUID INTERACTION IN TWO PHASE FLOW SYSTEMS, by Richard L. Peskin. Rept. on Project Squid, Contract Nonr-1858(25). Oct 59, 151p. 41 refs. Technical rept. PR-97-T-R; AD-226 990.
Order from LC mi$7.50, ph$24.30 PB 149 869

The intensity of motion and the diffusivity of a single particle suspended in a turbulent fluid is discussed. The statistical behavior of particle motion is considered for the case of an isolated particle and for the case in which other similar particles present in the fluid exert pressure forces on the particle. (Author)

Rocketdyne, Canoga Park, Calif.
SOME COMMENTS ON PUMP CAVITATION RESEARCH, by A. J. Acosta (Calif. Inst. of Tech.) and G. F. Wislicenus (Pennsylvania State U.). Rept. on Study of Unconventional Methods for Alleviating Cavitation Problems in Rocket Pump Systems, Contract AF 33(616)5785. June 60, 25p. 28 refs. Excerpts from rept. R-1705; WADD Technical note 60-23.
Order from OTS $0.75 PB 161 952

Comments by Prof. A. J. Acosta and Prof. G. F. Wislicenus concerning pump cavitation research are presented. They are excerpts from a contract status report by Rocketdyne Division and originated in connection with a proposed study of fluid injection around a single cavitating hydrofoil. Both commentators question very strongly the value of such tests for present day pump cavitation research. Prof. Acosta points out in particular the general ineffectiveness of fluid injection as a means for cavitation control. As an extension to his comment, a theoretical analysis, previously advanced by Prof. Acosta, for the flow in a cavitating cascade is added. Prof. Wislicenus discusses in detail three-dimensional effects in pump cavitation and suggests also ways for attacking the associated problems. (Author)

St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis.
INSTABILITY OF VENTILATED CAVITIES, by E. Silberman and C. S. Song. Rept. on Contract Nonr-710(24). Nov 59, 47p. 6 refs. Technical Paper no. 29, Series B; AD-237 387.
Order from LC mi$3.30, ph$7.80 PB 148 010

Cavitation number σ is defined by $\sigma = (p_o - p_k)/q$. It can be controlled by controlling the dynamic pressure q, the ambient pressure p_o, or the internal cavity pressure p_k. Controlling p_k by adding air to the wakes of fully submerged bodies (called ventilation) is investigated. With p_o and q fixed, p_k increases nearly linearly with the rate of air supply. Once σ was decreased to a certain critical value, further increase in the air supply rate would not produce a continuing linear decrease in σ. Rather, σ remained nearly constant and the cavities began to vibrate. Both two-dimensional and finite aspect-ratio bodies were tested in the two-dimensional, vertical, free-jet water tunnel.

Technion Research and Development Foundation, Ltd. (Israel).
RESEARCH ON CROSS-STRESSES IN THE FLOW OF LIQUIDS, by Markus Reiner. Technical rept. for 1 Mar 59-28 Feb 60 on Contract AF 61(052)223. [1960] 24p. 6 refs. AFOSR-TN-60-996.
Order from LC mi$2.70, ph$4.80 PB 150 357

Cross-stresses in the laminar flow of liquids. It is shown that cross-elasticity effects exist in a simple homogeneous liquid such as toluene. These effects manifest themselves in cross-stresses observed in an instrument consisting of two circular metal plates, one stationary, the other rotating opposite it. The stator can be displaced along the axis of rotation against forces exerted by springs. Stator and rotor are in contact when at rest. When the rotor is brought into rotation, cross-stresses in the liquid separate stator and rotor and a bearing effect is produced. Centripetal air-pump operated electromagnetically. Reprinted from the British Jnl. of Applied Physics 10:54-55, Jan 59.

METALLURGY

Brown U. Div. of Engineering, Providence, R. I.
AN EXPERIMENTAL DESIGN FOR VIBRATORY LIQUID SINTERING, by Dogan E. Gücer. Rept. on Contract DA 19-020-ORD-4888. June 60, 24p. 6 refs DA-4888/4; OOR rept. 2060. 4-Met.
Order from LC mi$2.70, ph$4.80 PB 150 398

This report describes an experimental set-up for measuring and controlling the vibrational energy input into a WC-Co liquid sintering specimen inside a high temperature hydrogen furnace. The control of input energy is achieved by proper acoustic design of the wave path and the measurement of dynamic strain amplitudes along this path. A method of calculation of the energy transmitted through the interface between the transmission bar and liquid sintering specimen and of the dynamic variables inside the specimen is proposed. The reproducibility of dynamical measurements and of alloy microstructures are also discussed. The same arrangement can easily be adapted to other applications. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DESIGN INFORMATION ON PH 15-7 Mo STAINLESS STEEL FOR AIRCRAFT AND MISSILES, by R. J. Favor, O. L. Deel, and W. P. Achbach. Rept. on Contract AF 18(600)1375. 22 Aug 60, 43p. 9 refs. DMIC rept. 135.
Order from OTS $1.25 PB 151 093

This report is a summary of design information pertinent to the use of PH 15-7 Mo stainless steel in aircraft and missile applications. Welding problems are discussed briefly. Data on the elevated-temperature mechanical properties of this alloy have been collected and evaluated. The presentation and evaluation of these data are in accordance with procedures employed by the AMC-5 Committee. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF REFRACTORY METAL SHEET IN THE UNITED STATES, by R. I. Jaffee, W. J. Harris, Jr., and N. E. Promisel. Rept. on [Contract AF 18(600)1375]. 20 Sep 60, 12p. DMIC memo. 67.
Order from OTS $0.50 PB 161 217

Text of a talk presented at the Conference on Niobium, Tantalum, Molybdenum, and Tungsten, held at the University of Sheffield, 20-22 Sep 60.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
RECENT DEVELOPMENTS IN SUPERALLOYS, by H. L. Wagner. Rept. on Contract [AF 18(600)1375]. 8 Sep 60, 14p. DMIC memo. 64.
Order from OTS $0.50 PB 161 214

A significant expansion of the operating limits of superalloys has been brought about in the past few years with the development of over a dozen new nickel-base and cobalt-base materials. Some of these alloys are fabricable into sheet, while others are suitable only for precision casting. Both, of course, have their advantages and disadvantages. The purpose of this memorandum is to highlight some of the newer superalloys and to discuss some of their important properties and characteristics.

Illinois U., Urbana.
AN INVESTIGATION OF THE USE OF INTERNAL FRICTION TECHNIQUES IN THE STUDY OF DIFFUSION AND PHASE CHANGES IN METALS, by James Cost and Charles Wert. Final rept. on Contract AF [18](603)22. 15 May 60, 34p. AFOSR-TR-60-83.
Order from LC mi$3.00, ph$6.30 PB 149 595

Contents:
Studies of phase separation in Au-Ni alloys
Anelasticity in alloys of Cd with Mg
The effect of ferromagnetism on diffusion
Studies of the group VB metals and their equilibrium with oxygen and nitrogen
The internal friction of Hf.

Institute of Metals and Explosives Research, U. of Utah, Salt Lake City.
OBSERVATION OF VAPORIZATION ACCOMPANYING ULTRA-HIGH VELOCITY IMPACT, by R. W. Bartlett. Rept. on Contract AF 18(603)100. 4 Jan 60, 26p. 9 refs. AFOSR-TN-60-327; AD-237 546.
Order from LC mi$2.70, ph$4.80 PB 148 013

The explosive techniques employed were capable of generating velocities sufficiently high to produce target vaporization in many metals. These impact-generated vapors were sufficiently luminous for short periods of time to be photographed, and they exhibited considerable electrical conductance evidencing a high degree of ionization which decayed faster in air and various inert gases than in vacuum. Because of the high luminosity and the ionization of the impact-generated metal vapors or plasmas high-speed framing camera techniques and electrical conductivity measurements were employed. Small quantities of the condensed vapors also were collected and analyzed quantitatively to determine the ratios of the projectile or jet to target metals in the vapor condensate as a function of impact velocity. In most cases mixtures of metal oxides were indicated but the X-ray diffraction patterns did not permit conclusive identification of specific compounds. Some condensation of reduced metal also was observed (aluminum, iron and zinc) and a substitutional solid solution alloy, alpha brass, was produced by the simultaneous condensation of copper and zinc vapors originating from different targets impacted in tandem. (Author)

Westinghouse Electric Corp., Bloomfield, N. J.
PHYSICAL METALLURGY OF TUNGSTEN AND TUNGSTEN BASE ALLOYS, by Russell H. Atkinson. Rept. for 1 Apr 58-30 Nov 59 on Metallic Materials, Contract AF 33(616)5632. May 60, 251p. 90 refs. WADD Technical rept. 60-37.
Order from OTS $4.00 PB 161 978

The program provided base line data and fundamental physical metallurgical information on tungsten of various purity levels. High temperature tensile properties and recrystallization temperature could not be directly correlated with the impurity level. The tensile transition temperature of tungsten single crystals lies between - 196°C and 107°C, the main influence being surface condition. Polycrystalline tungsten internal friction peaks of undetermined origin in the 20° - 800°C region. Annealed single crystals show no such behavior. Alloying with a dispersed second phase was studied; at present W-2% ThO_2 offers the greatest improvement in high temperature properties data on alloying studies are incomplete. (Author)

Ferrous Metals

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.
A STUDY OF THE MINIMIZATION OF THE ADVERSE EFFECTS OF CHROME PLATING ON THE FATIGUE LIFE OF AISI 4340 STEEL AND THE CORRELATION OF FATIGUE AND ELASTIC LIMITS, by Joseph Viglione. Rept. on Proj. TED NAM AE 4110, pt. 13. 20 July 59, 38p. 3 refs. Rept. no. NAMC-AML-AE-1098.
Order from LC mi$3.00, ph$6.30 PB 150 787

This report released for sale to the public 11 Oct 60.

The effect of shot-peening prior to and baking after chrome plating AISI 4340 steel was investigated at strength levels up to 295,000 psi. It was found that this treatment had excellent beneficial effects on the fatigue limits of chrome plated 4340 steel at all the strength levels likely to be used in aircraft construction. It was determined that there was no relationship between the fatigue limits and any of the other mechanical properties of the plated steel. In the case of the unplated steel, it was established that there was a definite straight-line functional correlation between the fatigue limit to elastic limit ratios and the tensile strength levels of the steel. (Author)

Battelle Memorial Inst., Columbus, Ohio.
DETERMINATION OF THE CAUSES OF WELD-METAL CRACKING IN HIGH-STRENGTH STEELS AND THE DEVELOPMENT OF HEAT-TREATABLE LOW-ALLOY-STEEL FILLER WIRES FOR USE WITH THE INERT-GAS-SHIELDED ARC-WELDING PROCESS, by Herbert W. Mishler, Robert E. Monroe, and Perry J. Rieppel. Rept. for 16 June 58-30 July 59 on Welding, Brazing, and Solering of Metals, Contract AF 33(616)5878. May 60, 60p. 12 refs. WADC Technical rept. 59-531.
Order from OTS $1.50 PB 161 981

The work conducted under this contract was divided into four phases: three dealt with the study of the causes of weld-metal-cracking in SAE 4340 steel and the fourth was concerned with the study of filler wires for producing welds heat treatable to ultimate-tensile-strength levels greater than 225,000 psi. Freezing-cycle hot-tension studies were made on various heats of SAE 4340 steel containing various sulfur and phosphorus contents. Results indicated that the combined sulfur and phosphorus contents of SAE 4340 steel should be kept below 0.025 per cent to prevent weld-metal hot cracking. An intergranular phase believed to be associated with hot cracking was found during light and electron microscopy of high-phosphorus SAE 4340 steels. This phase was tentatively identified as the iron-iron phosphide euctectic. Two new restrained weld-metal-cracking tests were developed that will give a quantitative measure of weld-metal-cracking resistance and which also will be inexpensive to conduct. Filler wires were developed which can produce weld metals capable of being heat treated to various strength levels in the range of 225,000 to 280,000 psi ultimate tensile strength. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN X-RAY ANALYSIS OF THE STRAIN IN STEEL DUE TO IMPULSIVE LOADS, by G. Moss, S. Golaski and C. Glass. June 60, 12p, 5 refs. Technical note no. 1320.
Order from LC mi$2.40, ph$3.30 PB 149 884

A rod of pearlitic 1030 steel was subjected to an impulsive load, recovered, and analyzed for X-ray diffraction line broadening at a cross section which had been exposed to a maximum pressure of approximately 35 kilobars. The broadening of the diffraction peaks was then plotted versus $\sec\theta$ and θ in order to establish whether or not the primary mode of deformation was due to lattice fragmentation or micro-strain. The results indicated that deformation was not simple enough to be interpreted according to either of these models, for the broadening was probably due to both micro-strain and lattice fragmentation. (Author)

Naval Research Lab., Washington, D. C.
CRACK PROPAGATION TESTS OF HIGH-STRENGTH SHEET MATERIALS. PART V. AIR-MELTED AND CONSUTRODE AMS 6434 STEEL, by C. D. Beachem and J.E. Srawley. 18 Aug 60, 22p. 4 refs. NRL rept. 5507.
Order from OTS $0.75 PB 161 697

Crack propagation tests were conducted on air-melted and consumable-electrode vacuum-remelted SAE Aeronautical Materials Specification 6434 (modified AISI 4335 with vanadium), using specimens 1/2 in. or 1-1/2 in. wide and up to 0.125 in. thick, and heat-treated to have yield strength in the range 180 to 210 ksi. The full shear temperatures obtained with the different thicknesses and heat treatments were lower than those of any other steels of comparable thicknesses and yield strengths that have been tested to date, and the net fracture stress values were similarly superior. The consutrode material was significantly better than the air-melted material. Limited data indicated that the transverse properties were not significantly inferior to the longitudinal properties. The FST was higher the thicker the material, as previously observed for other materials. Austenitizing at 1620°F gave better results than at 1575°F, and tempering at 400°F gave better results than at 725°F. (Author) (See also PB 161 355)

Rodman Lab., Watertown Arsenal, Mass.
IMPROVED STEELMAKING PRACTICES ENHANCE THE MECHANICAL PROPERTIES OF HIGH STRENGTH STEEL CASTINGS, by John Zotos, and Kenneth D. Holmes. May 60, 26p. 13 refs. Rept. RPL 10/25.
Order from LC mi$2.70, ph$4.80 PB 149 560

Recent advances in the basic-electric and basic-induction atmospheric and vacuum steelmaking practices have, (1) clarified the necessity of minimizing phosphorus and sulphur contents in cast low alloy steels to maximize ductility and toughness at low, medium and high strength levels, (2) shown that the ductility and toughness of these cast steels can be further significantly improved through the use of vacuum melting and casting techniques, and (3) indicated that the mechanical properties of heat treated castings with low sulphur contents compare favorably with the properties of forgings having similar analyses. (Author)

Light Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF RATE OF HEATING TO AGING TEMPERATURE ON THE TENSILE PROPERTIES OF Ti-2, 5Al-16V ALLOY SHEET, by G. S. Root and H. R. Ogden. Rept. on [Contract AF 18(600)1375]. 18 Aug 60, 11p. 3 refs. DMIC memo. 62.
Order from OTS $0.50 PB 161 212

The experiment described in this memorandum was designed to correlate tensile properties of aged Ti-2.5Al-16V alloy sheet, heated to aging temperature at various rates, with the quench and reheat time-temperature-transformation diagram developed for this alloy by the Armour Research Foundation. Specifically, the effects of three variables on aged strength and elongation were studied: (1) The effect of rate of heating to aging temperature, (2) the effect of minor variations in total time during aging, and (3) the effect of a low-temperature pre-aging treatment to obtain omega phase.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
TANTALUM AND TANTALUM ALLOYS, by F. F. Schmidt. Rept. on Contract AF 18(600)1375. 25 July 60, 334p. 287 refs. DMIC rept. 133.
Order from OTS $5.00 PB 151 091

A descriptive literature survy has been made covering physical properties, process metallurgy, binary and ternary alloy systems, chemical properties and metallurgical properties of tantalum and tantalum alloys. The properties of tantalum are well reported; however, investigations concerned with the effects of interstitial and substitutional alloying elements on the properties of tantalum are limited. Tantalum has only moderate strength at room temperature; however, the elevated-temperature strength decreases slowly in comparison with that of many other metals. The low ductile-to-brittle behavior, excellent fabricability, high melting point, and high solubility for interstitial and substitutional elements make tantalum an attractive candidate for use in high-temperature high-strength alloys. Refractory metals that exhibit brittle behavior at room temperature, such as molybdenum and tungsten, can be alloyed with tantalum to form tantalum-base alloys with a combination of high-temperature strength and low-temperature ductility not found in many metallic materials designed for ultra-high-temperature service. (Author)

Nonferrous (except light) Metals

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
PROPERTIES OF ZONE REFINED TITANIUM AND ZIRCONIUM. PART I, by J. L. Rutherford, R. L. Smith, and M. Herman. Rept. on Contract AF 18(600)1581. July 60, 33p. 4 refs. Interim rept. I-A1878-6; AFOSR-TN-60-694.
Order from LC mi$3.00, ph$6.30 PB 149 955

The properties of zone refined titanium and zirconium are presented and evaluated. Surveys of the properties along the length of the zone refined bars are shown which indicate a definite redistribution of impurities as well as some actual purification. The results of tensile tests at 4.2°K and the origin of the serrations appearing in these tensile curves are discussed. (Author)

Pitman-Dunn Labs. Group., Frankford Arsenal, Philadelphia, Pa.
RADIATION INDUCED RESISTIVITY CHANGES IN NICKEL, by D. B. Rosenblatt. Mar 60, 10p. 7 refs. Memo. rept. M60-29-1; AD-239 656.
Order from LC mi$1.80, ph$1.80 PB 149 792

Previous research with room temperature irradiations of nickel wire revealed anomalies in the increase of the electrical resistivity of this material. Comparison of results obtained by different investigators suggests that the excess resistivity saturates at very low values of integrated flux and does not anneal out in a reproducible fashion. The experiments reported here verify the existence of this anomalous behavior and provide additional data for various radiation doses. The annealing of the excess resistivity produced by cold work is studied and found to follow a smooth curve, with significant rates of disappearance of defects in the temperature range right above room temperature. The relationship between this behavior and the irreproducibility of data obtained with irradiated specimens is discussed. (Author)

Structural Metallurgy and Corrosion

American Machine and Foundry Co., Alexandria, Va.
ULTRA-SHORT-TIME CREEP RUPTURE, by Joseph S. Ives, Jr. Rept. for 2 Feb-31 Oct 59 on Materials Analysis and Evaluation Techniques; Contract AF AF 33(616)5557. May 60, 131p. WADC Technical rept. 59-762, Pt. 2.
Order from OTS $2.75 PB 161 983

The short time creep behavior of eight structural sheet materials when subjected to temperatures up to 2,000°F was determined for time periods of 10 seconds to three minutes. The test specimens were preloaded and subsequently heated to the desired test temperature within 100 milliseconds through capacitance discharge. Test temperature was then maintained by an a.c. current. Strain-time, isochronous stress-strain and stress-time curves are presented. Initial transient behavior due to thermal expansion is also reported. (Author) (See also PB 161 789)

Armour Research Foundation, Chicago, Ill.
THE DETERMINATION OF THE EFFECTS OF ELEVATED TEMPERATURES ON THE STRESS CORROSION BEHAVIOR OF STRUCTURAL MATERIALS, by Frank A. Crossley, Carl J. Reichel, and Charles R. Simcoe. Rept. on Materials Application, Contract AF 33(616)6392. May 60, 59p. 39 refs. WADD Technical rept. 60-191.
Order from OTS $1.50 PB 161 962

The dissolution rates of anodized oxide films on Ti-6Al-4V alloy were determined from 800° to 1000°F. Coefficients for oxygen diffusion in Ti-6Al-4V alloy are given by D, $cm^2/sec = 2.87 \times 10^4 \exp(-67,900 \pm 300/RT)$. Experiments showed conclusively that oxide film protection is lost by direct reaction with chloride salt. Elevated-temperature creep testing in the presence of chloride salt was found to be detrimental to post-exposure tensile properties of the materials: 17-7 PH, stainless Type 321, Inconel-X, and B 120-VCA. Materials exhibiting premature failure with greatly reduced ductility in tension static fatigue tests at room temperature in the presence of 10% chloride salt aqueous solution were: 2024T-86 Al alloy, ZK-60 Mg alloy, 17-7 PH, and B 120-VCA. The materails 2024T-86, Ni-plated 17-22 AS, 17-7 PH, Lapelloy, Type 321 stainless, and B 120-VCA were tested for JP-4 fuel stress-corrosion. Except possibly for 2024T-86, no susceptibility was found. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOME MICROSCOPIC OBSERVATIONS OF CRACKS DEVELOPED IN METALS BY VERY INTENSE STRESS WAVES, by G. Moss and C. M. Glass. Apr 60, 19p. 4 refs. Technical note no. 1312; AD-237 943.
Order from LC mi$2.40, ph$3.30 PB 148 913

Explosively induced stress waves were propagated through various metals so that scab type fractures resulted. Microscopic examinations were then made of the metal adjacent to the fracture surfaces. In each case, the fractures began at imperfections within a thin plate of metal that was parallel to and included the observable fracture surface. The thickness and position of this plate within the metal appears to be a function of the inclusions present, subboundaries and crystal orientation. It is concluded that these metallurgical factors influence the response of metals even under explosive loading. (Author)

Food Machinery and Chemical Corp., Buffalo, N. Y.
EFFECT OF COUPLING OF ALUMINUM OR STAINLESS STEEL ALLOYS TO ALUMINUM ON CORROSION BY 90% HYDROGEN PEROXIDE, by L. Goldschlag. Final rept. for 1 Feb-28 Oct 58 on Contract NObs-72383. [1958] 50p. 5 refs. Rept. 91:49-4; AD-212 846.
Order from LC mi$3.30, ph$7.80 PB 150 293

A study of the galvanic corrosion caused by coupling of stainless steels to aluminum alloys and of aluminum alloys to other aluminum alloys in 90% hydrogen peroxide containing chloride and nitrate ions has been completed. During a one-month period, galvanic corrosion was essentially unnoticeable in solutions containing 0 and 3 mg/l chloride but apparent at 10 mg/l. Data on the pronounced effect of chloride, and of anodizing the aluminum, and general data on chemical corrosion of aluminum was obtained. (Author).

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A CINEPHOTOMICROGRAPHIC STUDY OF THE ETCHING OF ZINC, by S. Tint and V. V. Damiano. Rept. on Contract AF 18(600)1581. July 60, 12p. 4 refs. Interim rept. I-A1878-8; AFOSR-TN-60-696.
Order from LC mi$2.40, ph$3.30 PB 149 956

A device was constructed to photograph, on motion picture film, the continuous formation of etch patterns on zinc monocrystals. This apparatus consists of: (1) a transparent cell to hold sample and etchant; (2) a microscope with vertical illuminator; and (3) a motion picture camera driven by an electric motor. Several sequences of these pictures are reproduced, showing looplike patterns similar in appearance to the Frank-Read dislocation source. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DISLOCATIONS AND IMPURITY BOUNDARIES IN ZINC CRYSTALS GROWN FROM THE MELT, by V. V. Damiano and S. Tint. Rept. on Contract AF 18(600)1581. July 60, 15p. 10 refs. Interim rept. I-A1878-9; AFOSR-TN-60-697.
Order from LC mi$2.40, ph$3.30 PB 150 127

Using etch pit techniques, the arrangement of dislocations in cadmium doped high purity zinc crystals grown from the melt was investigated. Crystals which exhibit a cellular segregation structure at a decanted interface were progressively polished and etched to a depth of several millimeters behind the interface. The location of the etch pits at microsegregation and their arrangement into networks is in agreement with Tiller's hypothesis that dislocations are introduced during solidification to accommodate the lattice strain induced by the inhomogeneous distribution of impurities. Networks form when the dislocations are set free after homogenization occurs behind the solid-liquid interface. The dislocations then become arranged in walls perpendicular to the slip plane by climbing away from the impurity boundaries. This secondary substructure fully developed 3 mm behind the solid-liquid interface increases in size as the crystal continues to grow and the dislocations climb and glide. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
PROPERTIES OF ZONE REFINED TITANIUM. PART II, by G. Spangler and M. Herman. Rept. on Contract AF 18(600)1581. July 60, 38p. 22 refs. Interim rept. I-A1878-7; AFOSR-TN-60-695.
Order from LC mi$3.00, ph$6.30 PB 150 126

The recrystallization characteristics, grain growth kinetics, residual resistivity ratio and mechanical deformation characteristics of zone refined titanium are presented and discussed. Both the ultimate purification and the redistribution of impurities in the zone refined material have been evaluated in terms of these operational parameters. Observations are presented and discussed on the effect of purity and grain size on the tendency for discontinuous plastic flow at 4.2°K. (Author)

General Electric Co., Evendale, Ohio.
GAS ATMOSPHERE EFFECTS ON MATERIALS, by R. A. Baughman. Rept. for Apr 58-Apr 60 on Aircraft Fuels, Contract AF 33(616)5667. May 60, 232p. 11 refs. WADC Technical rept. 59-511.
Order from OTS $3.50 PB 161 980

Effects of a special water saturated gas atmosphere on the properties of structural materials was studied at elevated and low temperatures. Parent material as well as welded and brazed joints were subjected to tensile, impact and strain aging tests. Fundamental mechanism and coating study was accomplished on Inco 702, which had proved the most sensitive to the gas environment. This report includes all data obtained and detailed discussion of results. The high temperature rupture strength of each alloy studied was shown to be reduced below the corresponding air atmosphere strength by the special gas. Low temperature properties were shown to be independent of the environmental effects studied. The basic mechanism effecting the high temperature properties has not been clearly determined. (Author)

James Forrestal Research Center, Princeton, N. J.
OXIDATION OF METALS AND ALLOYS, by C. E. Birchenall. Final rept. for 1 Jan 59-30 June 60 on Contract AF 49(638)533. 1960, 19p. AFOSR-TR-60-96.
Order from LC mi$2.40, ph$3.30 PB 150 138

This project has contributed to the following subjects: (1) the establishment of an unusual variation in self-diffusion coefficient in alpha iron in the temperature range containing the Curie point; (2) effects of disorder on thermodynamic properties in manganous oxide and on diffusion in ferrous sulfide; (3) the mechanism and kinetics of oxidation of iron-chromium alloys containing up to ten percent chromium; (4) the mechanism of sulfidation of iron; (5) equilibria in the chromium-sulfur system; (6) the effects of interstitial sites, in which ions are nearly as stable as in lattice sites, on the frequency factor in the rate equation for diffusion; (7) self-diffusion of iron in spinel ferrites of several compositions; and (8) self-diffusion in delta-iron.

Metals and Ceramics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ELEVATED TEMPERATURE DYNAMIC MODULI OF VANADIUM TITANIUM AND V-Ti ALLOYS, by W. H. Hill and B. A. Wilcox. Rept. for Oct 59-Apr 60 on Metallic Materials. May 60, 16p. 9 refs. WADD Technical rept. 60-245.
Order from OTS $0.50 PB 171 014

The dynamic moduli of calcium-reduced vanadium, high grade aluminothermic vanadium, iodide titanium and Ti-75A alloy were determined over the temperature range R. T. to 1250°F. In addition, elevated temperature dynamic modulus data were obtained for five V-Ti alloys, having nominal compositions of V-8Ti, V-17Ti, V-25Ti, V-32Ti, and V-48Ti. The decrease in modulus of vanadium with increasing temperature was found to be relatively small as compared to iodide Ti and Ti-75A. Solid solution additions of Ti were observed to lower the modulus of V over the entire temperature range studied, but the additions did not affect the slope of the modulus versus temperature curve. An empirical correlation relating modulus to density, absolute melting point, and atomic weight was successfully applied to vanadium and V-Ti alloys, such that good agreement was realized between the ratios of E_v/E_{alloy} (calculated) and E_v/E_{alloy} (measured). (Author)

Metals and Ceramics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
STRESS CORROSION OF NOTCHED AND UNNOTCHED AM-350 ALLOY, by Robert T. Ault. Rept. for Sep-Dec 59 on Materials Analysis and Evaluation Techniques. May 60, 14p. 3 refs. WADD Technical note 60-95.
Order from OTS $0.50 PB 161 998

One of the precipitation hardness stainless steel alloys (AM-350) was tested for stress corrosion susceptability in the notched and unnotched condition. A 3 1/2% sodium chloride solution was used. With the specimen stressed to 60% of the 0.2% offset Y. S., it was found that all of the unnotched specimens had failed within 150 hours and none of the notched specimens had failed after 800 hours. It was concluded that stress-raisers such as mechanically induced notches do not have an appreciable effect on the susceptability of an alloy to stress corrosion cracking (SCC). Rather the more important factor is local surface defects or inhomogeneities in the material. It was also found that concentration cell corrosion may be an important consideration for the AM-350 alloy. (Author)

Naval Engineering Experiment Station, Annapolis, Md.
EVALUATION OF TITANIUM AS A SALT WATER PIPING MATERIAL, by Frank Sutton. 15 Sep 58, 12p. 9 refs. Evaluation rept. 910037D; AD-212 792.
Order from LC mi$2.40, ph$3.30 PB 147 563

An experimental salt water piping system to evaluate titanium for piping applications operated for 39 months at a water velocity of 20 ft/sec. The titanium pipe and fittings exhibited complete resistance to salt water corrosion and erosion.

New York U. Coll. of Engineering, N. Y.
FURTHER STUDIES ON ACTIVE-EUTECTOID ALLOYS OF TITANIUM, by R. F. Bunshah, D. Osterberg and others. Rept. for 15 Apr 58-30 Sep 59 on Metallic Materials, Contract AF 33(616)5655. May 60, 80p. 26 refs. WADD Technical rept. 60-95.
Order from OTS $2.00, PB 161 964

This report covers work on active eutectoid titanium-copper alloys in which the decomposition of the beta phase to alpha plus compound occurs rapidly. The current program is divided into two parts. Part I deals with the properties of active eutectoid alloys. The effect of stepwise additions of Al and/or Zr to binary Ti-5Cu, Ti-6Cu, Ti-6Ni, Ti-2Ni-2Cu and Ti-4Ni-2Cu alloys on the tensile strength at room and elevated temperatures, creep-rupture properties and thermal stability under stress were studied. Several alloys exhibited outstanding short time tensile strengths up to 1200°F much superior to the best competition. The creep-rupture properties were correspondingly good. These alloys which exhibited highest strengths also showed instability. Stability could be restored partially by some sacrifices in strength. (Author)

Physical Science Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
VACUUM DEPOSITION OF CORROSION RESISTANT TITANIUM COATINGS, by David K. Wilburn and Charles W. Horn. Rept. on Contract DA 20-089-ORD-39246. Feb 60, 57p. 23 refs. Rept. no. RR-12.
Order from LC mi$3.60, ph$9.30 PB 149 809

A process has been developed for the production of vacuum metallized coatings of titanium for application on ferrous basis metals. Conditions of surface preparation, degassing of basis metal and the vaporization of the titanium are discussed in detail. Metallized titanium coatings are examined by spectrographic and X-ray diffraction techniques. An important phase of the titanium metallization process is the diffusion treatment of the coating which produces adhesion and reduces porosity. Laboratory samples metallized in accordance with this procedure satisfactorily pass the 200 hour salt-fog corrosion test and exhibit excellent adhesion and uniformity. (Author)

Rock Island Arsenal Lab., Ill.
EFFECTS OF VARIATIONS IN SILICON AND MANGANESE ON THE AS-CAST PROPERTIES OF NODULAR CAST IRONS, by P. E. Goettsch. 17 Feb 60, 17p. Rept. no. 60-406; AD-234 987.
Order from LC mi$2.40, ph$3.30 PB 147 342

Silicon levels ranging from 2.4 to 3.5% with manganese levels of 0.2 to 2.0% were used in a series of sixteen separate heats of nodular cast iron in order to study the effects of various concentrations of these elements on as-cast microstructure and tensile properties. Increases of manganese at any level of silicon increased the ratio of pearlite to ferrite, raised the yield strength, and lowered ductility. The mechanical property requirements for Classes 3, 4, and 5 of nodular iron Specification MIL-I-11466 were obtained in the as-cast condition. As-cast ductility was severely impaired when additive silicon-manganese totals exceeded 4.0%. (Author)

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Aerojet-General Nucleonics, San Ramon, Calif.
STANDARDIZATION OF FABRICATION TECHNIQUES (THRESHOLD FOILS) by I. E. Lamb and R. R. Tsukimura. Rept. for Jan 58-22 Sep 59 on Nuclear Instrumentation, Contract AF 33(600)35917. May 60, 101p. 4 refs. WADC Technical rept. 59-607.
Order from OTS $2.50 PB 161 982

The techniques used to develop and standardize a series of neutron detection foils for measurement of neutron spectra are described. The series includes gold and cobalt foils, and plutonium-239, uranium-238, and sulfur threshold foils. A method of calibrating the foils with a low-flux research reactor is discussed. The instrumentation required to obtain data from the foils is presented, together with the neutron intensities that may be explored with these detectors. (Author)

Chicago U., Ill.
RADIOLYSIS OF METHANOL ADSORBED IN SYNTHETIC ZEOLITE-ENERGY TRANSFER EFFECTS by Weldon G. Brown and Helen E. Krizek. Rept. for Aug-Dec 59 on Contract AF 33(616)3875. June 60, 16p. 10 refs. WADD Technical note 60-28.
Order from OTS $0.50 PB 161 953

Samples of Linde Type 5A Synthetic Zeolite, containing methanol at loadings from 2 to 23%, have been subjected to Co-60 gamma irradiation. Analytical data are given for the major products, hydrogen, formaldehyde and ethylene glycol. The data from these experiments, which were of a preliminary nature, are not sufficiently reliable to establish a significant difference with respect to product distribution as compared with the radiolysis of pure methanol. The yields indicate that a substantial fraction of the increase in total energy absorption due to the zeolite is utilized in product formation. The results, with respect to effect of adsorbent on yields, are generally similar to those previously reported by Caffrey and Allen for pentane on silica gel. Under the assumption that similar mechanisms operate with efficiencies comparable with the liquid state, estimates can be made of the energy transfer efficiency. These range from 10 to 65% over the range of methanol concentrations employed and are approximately linear with respect to methanol concentration up to saturation. Reference is made to some potential practical applications of the energy transfer effect. (Author)

Palmer Physical Lab., Princeton U., N. J.
COMPARISON OF THE STRANGE PARTICLE PRODUCTION IN CLOUD CHAMBERS WITH THE OBSERVATIONS OF DECAY γ-RAYS NEAR INTERNAL COSMOTRON TARGETS, by Theodore Bowen. Technical rept. no. 24 on Cosmic Ray and Elementary Particle Group, Contract Nonr-1858(06). 25 June 59, 33p. 11 refs. AD-217 593.
Order from LC mi$3.00, ph$6.30 PB 147 610

A detailed comparison is presented of strange particle production in cloud chambers with the observations of

decay γ-rays near internal cosmotron targets. The γ-rays were counted in a known geometry; the threshold of the γ counter was low enough (~10 Mev) so that the detection efficiency was essentially constant independent of γ-ray energy. For each of the 35 A^o's and 20 Θ_1^o's observed in the cloud chambers, the probability of counting a γ-ray was calculated for several target-to-occulter distances. Since the cloud chamber events were also used to determine production cross-sections, the total path length of material traversed by protons was determined for each plate material. The absolute comparison of numbers of γ-counts from C, Fe (Cu) and Pb, and the relative comparison of the shapes of the decay curves support a consistent interpretation, making use of currently accepted values of lifetimes and decay branching ratios. Since the production angular distributions and the γ-counts vs distance decay curves are very similar for A^o's and Θ_1^o's, the γ-counting results cannot directly reveal the relative contributions from A^o's and Θ_1^o's. The low upper limits on total production cross sections for strange particles from p-p collisions, in combination with the high K^+ yields observed by others, seem to indicate that the matrix element is not constant, but favors K mesons with low cms momentum.

Elementary Particles

Faculté des Sciences, Orsay (France).
A MODEL FOR THE CALCULATION OF THE OPTICAL POTENTIAL IN SOME FINITE NUCLEI, by B. Jancovici. Technical note no. 20 on Contract AF 61(052)173. [1960] 27p. 13 refs. AFOSR-TN-60-941.
Order from LC mi$2.70, ph$4.80 PB 150 352

The imaginary part of the optical potential is computed in second order in an harmonic oscillator shell model for He^4, O^{16}, Ca^{40}; finite nucleus shell model wave functions are consistently used. The results show a good agreement with those of the Thomas-Fermi approximation, providing a check for the validity of the latter. A stronger absorption in the surface is predicted; this effect is therefore not a spurious effect of the Thomas-Fermi approximation. (Author)

Johns Hopkins U., Baltimore, Md.
THE MASS OF THE SIGMA-PLUS HYPERON, by H. F. Perry and A. Pevsner. Rept. on Contract AF 18(603)143. June 60, 17p. 7 refs. AFOSR-TN-60-530; AD-239 905.
Order from LC mi$2.40, ph$3.30 PB 149 358

The stars produced by K-minus mesons stopping in nuclear emulsion were investigated to find examples of the decay at rest of $\Sigma^+ \rightarrow p + \pi^o$. Fourteen examples of this decay were obtained. The mean weighted range of the proton, corrected to the range in emulsion of standard density, is 1676.3 ± 7.7 microns. This corresponds to a kinetic energy of 18.85 Mev. The mass of the Sigma-plus hyperon was found to be 1189.41 ± 0.54 Mev. (Author)

Maryland U., College Park.
CAPTURE OF K⁻-MESONS FROM HIGH S-ORBITALS IN HELIUM, by T. B. Day and G. A. Snow. Rept. on Contract AF 49(638)24. June 60, 8p. 17 refs. Physics Dept. Technical rept. no. 181; [AFOSR] TN-60-761.
Order from LC mi$1.80, ph$1.80 PB 149 331

Maryland U., College Park.
K-MESON CAPTURE BY HELIUM, by T. B. Day. Rept. on Contract AF 49(638)24. July 60, 26p. 25 refs. Dept. of Physics Technical rept. no. 183; [AFOSR] TN-60-819.
Order from LC mi$2.70, ph$4.80 PB 150 106

Some atomic and molecular processes which occur when K^--mesons stop and are captured in liquid helium are investigated. It is shown that while the K^--meson is in its initially highly-excited atomic states, S-state capture is predominant. (Author)

Maryland U., College Park.
(Σ^o, Λ^o) RELATIVE PARITY AND THE DALITZ DECAY OF THE Σ^o HYPERON, by J. Sucher and G. A. Snow. Rept on Contract AF 49(638)24. July 60, 7p. 5 refs. Dept of Physics Technical rept. no. 188; [AFOSR] TN-60-853.
Order from LC mi$1.80, ph$1.80 PB 150 110

Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON COLLISION PROCESSES OF ELECTRONS AND ATOMS, by James R. Peterson, Otto Heinz, and Charles J. Cook. Annual rept. on Contract Nonr-2588(00). 31 July 59, 43p. 17 refs. SRI Project no. SU-2557; AD-226 525.
Order from LC mi$3.30, ph$7.80 PB 149 727

An apparatus for use in experimental studies of low-energy particle impact phenomena is described: investigation of collisions between electrons and ionized or neutral atoms or molecules will employ crossed-beam techniques, using modulated beams and phase-sensitive detection. The approach represents a departure from conventional atomic beam methods in that the atoms are obtained from a fast ion beam rather than from a thermal source. An analysis of the application of the method to the determination of electron-atom ionization cross sections demonstrates the feasibility of the method. (Author)

Instruments and Installations

Airborne Instruments Lab. [Mineola, N. Y.]
MICROWAVE GAMMA-RAY ION CHAMBER, by Conald A. Brown, Karl A. Speh, and Jesse J. Taub. Rept. for May 58-Nov 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5758. May 60, 70p. 7 refs. WADD Technical rept. 60-98.
Order from OTS $1.75 PB 161 986

A microwave gamma-ray ion chamber and its associated equipment has been developed that is capable of measuring gamma radiation in the range from 10^6 to 10^{10} ergs per gm-hr (carbon). This equipment operates at a microwave frequency of about 9 kmc and

measures radiation by using the changes in the reflection coefficient looking into a gas-filled microwave resonant cavity caused by ionization of the gas due to radiation. Data on gas conductivity and resonant frequency shift have been taken for different gas mixtures. (Author).

Frankford Arsenal, Philadelphia, Pa.
A VARIABLE SENSITIVITY GAS THERMOMETER FOR USE AT LOW TEMPERATURES, by F. Rothwarf and J. Steinberg. Sep 59, 13p. 7 refs. Memo. rept. no. M60-1-7; AD-229 586.
Order from LC mi$2.40, ph$3.30 PB 150 306

A variable sensitivity gas thermometer is described which is designed for use in low temperature experiments in the difficult region between liquid helium and room temperatures. The device makes use of the high sensitivity, dP/dT, that can be achieved by having the volume of gas which remains at room temperature considerably larger than that of the thermometer bulb proper. The theoretical analysis is presented, from which design criteria are obtained for various sensitivities and temperature ranges. It is further shown that higher sensitivities can be achieved for a given thermometer by charging the system with the bulb at low temperatures while the dead space is kept at room temperature. Corrections for the various errors that arise in constant volume gas thermometers are discussed. It is found that by increasing the dead space as the temperature is lowered, a fairly constant accuracy can be maintained over the range from 300° K to 4.2° K. (Author).

Lockheed Aircraft Corp., Sunnyvale, Calif.
FEASIBILITY OF A RADIATION DETECTION SYSTEM FOR SPACE TRAVEL. Rept. on Contract AF 29(600)2049. July 60, 50p. 17 refs. LMSD-703014; AFMDC-TR-60-15.
Order from LC mi$3.30, ph$7.80 PB 150 050

Preliminary design criteria are presented for a system of instruments for the measurement of the species, intensities, and energies of space radiation which may be expected on the basis of current understanding of radiation phenomena in space.

Naval Civil Engineering Lab., Port Hueneme, Calif.
RADIATION SLIDE RULE FOR ATOMIC FALLOUT PROBLEMS, by J. C. LeDoux. Final rept. 24 May 60, 24p. 5 refs. Technical rept. 083.
Order from LC mi$2.70, ph$4.80 PB 148 660

The theory, construction, and use of a circular slide rule is presented. It is designed to solve passive-defense residual-radiation problems. The rule is based on the $t^{-1.2}$ law of radioactive decay and can solve an infinite number of problems without recourse to tables, construction, or graphic plots. Several typical problems are worked with the slide rule to demonstrate it. (Author)

Nuclear Engineering and Power

Alco Products, Inc., Schenectady, N. Y.
HAZARDS AND MISSILE SURVEY OF NUCLEAR REACTOR VAPOR CONTAINMENT FOR SM-2, by H. F. Van Kessel. Rept. on Contract DA 44-009-eng-3506. [1958] 172p. 548 refs. APAE no. 45.
Order from LC mi$8.10, ph$27.30 PB 150 551

This report released for sale to the public 11 Oct 60.

Behavioral Sciences Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
TASK PERFORMANCE WITH THE CRL MODEL 8 MASTER-SLAVE MANIPULATOR AS A FUNCTION OF OBJECT SIZE, ANGLE, AND HEIGHT OF DISPLAY, by D. Frederick Baker. Rept. on Human Factors in Advanced Flight. May 60, 20p. 13 refs. WADD Technical rept. 60-167.
Order from OTS $0.50 PB 171 013

This experiment was undertaken to investigate criteria for design of equipment to be handled and tasks to be performed with remote-handling equipment. Three variables in remote-handling task performance were studied: size of object handled, height, and angle of display. A CRL Model 8 Master-Slave Manipulator was used for a performance task in which subjects removed three sizes of hexagonal nuts from a display panel presented at three different heights and five different angles. Task performance times were analyzed in relation to joint range limitations of shoulder, elbow, forearm and wrist movements. Within the limits of this study, the size of the object to be handled remotely has little effect on performance. Change in angle of display brings about significant differences in performance time. Performance time tends to improve as angle moves from horizontal to vertical at the upper height; and from vertical to horizontal at the lower height. (Author)

Johns Hopkins U., Baltimore, Md.
A DETERMINATION OF BACKGROUND RADIATION AND THE EFFECT OF SHIELDING, by H. F. Perry and A. Pevsner. Rept. on Contract AF 18(603)143. June 60, 12p. 3 refs. AFOSR-TN-60-548.
Order from LC mi$2.40, ph$3.30 PB 149 360

An investigation of the background radiation, in particular that due to "slow electrons," was undertaken to determine the rate of contamination of undeveloped nuclear emulsions. Unshielded emulsions were found to pick up 4×10^5 tracks/cm^3/day in the 35-200 kev energy range. In a specially constructed iron safe the background was reduced and emulsions picked up only $.09 \times 10^5$ tracks/cm^3/day. Under the shielded conditions, the latent images faded at a faster rate than the background was acquired. (Author)

Martin Co. [Baltimore, Md.]
A BORON DETERMINATION FOR THE APPR-1. Rept. on Contract DA 44-009-eng-3318. 25 May 59, 37p. MND-E-1718-1; AD-217 691.
Order from LC mi$3.00, ph$6.30 PB 150 550

This report released for sale to the public 13 Oct 60.

An investigation was made of the problem of B loss determination resulting from the fabrication of stainless steel - UO_2 dispersion-type fuel elements for the Army Packaged Power Reactor (APPR-1) in which B is employed as a burnable poison. Comparisons were made between the results of analyses of fuel elements by the Martin Company, Oak Ridge National Laboratory, and the Lucius Pitkin Company. Radiographs showed no detectable reactivity difference between two sets of APPR-1 fuel plates which were fabricated at ORNL. Based on reactivity measurements and compared with the Martin APPR-1 mockup, the amount of B in an average 18-plate APPR-1 element composed of ORNL plates is 71% of the design amount for a B loss of 29%. Chemical analysis of fabricated fuel plates by ORNL and Martin Nuclear showed an average B loss per plate of 22.4% for 100% design B loading or 25.9% for 103.5% of design B loading.

Nuclear Reactions

Institute of Mathematical Sciences, New York U., N. Y.
UPPER BOUNDS ON ELECTRON-ATOMIC HYDROGEN SCATTERING LENGTHS, by Leonard Rosenberg, Larry Spruch, and Thomas F. O'Malley. Rept. on Contracts AF 19(604)4555 and DA 30-069-ORD-2581. Feb 60, 27p. 65 refs. Research rept. no. CX-46; AFCRC-TN-60-249; AD-235 367.
Order from LC mi$2.70, ph$4.80 PB 148 986

Recently developed variational techniques for determining upper bounds on scattering lengths are applied to singlet and triplet scattering of zero energy electrons by atomic hydrogen. The results obtained are not only rigorous but are in fact somewhat lower and therefore somewhat better than those previously obtained by variational methods.

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh Pa.
ANGULAR CORRELATION STUDY OF THE Mg^{24} (d, p γ)Mg^{25} STRIPPING REACTION AS A TEST OF THE DISTORTED WAVE THEORY, by Joseph Pourcher Martin. Doctoral thesis. Technical rept. no. 1 on Precision Scattering of Nuclear Particles, Contract Nonr-624(10). Oct 59, 66p. 27 refs. AD-227 922.
Order from LC mi$3.90, ph$10.80 PB 149 936

Angular correlations between protons from the Mg^{24}(d, p)Mg^{25} reaction leading to the 3.40 Mev excited state of Mg^{25} and the resulting de-excitation gamma rays were investigated to test the validity of the distorted wave stripping theory. A natural magnesium target was bombarded by 15 Mev deuterons and proton-gamma coincidences were counted using scintillation detectors in conjunction with conventional fast-slow coincidence circuitry. The correlations were studied at laboratory proton scattering angles of 15° and 45°, each in two mutually perpendicular planes: the reaction plane and the plane perpendicular to it containing the deuteron axis. The angular distribution of protons from the same level was measured and fitted by a Butler stripping curve with $l_n = 1$ and $r_o = 5.0$ fermis. (Author)

Vienna U. (Austria).
THE TWO-BODY PROBLEM IN THE EXTREME RELATIVISTIC LIMIT, by W. Thirring and K. Baumann. Scientific note no. 5 on Contract AF 61(052)265. 10 June 60, 9p. 14 refs. AFOSR-TN-60-942.
Order from LC mi$1.80, ph$1.80 PB 150 353

Radioactivity

Army Engineer Research and Development Labs., Fort Belvoir, Va.
A STUDY OF THE ENGINEERING ASPECTS OF EXPEDIENT GAMMA-SHIELDING MATERIALS, by Cluey D. Hargrove and Allen F. Grum. Rept. for 1 Feb-1 June 59. 7 Apr 60, 69p. 6 refs. Technical rept. 1622-TR. AD-238 440.
Order from LC mi$3.90, ph$10.80 PB 149 317

The purposes of the tests covered in this report were (1) to determine attenuation (absorption) coefficients and (2) to determine dose rates as a function of shield thickness for 10 shielding materials that can be found in the field, such as water, rock, dirt, or wood. Measurements were made with a sodium iodide, thallium-activated crystal and a 128-channel pulse height analyzer. Point sources were used for the attenuation coefficient measurements and 12-inch-diameter uniformly distributed sources for the dose rate measurements. The report concludes that: (a) It is uneconomical to try for a "good" gradation of rock when using rock as an expedient shield because the differences in density between a good and poor gradation in most cases would be only 10 to 20 percent. In rare cases where the good gradation has a density appreciably greater than the poor gradation, it would be worthwhile to achieve a good gradation, (b) any effort spent on compacting soil in an expedient shield would be effort well spent; (c) sand should be used in its driest natural state for effective gamma attenuation; and (d) the curves as presented by WKNL may be unconservative for some applications. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
THE DISINTEGRATION OF Ba^{131}, by J. Richard Haskins. 1 Aug 59, 44p. 21 refs. ARGMA TR-1C32R; AD-220 888.
Order from LC mi$3.30, ph$7.80 PB 149 094

The energies of the high energy gamma rays in the decay of Ba^{131} were measured and found to be: 810 ± 10, 925 ± 10 and 1050 ± 15 Kev. The existence of a 405 Kev. gamma ray in coincidence with the 214 Kev. gamma ray was confirmed. It was determined that there are two gamma rays with energies of approximately 250 Kev., one in coincidence with the 122 Kev. gamma ray and the other in coincidence with the 372 Kev. gamma ray. The 496 Kev. -122 Kev. cascade was investigated. The K conversion coefficient for the 496 Kev. gamma ray was determined to be $(10.5 \pm 1.0) \times 10^{-3}$. The gamma-gamma angular correlation was found to be isotropic with both liquid and metallic barium sources. The K/L conversion ratio for the 122 Kev. gamma ray was determined to be 2.7 ± 0.5. These results are consistent with a 3/2 (M1) 1/2 (E2) 5/2 cascade or a 3/2 (M1 + E2) 5/2 (M1 + E2) 5/2 cascade with certain possible mixing ratios. Additional experiments are proposed, the results of which should make a decision between these two cases possible. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PLOTTING SCALE ML-556(XE-1)/UM, by Bruce F. Watson. 1 Aug 59, 26p. 2 refs. USASRDL Technical rept. 2059; AD-226 417.
Order from LC mi$2.70, ph$4.80 PB 147 824

Plotting Scale ML-556(XE-1)/UM is designed to speed and simplify the construction of the fallout wind plot for the Army method of fallout prediction. The fallout wind plot is a configuration through means of which the location of close-in fallout can be predicted by considering the vertical and horizontal velocities of fallout particles. The plotting scale is developed to fulfill the requirement for a convenient method of accounting for the changing rates of descent and horizontal displacements of fallout particles as they move through the atmosphere.

Convair, Fort Worth, Tex.
AIR AND CONCRETE SCATTERING OF GAMMA RAYS, by M. B. Wells. Rept. on Contract AF 33(600)32054. 20 Mar 59, 107p. 13 refs. ANP doc. no. NARF-59-11T; MR-N-229.
Order from LC mi$5.70, ph$16.80 PB 150 674

This report released for sale to the public 12 Oct 60.

This report describes a Monte Carlo method of computing the angular distribution and energy spectrum of gamma rays scattered in air and ground. The development of the integrals representing the contribution of each order of scattering to the total scattered flux, and the application of random sampling methods to the evaluation of these integrals, are outlined in detail. Calculation of the flux arising from pair-production interactions is also described. Results obtained in a parameter study for a source-detector height of 12.5 feet above a concrete slab are presented in both graphical and tabular form for various source energies and separation distances. (Author)

Defense Atomic Support Agency, Washington, D. C.
RADIOACTIVE FALLOUT FROM NUCLEAR EXPLOSIONS, by Edward N. Parker. 1 Aug 60, 32p. DASA-1188.
Order from OTS $1.00 PB 161 970

This report is a non-technical description of Fallout from Nuclear Explosions. The mechanisms of local and world-wide fallout are described. The relative importance of local fallout in a nuclear war is discussed. The effects upon man of world-wide fallout from past nuclear testing is discussed. It is pointed out that doses to man from testing have been quite small when compared to the natural radiation background. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PROBABILITY DISTRIBUTIONS USING A COUNTING SYSTEM WITH A FINITE RESOLVING TIME, by Arthur Hausner. 15 Aug 60, 13p. 3 refs. Technical rept. TR-853.
Order from LC mi$2.40, ph$3.30 PB 149 294

Analysis is made of the probability distributions of a counting system that requires two particles to be separated by a time, τ, for both to be counted. If a radioactive source emits particles that satisfy a Poisson distribution and an average of ν particles per unit time arrive at the counter, then counting for a period, T, results in a non-Poisson distribution of counts as a result of the dead time, τ. The distribution of counts is slightly skewed to the right, but for sufficiently large T, the skewness diminishes and the distribution approaches a normal one. Exact computations with the IBM 704 digital computer are in good agreement with results given.

Illinois U., Urbana.
MÖSSBAUER EFFECT: RECOILLESS EMISSION AND ABSORPTION OF GAMMA RAYS; CONFERENCE HELD JUNE 6-7, 1960, AT UNIVERSITY OF ILLINOIS, by Hans Frauenfelder and Harry Lustig. Rept. on Contract AF 18(603)49. [1960] 79p. 52 refs. [AFOSR] TN-60-698; AD-240 109.
Order from LC mi$4.50, ph$12.30 PB 149 301

Contents: Session I: Theory, isotopes, experimental; Session II: Relativity, nuclear applications, chemical shifts, line width; Session III: Internal fields, impurities, resonance experiments and ultrasonics, Raleigh scattering and Varia.

Institute of Engineering Research, U. of California, Berkeley.
COMPUTED EFFECTS OF THE INTERIOR WALLS OF A HOUSE ON THE GAMMA RADIATION INTENSITY FROM A GROUND SOURCE FIELD, by C. Schlegel. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 14p. 3 refs. Series no. 2, issue no. 10.
Order from LC mi$2.40, ph$3.30 PB 149 920

A point-to-point computation method is used to determine intensity levels and intensity patterns within a test house. The investigations show that interior walls should be considered in a sophisticated determination of intensity level and intensity pattern. (Author)

Institute of Engineering Research, U. of California, Berkeley.
COMPUTED EFFECTS OF THE ROOF PITCH AND THE CEILINGS OF HOUSES ON THE GAMMA RADIATION INTENSITY FROM A ROOF SOURCE FIELD, by C. Schlegel. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 26p. 3 refs. Series no. 2, issue no. 9.
Order from LC mi$2.70, ph$4.80 PB 149 919

A point-to-point computational method for simulating a roof source field is used to study the shielding effects of roofs and ceilings. A method for representing a pitched roof by an equivalent flat roof is developed for one case. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A COMPUTER PROGRAM FOR CALCULATING GAMMA RADIATION INTENSITY, by A. Ruyle. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 14p. Series no. 2, issue no. 7.
Order from LC mi$2.40, ph$3.30 PB 149 917

A program is described which calculates the intensity from a set of isotropic point sources at a set of isotropic point detectors in the presence of a set of parallelepiped shields. A number of optional variations are available. (Author)

Institute of Engineering Research, U. of California, Berkeley.
COMPUTER PROGRAM FOR RANKING VALUES AND DETERMINING PROBABILITY FREQUENCIES OF DOSE AND INTENSITY OBTAINED FROM A MONTE CARLO CALCULATION, by R. C. Grassi. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 37p. Series no. 2, issue no. 3.
Order from LC mi$3.00, ph$6.30 PB 149 913

A program has been developed which will give ranked values of dose after an infinite time and ranked values of intensity one hour following burst for a given location (monitoring point). Each value of dose and/or intensity calculated represents the fallout received from a Monte Carlo iteration. In addition, the program will calculate the number of values of dose and intensity, respectively, for each throw or iteration, which are above a specified level of radiation. The computing procedure uses a modification of a program previously reported for plotting iso-intensity and iso-dose contours resulting from the effects of radioactive fallout. (Author)

Institute of Engineering Research, U. of California, Berkeley.
FALLOUT PREDICTION: A SIMPLIFIED DETERMINISTIC METHOD, by D. C. Kleinecke. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 1 Dec 59, 23p. 5 refs. Series no. 2, issue no. 27.
Order from LC mi$2.70, ph$4.80 PB 149 932

Many deterministic fallout models express the predicted contamination as an integral over an area surrounding the contaminated point. This integral is equivalent to an integral over a region in the fallout cloud. Precalculated scatter diagrams representing the cloud as an array of dots reduce the evaluation of this integral to a simple process. An example is described in detail. (Author)

Institute of Engineering Research, U. of California, Berkeley.
GAMMA RAY ABSORPTION COEFFICIENTS FOR STRUCTURAL MATERIALS, by P. R. Werling. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 50, 8p. 3 refs. Series no. 2, issue no. 8.
Order from LC mi$1.80, ph$1.80 PB 149 918

Linear absorption coefficients for usual structural members are tabulated. The members are assumed to be approximated by homogeneous slabs. (Author)

Institute of Engineering Research, U. of California, Berkeley.
THE INFLUENCE OF A FIRE-INDUCED CONVECTION COLUMN ON RADIOLOGICAL FALLOUT PATTERNS, by A. Broido and A. W. McMasters. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 49p. 10 refs. Series no. 2, issue no. 13.
Order from LC mi$3.30, ph$7.80 PB 149 923

Since no nuclear devices have been detonated by the United States under conditions leading to both mass fires and radiological fallout, a theoretical and small-scale experimental study was undertaken to see if fire-induced convection columns could significantly effect fallout patterns. Experiments were conducted in a 6- by 6-foot low-velocity wind tunnel using full-scale fallout simulants. Values of characteristic parameters of fallout patterns were compared for experiments conducted with and without fire, all other factors being held constant. As predicted by theory, a fire upwind of the region of deposition introduced a further downwind movement and lateral dispersion of the fallout. In a few experiments in which the fire was located at the edge of the no-fire pattern, air flow into the convection column shifted the pattern peak upwind. These results suggest quite strongly that effects which can markedly alter civil defense planning will be found for large-scale fires. Since this effect can be significantly influenced by the air flow into and around the column, open air experiments on a larger scale should be performed so that such flow will not be affected by tunnel walls and ceiling. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A MACHINE PROGRAM FOR PARTICLE POSITION VARIANCES AND COVARIANCES, by C. L. Bisson. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 7 Apr 59, 22p. 3 refs. Series no. 2, issue no. 21.
Order from LC mi$2.70, ph$4.80 PB 149 928

This report gives an IBM 704 digital computer program for calculating the variances and covariances of the coordinates of the positions of fallout particles or discs of fallout particles when they reach the ground. (Author)

Institute of Engineering Research, U. of California, Berkeley.
ON EVALUATING CERTAIN INTEGRALS APPEARING IN THE PROBABILISTIC MODEL DESCRIBING THE RADIATION INTENSITIES OF FALLOUT, by A. Grasselli. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 13p. 2 refs. Series no 2, issue no. 11.
Order from LC mi$2.40, ph$3.30 PB 149 921

This report describes in detail the method of computation of certain integrals that appear in the mathematical model of radiation intensities of fallout from a nuclear detonation.

Institute of Engineering Research, U. of California, Berkeley.
AN EXTRAPOLATION FROM FISSION PRODUCT SPECTRA TO FALLOUT SPECTRA, by I. R. Jones. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 1 June 59, 15p. 7 refs. Series no. 2, issue no. 23.
Order from LC mi$2.40, ph$3.30 PB 149 929

Using unclassified sources of information an estimate is made of the neutron-induced gamma ray activity accompanying fission. This is combined with available information on the gamma ray activity of fission products to provide an estimate of the gamma ray spectra of fallout. (Author)

Institute of Engineering Research, U. of California, Berkeley.
GAMMA SHIELDING EXPERIMENTS, by D. Doughty, I. Jones and H. Shaked. Progress rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 21p. Series no. 2, issue no. 6.
Order from LC mi$2.70, ph$4.80 PB 149 916

A series of preliminary experiments have been performed to determine the lateral extent of a shield which is equivalent to a shield of infinite lateral extent. (Author)

Institute of Engineering Research, U. of California, Berkeley.
PARTICLE FALL RATE CALCULATION, by M. L. Katz and R. R. Read. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 15 Apr 59, 17p. 12 refs. Series no. 2, issue no. 12.
Order from LC mi$2.40, ph$3.30 PB 149 922

An examination is made of the present methods of calculating fall rates for irregularly shaped particles and it is pointed out that the present methods are not reliable. Brief mention is made of planned experimental work to rectify this situation. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A PROBABILISTIC BASIS FOR DESCRIBING THE RADIATION INTENSITIES OF FALLOUT, by Robert R. Read and Ronald W. Shepherd. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 7 Apr 59, 55p. 16 refs. Series no. 2, issue no. 20.
Order from LC mi$3.60, ph$9.30 PB 149 927

The report contains the application of statistical regression techniques to the problem of finding minimum variance linear estimators for positions of deposited fallout particles given some meteorological information in the form of hodographs. It is indicated how these methods can be integrated with stabilized cloud models to obtain probabilistic fallout models. The mathematical problems that arise when converting particle position estimators into radiation intensity estimators are exhibited for purposes of presenting the meanings of certain simplifying assumptions that are often made. Methods for calculating variances and covariances of radiation intensity residuals from the estimated values are presented. A formula for the joint probability density function of distances of deposited cloud slice centers from a particular point is derived, under the assumption that wind velocities form a Gaussian process. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A PROGRAM FOR COMPUTING RADIATION FLUX FROM A UNIFORM FIELD, by H. L. Dachslager. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 5p. Series no. 2, issue no. 4.
Order from LC mi$1.80, ph$1.80 PB 149 914

A program is described which computes the radiation flux from an infinite uniform plane contaminated outside a circle. A number of cases can be handled simultaneously. (Author)

Institute of Engineering Research, U. of California, Berkeley.
THE SAMPLE SURVEY OF SHELTER AREAS, by D. W. Barker and D. J. Sundblom. Progress rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 41p. 12 refs. Series no. 2, issue no. 15.
Order from LC mi$3.30, ph$7.80 PB 149 925

A pilot study for the proposed sample survey has been completed. Before the survey is completed it will be necessary to obtain engineering approximations to structural characteristics and to revise the statistical design. An appendix discusses the statistical problem in detail. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A SIMPLIFIED TIME-DEPENDENT GAMMA-RAY SPECTRUM FOR FALLOUT, by D. J. Doughty and D. C. Kleinecke. Rept. on Civil Defense Research Project, Contract CR-SR-58-40. 15 Aug 59, 26p. 7 refs. Series no. 2, issue no. 26.
Order from LC mi$2.70, ph$4.80 PB 149 931

The gamma radiation emitted by fallout is a mixture of hundreds of different photon energies whose relative importance changes through time. It is desirable to approximate this spectrum by a simpler spectrum involving fewer photon energies. A simplified spectrum with four photon energies, which closely approximates more detailed spectra, is proposed and illustrated. (Author)

Institute of Engineering Research, U. of California, Berkeley.
STABLE CLOUD MODELS FOR FALLOUT PREDICTION, by M. L. Katz and D. C. Kleinecke. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 15 Feb 59, 20p. 8 refs. Series no. 2, issue no. 18.
Order from LC mi$2.40, ph$3.30 PB 149 926

This report presents the most general formulation of stable cloud models. It is shown how to specialize this general formulation to obtain a version of the cloud which can be used in studying actual events. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A STATISTICAL APPROACH TO A SURVEY OF FALLOUT SHELTER AREAS IN CONTRA COSTA COUNTY, by D. J. Sundblom. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 9p. Series no. 2, issue no. 5.
Order from LC mi$1.80, ph$1.80 PB 149 915

A possible sampling survey of shelter areas in Contra Costa County is described. The same methods might be used to check the proposed OCDM survey. (Author)

Institute of Engineering Research, U. of California, Berkeley.
SUMMARY OF PROBLEMS RELATING TO LOCAL FALLOUT CONTAMINATION OF WATER SUPPLIES, by M. B. Hawkins. Progress rept. on Civil Defense Research Project, Contract CD-SR-58-40. 24 Feb 59, 73p. 67 refs. Series no. 2, issue no. 14.
Order from LC mi$4.50, ph$12.30 PB 149 924

Institute of Engineering Research, U. of California, Berkeley.
VERTICAL AIR FLOW AND FALLOUT, by Arnold Court. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 1 June 60, 13p. 17 refs. Series no. 2, issue no. 29.
Order from LC mi$2.40, ph$3.30 PB 149 933

Techniques for the prediction of radiological fallout patterns usually ignore the effects of the vertical component of winds. The purpose of this study is to determine the magnitude of such vertical motions and estimate the consequences of neglecting them in civil defense problems. Using data computed daily by the Joint Numerical Weather Prediction Unit of the National Meteorological Center, this study has determined that the monthly average of the vertical air movement at 600 mb (in the middle of the troposphere) is about 0.5 cm/sec over continental areas of the Northern Hemisphere; the standard deviation is roughly the same magnitude. Averages computed separately for the 00 and 12 GMT observations show good agreement in the various months, and change slowly from month to month during the six months, December 1958 through May 1959, that are analyzed. The analysis tends to support the assumption that average vertical wind motions as described by the available data may be neglected for civil defense purposes. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
THE CONDENSATION OF RUBIDIUM VAPOR ONTO HOT OXIDE SURFACES, by C. E. Adams. 7 Aug 59, 31p. 26 refs. Research and development technical rept. USNRDL-TR-355; AD-226 430.
Order from LC mi$3.00, ph$6.30 PB 150 303

By use of an atomic beam technique, an investigation was made of the condensability of vaporized rubidium in a slightly oxidizing atmosphere upon the surfaces of different oxides at varying temperatures. It was found that rubidium vapor was effectively condensed at high temperatures upon oxides with which rubidium oxide could form thermally stable complex compounds. Rubidium vapor was not condensed at high temperatures upon oxides with which rubidium oxide does not form stable complex compounds. A method of predicting the relative tendency for rubidium oxide to form complexes with a series of different oxides was devised. (Author).

Naval Radiological Defense Lab., San Francisco, Calif.
DIATOMITE FILTER, TEST TO DETERMINE FEASIBILITY OF USE IN REMOVING Y^{91} FROM FRESH WATER, by M. M. Bigger and A. J. Hodges, Jr.. Memo. rept. 17 Aug 50, declassified 10p. AD-229(OE).
Order from LC mi$1.80, ph$1.80 PB 149 982

The test indicates that flocculation may be expected to remove Y^{91} or similar fission products from fresh water with a factor of approximately 100. Diatomite filtration was less effective, with a factor of approximately 8. The flocculation results are in agreement with small-scale laboratory tests.

Naval Research Lab., Washington, D. C.
ATMOSPHERIC RADIOACTIVITY IN SOUTH AMERICA AND ANTARCTICA, by L. B. Lockhart, Jr. 15 Aug 60, 10p. 8 refs. NRL rept. 5526.
Order from LC mi$1.80, ph$1.80 PB 148 664

Information on the concentration of the major natural radioactive species and of gross fission product β activity in the ground-level air at several sites in South America and Antarctica is reported. These data have been obtained through a cooperative program between the U. S. Naval Research Laboratory and groups at the various collecting sites utilizing equipment designed and supplied by NRL. Fission products have been found to be a minor contributor to the radioactivity of the air in the Southern Hemisphere except that in the antarctic region (and presumably at some island sites) it assumes relatively more importance because of the low concentrations of natural activity there. Seasonal variations in one or more of the radioactive components of the atmosphere are evident at each of the various sites. (Author)

Naval Research Lab., Washington, D. C.
FISSION PRODUCT RADIOACTIVITY IN THE AIR ALONG THE 80th MERIDIAN (WEST) DURING 1959, by L. B. Lockhart, Jr., R. L. Patterson, Jr. and others. 15 Aug 60, 19p. 11 refs. NRL rept. 5528.
Order from LC mi$2.40, ph$3.30 PB 148 665

The program of measurement of the fission product concentration in the air at ground level at sites along the 80th meridian was continued during 1959. During this period no fresh nuclear debris was added to the atmosphere, with the result that seasonal changes in deposition rates from stratospheric sources were more apparent. The radioactivity levels in the Northern Hemisphere reached the highest average during the operation of this network (started May 1956) in the spring of 1959. Radiochemical analyses indicated that the bulk of this debris was introduced into the stratosphere during the October 1958 series of high-yield nuclear tests held in the arctic region of the Soviet Union. There has been obtained evidence of a definite seasonal dependence for

stratospheric deposition with debris in the arctic stratosphere being more strongly influenced than that in the tropic stratosphere. No such definite conclusions can be made from radioactivity collected in the Southern Hemisphere. Evidence indicates that mixing of the stratospheric sources in the Northern Hemisphere was not complete by the end of 1959; and though radioactivity levels in the two hemispheres were approaching unity during the fall of 1959, the isotopic composition of the collections indicated the average age of the debris in the Southern Hemisphere to be much greater. (Author)

North Carolina State Coll., Raleigh.
THEORETICAL EVALUATION OF THE VARIANCE FOR THE STATISTICAL CORRELATION METHOD FOR MEASURING DAUGHTER HALF-LIVES IN THE 10^{-4} - 10^{-1} SECOND RANGE, PART I, by Robert P. Kennel (Master's thesis) Wesley O. Doggett, and Linus K. Han. Technical rept. no. 2 on Contract DA 01-009-ORD-820. July 60, 75p. 8 refs. OOR rept. no. 2543.2-P.
Order from LC mi$4.50, ph$12.30 PB 150 401

A time correlation method proposed by Petroff and Doggett ("Application of a statistical correlation function for determining daughter half-lives in the range 10^{-1} - 10^{-4} second." Rev. Sci. Instr., Vol. 27, No. 10, 838, October, 1956.) for investigating two connected nuclear disintegrations was studied. The method permits determination of half-lives in the 10^{-4} - 10^{-1} second range for daughters in equilibrium with long lived parents without the count rate restrictions imposed on the usual delayed coincidence method by the occurrence of accidental coincidences. The variance and fractional standard deviation of the correlation measurement are theoretically evaluated for a radioactive source cascade with negligible background and constant source strength, and the variance is determined for background activity with no cascade present. (Author)

Space Tech. Labs., Inc., Los Angeles, Calif.
EFFECTS OF NUCLEAR RADIATION ON SOME COMMON MATERIALS AND ELECTRONICS COMPONENTS, by Newell Hart Smith. 4 Feb 58, 27p. 18 refs. Rept. GM-TR-0165-00358.
Order from LC mi$2.70, ph$4.80 PB 148 960

This report has been written to provide guidance for those doing preliminary design of equipment to be exposed to nuclear radiation. It is based upon a review of many of the documents from the extensive literature on radiation damage, and presents information from the literature concerning radiation damage to a few common materials and to typical electronic equipment. In addition, an example illustrating the way in which this information may be useful for space vehicle design is also given.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aerospace Medical Div., Wright Air Development Div., Wright-Patterson AFB, Ohio.
EFFECTIVE DEAD SPACE IN THE MA-3 HELMET, by Elizabeth Comfort. Rept. on Pressure Suits and Accessories. May 60, 8p. 3 refs. WADD Technical rept. 60-362.
Order from OTS $0.50 PB 171 018

The respiratory response of a group of subjects wearing the MA-3 full-head helmet was compared with the response to known dead space volumes. Comparison of these data showed that the average effective dead space or volume of rebreathed air was approximately 235 cc. when the MA-3 helmet was supplied with oxygen at 3 to 4 inches of water positive pressure from a standard pressure suit regulator. The concentration of inspired CO_2 was calculated to be 0.8 percent. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
VENTILATION OF INSULATED BOOTS, by A. H. Woodcock and R. L. Pratt. June 60, 10p.. 1 ref. Technical rept. EP-135.
Order from LC mi$1.80, ph$1.80 PB 150 119

An investigation has been made of the quantity of air which must be pumped into the insulated boot to evaporate the sweat secreted by the foot in a warm environment. At an ambient temperature of 80°F an unventilated boot accumulated approximately 44 gm of sweat in 2 hours. In a ventilated boot, ventilation rates as high as 20 liters per minute failed to evaporate this moisture and left an accumulation of at least 10 gm of sweat within the boot. Complete change of air within the boot at each step at normal walking rate would produce a ventilation rate of considerably less than 20 liters per minute. At a lower ambient temperature (67°F) sweat secretion was somewhat less, but the cooler ambient air which was supplied was less efficient in removing moisture, so that the net accumulation was almost the same as at the higher temperature. (Author)

PHYSICS

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
CURRENT INDUCED SWITCHING OF SUPERCONDUCTIVE THIN FILMS, by Frederick W. Schmidlin and Arthur J. Learn. Eugene C. Crittenden, Jr. and John N. Cooper (Naval Postgraduate School). 15 June 60, 30p. 4 refs. STL/TR-60-0000-NR165.
Order from LC mi$2.40, ph$3.30 PB 150 042

Currents required to cause superconducting to normal transitions of thin films have been measured as a function of temperature for various widths and thicknesses. Normal to superconducting transition times for the same films have also been measured as a function of the magnitude of drive current. In spite of the lack of a satisfactory theoretical model for the initiation of the transition, the bulk of the results can

be understood in terms of temperature changes in the film, as governed by factors limiting the flow of heat (generated subsequent to the initial transition) into the substrate and liquid helium bath. (Author)

Acoustics

Anti-Submarine Warfare Lab., Naval Air Development Center, Johnsville, Pa.
INSTRUMENTATION AND TECHNIQUES FOR AIRCRAFT USE IN ACOUSTIC RESEARCH AND IN OCEANOGRAPHIC SURVEYS, by J. J. Coop. Technical note. 28 July 59, 19p. Rept. no. NADC-AW-N5914.
Order from LC mi$2.40, ph$3.30 PB 149 158

Since 70 percent of the earth's surface is covered with water, neither the sonar conditions nor their variations with time are known in most areas of the world. The seasonal trend is known in many areas, but because of meteorological factors and ocean currents prediction of the sonar conditions for a given day are often inaccurate. It is proposed that by use of aircraft the acoustic condition over large areas, commensurate with meteorological factors such as storms, should and could be measured before, during, and after the passage of such storms to correlate cause and effect.

Princeton U., N. J.
EFFECT OF TRANSPORT PROCESSES ON ATTENUATION AND DISPERSION IN AEROSOLS, by S. L. Soo. Rept. on Project Squid, Contract Nonr-1858(25). Oct 59, 15p. 8 refs. Technical rept. PR-100-P; AD-229 222.
Order from LC mi$2.40, ph$3.30 PB 149 494

Rome Air Development Center, Griffiss, AFB, N. Y.
THE EFFECTS OF INTERFERENCE ON SPEECH COMMUNICATION, by George E. Renaud. June 60, 19p. 14 refs. RADC-TN-60-104.
Order from LC mi$2.40, ph$3.30 PB 149 973

This report was written in an attempt to tie together many of the data which pertain to the ability of the operator to derive intelligence from a speech signal when this signal has been altered by processes which occur or could occur in a communication link. No attempt has been made to present a complete summary of all the data in existence in this area. The accent has been on the auditory response of the operator. There were two major purposes in writing this report. The first was to indicate that it is not necessary to build a hi-fi system when the purpose is to transmit information by means of voice. The second is to indicate the lower limits of system performance which can be tolerated and still operate with some degree of efficiency. In other words, the design and subsequent successful operation of any voice communication system can be made easier when the operator is considered as a functional operating link (subsystem) in the system. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
THE EFFECT OF SPEECH AND NOISE LEVEL ON THE MASKING OF SPEECH BY PURE TONES AND RANDOM NOISE, by R. J. Christman, George E. Renaud, and Arthur Rubin. June 60, 24p. 7 refs. RADC TN-60-97.
Order from LC mi$2.70, ph$4.80 PB 149 972

This report describes an experiment on the masking of speech with random noise and pure tones. Harvard PB-50 word lists were used as test material, with masking signals of 100, 175, 250, 350, 500, 700, and 1000 cycles per second and random noise. Speech levels at the ear, ranging from 45 to 115 db and noise from 75 to 120 db (all re 0.0002 dynes/cm^2), were used. Data are presented in the form of curves, illustrating the relationship among the parameters: speech level, interference level, and frequency of interference (for the pure tone masking). It is shown, in general, that masking with random noise is some 30 db superior to masking with pure tones. It is further shown that for low levels of intelligibility pure tone masking is greatest with tones in the 400 to 600 cps range. For intelligibility levels of 85 percent or greater, masking efficiency increases with frequency of the masking tone, at least up to 1000 cps, the highest frequency used in the experiment. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
COMPUTATION OF ACOUSTIC TRANSMISSION THROUGH A PLANE ELASTIC PLATE, by G. B. Thurston and Raya Stern. Rept. on Contract Nonr-1224(24). Oct 59, 24p. 9 refs. 2784-3-T; AD-227 906.
Order from LC mi$2.70, ph$4.80 PB 149 939

Results are presented of a series of computations of the magnitude and phase of the pressure transmitted by a plane wave through a plane plate. The plate is assumed to possess perfect elasticity and to be immersed in a perfect fluid. The procedure for carrying out transmission computations with the equations of H. Reissner is specified. Computations according to the approximate equation of L. Cremer are compared with those of Reissner. Computed results for plates of steel, Lucite, and polyethylene immersed in sea water are presented. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
A METHOD OF DETERMINATION OF THE RADIATED ACOUSTIC FIELD OF A SOURCE TRANSMITTING THROUGH A FINITE PLATE, by George B. Thurston. Rept. on Contract Nonr-1224(24). Oct 59, 33p. 23 refs. 2784-4-T; AD-227 907.
Order from LC mi$3.00, ph$6.30 PB 149 940

A method is given for the determination of the radiated acoustic field of a course transmitting through a finite plate. The method is based on the use of the Helmholtz formula together with appropriate assumptions concerning the part played by a transmitting plate in modifying the transmitted wave. The method involves the use of information on plane-wave transmission properties of infinite plane plates. The procedure is specifically set up for use of high-speed computing equipment in carrying out computations of the radiated field. A numerical example is given of the determination of the acoustic field of a modified spherical source transmitted through a plane circular steel plate immersed in sea water. (Author)

Electricity and Magnetism

Carnegie Inst. of Tech., Pittsburgh, Pa.
THE MAGNETIC SUSCEPTIBILITIES OF SINGLE CRYSTAL $NiCl_2 \cdot 6H_2O$ AND $CoCl_2 \cdot 6H_2O$ AT LOW TEMPERATURES, by R. B. Flippen and S. A. Friedberg. Technical rept. no. 6 on Contract Nonr-760(05). 29 Oct 59, 9p. 6 refs. AD-228 108.
Order from LC mi$1.80, ph$1.80 PB 149 867

The magnetic susceptibilities of single crystal $NiCl_2 \cdot 6H_2O$ and $CoCl_2 \cdot 6H_2O$ were measured down to 1.3°K for various orientations. The occurrence of antiferromagnetism in $CoCl_2 \cdot 6H_2O$ below ~2.3°K is confirmed as is the anisotropy of the g-factor of the Co^{++} ion over the whole range. It is concluded that $NiCl_2 \cdot 6H_2O$ is antiferromagnetic in the helium region and that the temperature-independence of the powder susceptibility here is due to the fact that $\chi_\perp$ rises as T falls below T_N. In both salts the c-axis is apparently the preferred direction of spin alignment in the antiferromagnetic state. (Author)

Geophysical Inst., U. of Alaska, College.
EARTH CURRENT ACTIVITY AT COLLEGE, ALASKA, JULY 1959, by V. P. Hessler. Scientific rept. no. 4 on Contract AF 19(604)3075. 15 June 60, 42p. 11 refs. UAG-R110; AFCRC-TN-60-481.
Order from LC mi$3.30, ph$7.80 PB 149 758

This report presents College N-S earth current records for the month of July 1959. The scale of 1 inch per hour permits detailed scaling directly from the reproductions in the report. Scalings of hourly range in amplitude and rapid fluctuation activity are given. The amplitude scalings are also presented as curves together with average curves for a period of several years to show the relative magnitudes of the July 1959 activity. The earth current always displays much more pronounced fine structure than the corresponding geomagnetic activity. (Author) (See also PB 147 513)

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
FIELD DISPLACEMENT EFFECTS IN DIELECTRIC AND FERRITE LOADED WAVEGUIDES, by T. M. Straus. Doctoral thesis. Technical rept. no. 1, Series 2, on Contract AF 19(604)5487. 25 sep 59, 98p. 35 refs. AFCRC-TN-60-582.
Order from LC mi$5.40, ph$15.30 PB 149 787

The only available calculations concerning propagation in ferrite slab loaded waveguides are those of Lax, Button and Roth which are limited to transverse electric type modes. Due to its imcompleteness the theory leads to certain anomalies which have been the subject of considerable discussion in recent years. It is the purpose of the work herein reported to solve the anomalies dealing with one-way transmission and with the field displacement isolator. This is done largely through experiments which indicate the extent to which the theory is able to predict the actual mode configurations.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
A SPIN WAVE ANALYSIS OF FERROMAGNETIC RESONANCE RELAXATION, by Charles R. Buffler. Scientific rept. no. 3, Series 2, on Contract AF 19(604)5487. 25 Feb 60, 161p. 161 refs. AFCRC-TN-60-589.
Order from LC mi$7.80, ph$25.80 PB 149 788

The work reported is primarily an investigation of the mechanisms involved in ferromagnetic resonance line width processes in both single crystal and polycrystalline materials. Experimental work has been performed to indicate how the line width is related to the recent theories of ferromagnetic resonance. These experiments have primarily taken the form of line width and g value versus frequency studies. By investigating the behavior of these spectrums, the validity of the various theoretical explanations are indicated.

Institute for Advanced Study, Princeton, N. J.
COMBINATORIAL ASPECTS OF THE ISING MODEL FOR FERROMAGNETISM. I. A CONJECTURE OF FEYNMAN ON PATHS AND GRAPHS, by S. Sherman. Rept. on Contract Nonr-2969(00). Oct 59, 48p. 16 refs.
Order from LC mi$3.30, ph$7.80 PB 149 478

In this paper Feynman's conjectured identity between a function of weighted paths and the desired function of admissible subgraphs is generalized to any reasonable planar graph and shown to be correct.

Materials Research Lab., Watertown Arsenal, Mass.
ANALYSIS OF FERROMAGNETIC AND ANTIFERROMAGNETIC SECOND ORDER TRANSITIONS (ERRATA), by J. A. Hofmann, A. Paskin and others. June 60, 3p. 1 ref. MRL rept. no. 76.
Order from LC mi$1.80, ph$1.80 PB 148 408

Naval Ordnance Lab., White Oak, Md.
NEW FLUX-GATE MAGNETOMETERS FOR USE WITH SINGLE STRIP PERMEAMETERS, by C. Q. Adams. 21 Mar 60, 27p. 3 refs. NAVORD rept. 6835; AD-239 498.
Order from LC mi$2.70, ph$4.80 PB 149 226

Two new sensitive flux-gate magnetometers of the second harmonic type have been developed for use as H-measuring systems of a d-c single-strip permeameter. Both are employed with a simple bridge circuit which eliminates the necessity of complex filters and selective amplifiers and allows operation over a wide range of frequencies independent of source frequency stability. The first magnetometer is an open-magnetic-circuit type of two Supermalloy cores. The second magnetometer is a closed-magnetic-circuit type which does not influence the field being measured. The magnetometers were designed to measure fields from 1 milli-oersted to about 10 oersteds, although these are not physical limits of sensitivity. (Author)

Electronics

Office of Technical Services, Dept. of Commerce, Washington, D. C.
MAGNETOSTRICTION. Aug 60, 6p. 59 refs. OTS Selective Bibliography SB-427.
Order from OTS $0.10 OTS SB-427

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. This bibliography covers reports added to the OTS collection during the period 1946 to September 1960.

Ohio State U. Research Foundation, Columbus.
THERMOMETERS FOR THE TEMPERATURE RANGE 0.1°K TO 20°K, by J. G. Daunt. Final rept. for 1 Sep 56-31 Aug 59 on Contract Nonr-495(13). 21 Oct 59, 16p. 22 refs. Rept. 712; AD-228 661.
Order from LC mi$2.40, ph$5.30 PB 149 504

An experimental investigation was made of the synthetic ruby as the working substance for a magnetic thermometer. An experimental study was conducted at low temperatures of some magnetic properties of a number of other gems and aluminas. The Cr ions in the synthetic ruby showed a paramagnetic behavior in the liquid He temperature region. The data obtained indicated the following advantages: (1) complete coverage of the entire range 0.1°K to 20°K, (2) extreme stability and reproducibility of the working thermometric substance, (3) ease of thermal contact with other materials, since ruby can be readily metallized, (4) good sensitivity, as ruby has a relatively high Curie constant, (5) high precision since the susceptibility can be accurately measured by ac bridges, (6) short time constant, since the material has a very small specific heat, (7) excellent temperature homogeneity throughout the thermometric specimen, and (8) cheapness and availability of the material.

Stanford Research Inst. [Menlo Park] Calif.
RADIO INTERFERENCE FROM CORONA DISCHARGES, by R. L. Tanner. Technical rept. no. 37 on Contract AF 19(604)266. Apr 53, 122p. 32 refs. SRI Proj. 591; AD-12 600.
Order from LC mi$6.30, ph$19.80 PB 149 057

Corona-discharge studies are described that were devoted specifically to the mechanisms by which electromagnetic disturbances are produced that cause interference with radio reception. The means by which these disturbances are coupled into a receiver are treated as well as the nature of the dependence of this coupling upon the geometrical configuration of the body on which the discharge occurs. A fundamental coupling theorem of considerable generality is developed which is based directly on Maxwell's field equations. The theorem can be applied in studying the noise signals coupled into the receiver from a discharge occurring at some remote corner of an aircraft; in addition, it is applicable to the converse situation: the dipole moment of the discharge can be inferred from the current pulse measured at the base of a discharge point and from certain supplemental electric-field investigations for the discharge electrode system.

Air Force Cambridge Research Center, Bedford, Mass.
APPROXIMATE VALUES OF THE RADIATION HARMONICS FROM RELATIVISTIC CHARGES IN UNIFORM CIRCULAR MOTION, by E. A. Lewis. Jan 60, 51p. 9 refs. AFCRC-TR-60-113; AD-234 554.
Order from LC mi$3.60, ph$9.30 PB 148 248

Graphs and tables are given of approximate numerical values of the known expressions for the harmonic components in the radiation fields of a relativistic charge in uniform circular motion. These expressions contain Bessel functions of large order and large argument, evaluated by means of asymptotic and special interpolation formulas. (Author)

Air Force [Cambridge Research Center] Bedford, Mass.
ELECTRONIC MATERIAL SCIENCES LABORATORY. Semiannual status rept. no. 3, 1 June 60, 172p. 20 refs. AFCRC-TR-60-150.
Order from LC mi$8.10, ph$27.30 PB 150 162

This status report provides brief summaries of the Laboratory and Branch programs, research reports concerning work currently in progress, and summaries of contract activities. Details concerning missions to be performed, personnel assignments, publications, roster of contracts, and ARDC project structure are provided in appendices. (See also PB 146 349)

Antenna Lab., Ohio U. Research Foundation, Columbus.
THE BANDWIDTH OF LONG, UNIFORM ARRAYS OF PARASITIC DIPOLES, by Francesco Serracchioli. Rept. on Contract DA 36-039-sc-70174. 30 June 59, 38p. 8 refs. Rept. 662-33.
Order from LC mi$3.00, ph$6.30 PB 146 455

The introduction of surface waves in the study of end-fire arrays has led to the result that an infinity of array configurations, for a given over-all length, are equivalent with respect to far-field radiation at a given frequency. In this report a study is carried out on the behavior of end-fire arrays with respect to frequency variations about the design frequency. It is then shown that the aforementioned equivalence in general holds no longer if the frequency is varied about the design frequency. A definition of bandwidth is given for a uniform end-fire array, and accordingly a number of figures are calculated for different uniform dipole arrays. It is also shown that the condition of optimum directivity is a slowly varying function of the array length, so that is does not become a critical one to realize, even when the array is very long. (Author).

Armour Research Foundation, Chicago, Ill.
ELECTRON EMISSION PROCESSES BIBLIOGRAPHY, by Robert G. Pohl, and Martha Williams. Scientific rept. no. 1 on Super Power Cathode Study. Contract AF 30(602)2043. May 60, 341p. 3255 refs. ARF 1146-4; RADC TR-60-115; AD-238 963.
Order from LC mi$11.10, ph$53.10 PB 149 303

A comprehensive search of the literature relating to electron emission processes for the years 1947 to 1960 is contained in this report. Abstracts of the references are generally given, and complete cross-filing of a given reference into all pertinent subject categories has been maintained. The punched card coding system used in compiling the search is described. A convenient graph paper and an auxiliary scale for a slide rule, which are useful for determining effective work functions, are given and discussed in this report. (Author)

Armour Research Foundation, Chicago, Ill.
SUPER POWER CATHODE STUDY, by Robert G. Pohl. Final rept. no. 1, phase no. 1, for 1 June 59-30 June 60, on Contract AF 30(602)2043. 30 June 60, 71p. 45 refs. ARF-1146-5.
Order from LC mi$4.50, ph$12.30 PB 149 761

Barium nickelate, $BaNiO_2$, has been selected for study as a high power cathode material because of its low work function, 1.7 ev, and low evaporation rate. The effect of cathode processing changes on the thermionic emission, and on the surface and bulk crystal structure are reported herein. The available literature on nickelate cathodes is contained as reprints. (Author)

California U., Los Angeles.
EXTENSIONS IN SYNTHESIS TECHNIQUES FOR LINEAR SYSTEMS. PART I, by M. D. Schwartz and C. T. Leondes. Rept. on Contract AF 49(638)438. May 60, 60p. Dept. of Engineering rept. no. 60-38; AFOSR-TN-60-610.
Order from LC mi$3.60, ph$9.30 PB 150 253

Synthesis techniques for linear control systems with deterministic inputs have been based in main, thus far, on such highly idealized inputs as steps or ramps and such criteria as overshoot, rise time, and settling time. It would be desirable if analytical synthesis techniques were to be available for inputs which are arbitrary polynomial functions of time and for extended design criteria such as guarantying that the absolute value of system error is less than a specified required amount. This report presents such synthesis techniques, and in the process, establishes methods for guarantying that the minimum size power actuator is selected in the synthesis procedure. An additional consideration introduced in the synthesis techniques presented is the minimization of the complexity of the required compensation networks.

California U., Los Angeles.
EXTENSIONS IN SYNTHESIS TECHNIQUES FOR LINEAR SYSTEMS. PART II, by M. D. Schwartz. Rept. on Contract AF 49(638)438. May 60, 39p. 3 refs. Dept. of Engineering rept. no. 60-39; AFOSR-TN-60-609.
Order from LC mi$3.00, ph$6.30 PB 150 254

This report presents extensions in synthesis techniques for linear control systems for more general inputs and more general error criteria than were heretofore available in the control literature. (Author) (See also PB 150 253)

California U., Los Angeles.
ON THE SYNTHESIS OF OPTIMUM MULTIPOLE FILTERS, by Edwin B. Stear. Rept. on Contract AF 49(638)438. May 60, 10p. 7 refs. Dept. of Engineering rept. no. 60-27; AFOSR-TN-60-617.
Order from LC mi$1.80, ph$1.80 PB 150 250

Most of the developments in control systems theory in the past have been based on the one input-one output control system problem. However, in a great number of modern complex control system's problems, it is essential to approach the system design as a multipole or "n" input-"m" output design problem. For example, the optimal design of guidance and control systems for aerospace vehicles must be approached in this manner. Numerous results of basic importance to the design of such systems have been developed. This report presents some of the results obtained in the overall program.

California U., Los Angeles.
ON THE THEORY OF PROCESS ADAPTIVE CONTROL SYSTEMS, THE LEARNING MODEL APPROACH, by M. Margolis. Doctoral thesis. Rept. on Contract AF 49(638)438. May 60, 161p, 31 refs. Dept. of Engineering rept. no. 60-32; AFOSR-TN-60-618.
Order from LC mi$7.80, ph$25.80 PB 150 252

This dissertation attempts to extend the theory of feedback control to those systems that operate in a widely changing environment. The particular method devised for determining the dynamic characteristics of the process makes use of a model, referred to as the learning model, and a mechanism for adjusting the parameters of the learning model. The model is an analog of the process but with undetermined parameters. Both the model and the process are subjected to the same actuator signals. The response of the model is compared to the response of the process and the resulting error is used to activate the adjusting mechanism. It is the function of the adjusting mechanism to so set the parameters of the model that the model will behave as much like the process as possible. The particular method for adjusting the parameters of the learning model is based on an approximation to the method of steepest descent. The equations describing the operation of the adjusting mechanism are derived and result in a nonlinear nonautonomous system. The stability and dynamic response of the learning mechanism are examined by both analytic methods and computer experiments. The learning mechanism was found capable of tracking the parameters describing the process for a wide variety of actuating signals. (Author).

Electronics Research Lab., U. of California, Berkeley.
A STUDY OF THE HALL EFFECT IN GASEOUS CONDUCTORS, by B. N. Edwards. Scientific rept. no. 6 on Contract AF 19(604)2270. 30 Sep 59, 161p. 29 refs. Series no. 60; issue no. 253; AFCRC-TN-59-783.
Order from LC mi$7.80, ph$25.80 PB 149 559

An expression is derived for the dc Hall voltage across the positive column of a glow discharge tube. Experimental results are reported with a tube containing neon. Depending on the pressure and the current, these results show that the Hall voltage in different regions of the tube has opposite polarities; for example, the gaseous conductor may be p-type toward the cathode and n-type toward the anode. The use of the Hall effect in a gaseous conductor as a magnetometer is discussed. The conclusion is reached that such a device could have advantageous results in certain circumstances. The dc component of the Hall voltage at high frequency (without an external magnetic field) is derived by using both the radiation pressure concept and Lorentz's force equation, yielding identical results. Specific limitations on the applicability of the expression are deduced. The expression differs from that which appears in the literature. The result is interpreted to various situations of interest, viz., a plasma, a solid semiconductor, and a dielectric, for which numerical examples are given. The high-frequency conductivity of a gaseous conductor, including the effect of the high-frequency magnetic field, is calculated using Boltzmann's transport equation. Experimental attempts to measure the Hall voltage at high frequency in a plasma are described, and some experimental results are given. (Author)

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, by J. H. Affleck. Scientific rept. no. 8 on Contract AF 19(604)4093. 6 June 60, 20p. 9 refs. AFCRC-TN-60-576; AD-239 219.
Order from LC mi$2.40, ph$3.30 PB 148 926

(See also PB 145 364)

Institute of Mathematical Sciences, New York U., N. Y.
A NOTE ON THE LOCAL STRUCTURE OF SHOT NOISE, by R. A. Silverman. Rept. on Contract AF 19(604)5238. May 60, 11p. 4 refs. Research rept. no. EM-160; AFCRC-TN-60-396.
Order from LC mi$2.30, ph$3.30 PB 150 056

By appropriately choosing the pulse shape and the shot density, shot noise is constructed which, like the turbulent velocity field, is accurately univariate normal, but has a markedly non-normal bivariate distribution at close ranges. Both the one-dimensional and three-dimensional cases are discussed. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
SURFACE WAVES ON A REACTIVE HALF PLANE, by Julius Kane. Rept. on Contract AF 19(604)5238. May 60, 31p. 4 refs. Research rept. no. EM-159; AFCRC-TN-60-554.
Order from LC mi$3.00, ph$6.30 PB 150 057

The following two-dimensional problem is considered: An arbitrary antenna is located at the origin which launches surface waves on a reactive half-plane $y = 0$, $x < 0$. It is assumed that the other half-plane, $y = 0$, $x > 0$ is occupied by a perfect conductor. The antenna is approximated by a distribution of multipoles easily found from the antenna's radiation pattern. With this approximation, simple algebraic expressions are obtained for the ratio of the power delivered to the surface waves as compared to the power in the radiated cylindrical field. (Author)

Stanford Electronics Labs., Stanford U., Calif.
THE D-C PUMPED QUADRUPOLE AMPLIFIER: A WAVE ANALYSIS, by A. E. Siegman. Rept. on Contract DA 36-039-sc-73178. 2 Mar 60, 13p. 5 refs. Technical rept. no. 159-1; AD-237 238.
Order from LC mi$2.40, ph$3.30 PB 147 751

The 'Larmatron' is a quasi-parametric electron-beam amplifier recently announced by Gordon and others. It uses the same transverse beam waves as the Adler-Wade quadrupole amplifier, but the pumping is done by d-c voltages applied via a twisted quadrupole structure. This paper analyzes the d-c pumped case in terms of the four transverse beam waves and their coupling. Amplification is found to be the result of coupling between the fast and slow cyclotron waves. The pump voltage does not really pump, i.e., it does not supply any energy. Another d-c pumping scheme is also examined and found not to give amplification. (Author)

Tufts U., Medford, Mass.
ON SOLUTIONS OF THE HEAT EQUATION, James A. Clarkson and Dawson G. Fulton. Scientific rept. no. 2 on Contract AF 19(604)1578. 21 July 59, 29p. AFCRC-TN-59-449; AD-235 068
Order from LC mi$2.70, ph$4.80 PB 147 877

Let $H(f;x,t)$ be the temperature, at point x and time t, in a semi-infinite rod, initially at temperature zero, whose free end is maintained at temperature given by the function f(t). The solution given by

$$H(f;x,t) = \frac{x}{2\sqrt{\pi}} \int_0^t s^{-3/2}\, e^{-x^2/4s}\, f(t-s)\,ds$$

is considered. For many simple functions f(t) it is true that

$$I(f;x,T) = \int_0^T (H_x^2 - HH_{xx})\,dt \geq 0 \text{ for all } x, T>0.$$

It is shown that $I(f;x,T)$ can be negative for certain values of x and T, even for comparatively uncomplicated drive functions f(t).

Molecular Physics and Spectroscopy

Aerojet-General Corp., Azusa, Calif.
THE DEVELOPMENT OF A MASS SPECTROMETER FOR ION STUDIES, by R. J. Sunderland and J. R. Radbill. Rept. on Contract AF 49(638)214. June 60, 24p. 2 refs. Aerojet rept. TN-35; AFOSR-TN-60-702; AD-240 229.
Order from LC mi$2.70, ph$4.80 PB 149 561

Mechanisms for the production of positive ions on metallic and nonmetallic surfaces are being investigated. In order to determine the mass spectrum of the emission from a particular source, a magnetic-sector-field mass spectrometer has been constructed. This instrument is a first-order-focusing type, having a 60°-sector magnetic field in which the ion trajectories have a 5-in. radius of curvature. The spectrometer is constructed entirely of metal, with the central portion of the tube forming the pole faces of the magnet, which has high-impedance windings. The magnet-current power supply, regulated to 1 part in 10^4, is capable of generating fields greater than 16,000 gauss in the focusing region. The precision accelerating voltage is also regulated to 1 part in 10^4 up to 15 kv at 10 ma. The system is evacuated by a 6-in. oil-diffusion pump which is well trapped with liquid nitrogen; pressures throughout the system are of the order of 10^{-6} mm Hg.

Battelle-Institut E. V., Frankfurt-am-Main (West Germany).
DEVELOPMENT OF AN ANALYTICAL METHOD FOR EMISSION-SPECTROGRAPHIC DETERMINATION OF ALKALI WITHOUT CLASSICAL CHEMICAL METHODS OF PREVIOUS FUSION OR DISSOLVING. Final rept. for 1 Dec 59-15 May 60 on Contract DA 91-591-EUC-1346. [1960] 23p.
Order from LC mi$2.70, ph$4.80 PB 149 430

Two methods are described for the rapid spectrographic analysis of alkali in a variety of test materials. If the Na 3302 and K 4044 spectral lines are used for analysis, standard spectrographic equipment with ultra-violet sensitive film can be used. The precision of this method permits quantitative analyses to as low as 0.1 per cent Na_2O. If the Na 5890 and K 7655 lines are used, even smaller alkali concentrations can be determined and the preparation of the samples is easier because the analytical sample is merely diluted with graphite powder. As it is often difficult to procure special films sensitive to infrared light, this method is only recommended for routine work. With slight variations, the second method can also be used for determinations of very small alkali concentrations in organic substances.

Clarendon Lab., U. of Oxford (Gt. Brit.)
ELECTRON SPIN RESONANCE OF Gd^{+++} IN LANTHANUM FLUORIDE, by D. A. Jones, J. M. Baker, and D. F. D. Pope. Technical (Scientific) note no. 1 on Contract AF 61(052)92. Mar 59, 18p. 9 refs. AFCRC-TN-59-580; AD-234 549.
Order from LC mi$2.40, ph$3.30 PB 147 876

Electron spin resonance in a single crystal of LaF_3 containing 0.01% Gd^{+++} shows 3 magnetically distinguishable ions per unit cell in a rhombic crystalline electric field which is consistent with a hexamolecular unit cell of symmetry $O6/mcm$. This is in disagreement with recent crystallographic measurements, but in agreement with the interpretation of the Faraday rotation given by Van Vleck and Hebb (Phys. Rev. 46.17, 1934). The parameters of the spin Hamiltonian are given. The crystal field splitting in zero magnetic field is $\sim 0.3\ cm^{-1}$ which makes this a possible salt for maser operation in low magnetic field. (Author)

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE AND OPTICAL SPECTRUM OF IRON IN BERYL, by M. Dvir and W. Low. Technical note no. 13 on Contract AF 61(052)59. May 60, 21p. 9 refs. AFOSR-TN-60-994.
Order from LC mi$2.70, ph$4.80 PB 150 355

The paramagnetic resonance spectrum of Fe^{3+} in beryl was measured at 20° and 290°K. In addition to this spectrum many weak lines were observed and possible explanations of these lines are discussed. The optical spectrum shows a spectrum characteristic of trivalent iron. In the infrared region there are several groups of sharp lines whose origin is not yet known. (Author)

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE AND OPTICAL SPECTRA OF DIVALENT IRON IN CUBIC FIELDS. I. THEORY. II. EXPERIMENTAL RESULTS, by W. Low and M. Weger. Technical note no. 14 on Contract AF 61(052)59. May 60, 99p. 23 refs. AFOSR-TN-60-801.
Order from LC mi$5.40, ph$15.30 PB 150 344

The energy level splittings of the ground state of the d^6 configuration in cubic and axial fields are given. The Zeeman splittings of the various levels are calculated for weak and strong magnetic fields. In the case of tetrahedral symmetry the effect of the perturbation of the odd parity configurations d^5p and d^5f on the ground state is estimated. The paramagnetic resonance absorption of Fe^{2+} in MgO is observed at $g = 3.428$ and 6.86. The optical absorption line is found at 10,000 cm. The paramagnetic resonance spectrum indicates considerable covalent bonding. The origin of the line at 6.86 is discussed. In tetrahedral ZnS a paramagnetic line is found at $g = 2.25$ and optical absorption at 3μ and 0.7μ. Possible explanations of this spectrum are discussed. A short discussion of the optical absorption spectra of trivalent iron in MgO is presented. (Author)

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE SPECTRUM OF Mn^{2+} IN $ZnSiF_6{:}6H_2O$, $\Delta m = \pm 1$ TRANSITION, by E. Friedman and W. Low. Technical note no. 15 on Contract AF 61(052)59. June 60, 12p. 3 refs. AFOSR-TN-60-995.
Order from LC mi$2.40, ph$3.30 PB 150 356

In the spectrum of Mn^{2+} in $ZnSiF_6{:}6H_2O$ a number of weaker lines are observed at intermediate angles of the magnetic field H with respect to the crystal axis, in addition to the 30 allowed transitions $\Delta M = \pm 1$, $\Delta m = 0$. These lines have been measured and assigned

to $\Delta M = \pm 1$, $\Delta m = \pm 1$ transitions. The relatively strong intensity is explained and the intensity of the lines is shown to be proportional to $(D/A)^2 \cos^2\theta \sin^2\theta$. These forbidden transitions can be utilized for dynamic polarization of manganese nuclei. (Author)

Heidelberg U. (West Germany).
PROGRAM: "BROOKHAVEN" CONFERENCE [NO. 4] ON NUCLEAR BEAMS JUNE 9-11, 1959, UNIVERSITY OF HEIDELBERG, HEIDELBERG, GERMANY. [1959] 54p. 17 refs. AFOSR-TR-59-152; AD-228 005.
Order from LC mi$3.60, ph$9.30 PB 150 152

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
APPLICATION OF SUMMABILITY METHODS TO SPECIFIC HEAT CALCULATIONS, by A. A. Maradudin, G. H. Weiss, and R. A. Sack. (Laboratory for Molecular Studies). Rept. on Contract AF 18(600)1315. Mar 60, 16p. 5 refs. Technical note BN-201; AFOSR-TN-60-345; AD-235 771.
Order from LC mi$2.40, ph$3.30 PB 148 996

Thirring obtained an expansion for the vibrational contribution to the specific heat of a crystalline solid in powers of 1/T. The coefficients of this Taylor series are proportional to successive moments of the frequency spectrum. Thirring's expansion converges only for $T > \Theta/2\pi$, where $\Theta = h\omega_L/k$ and ω_L is the maximum normal mode frequency. The series converges very poorly near the radius of convergence and is completely useless there. The series can be analytically continued beyond its radius of convergence by means of the Euler transformation, which, greatly increases the rate of convergence of the series near the radius, so that only about 7 moments are required for better than 3 figure accuracy for the specific heat of a body-centered cubic lattice at this point. Other methods for summing divergent series can also be used effectively. Some examples of the use of these methods are presented. (Author)

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
SATURATION OF THE MAGNETIC RESONANCE ABSORPTION IN DILUTE INHOMOGENEOUSLY BROADENED SYSTEMS [AND] MAGNETIC RESONANCE AND RAPID PASSAGE IN IRRADIATED LiF, by James S. Hyde. Rept. on Contract Nonr-1841(10). Oct 59, 49p. 29 refs. Technical rept. nos. 141, 142; AD-228 364.
Order from LC mi$3.30, ph$7.80 PB 149 938

Portis proposed a theory of inhomogeneous saturation in which an integration is carried out of the contributions to the magnetic loss by spin packets precessing at a distribution of Larmor frequencies. The shape of the spin packets critically determines the saturation behavior. In this paper the theory of Portis is reviewed and a number of criticisms and modifications of the theory are presented. The experimental result of Portis that at room temperature the paramagnetic dispersion signal ($d\chi'_m/dH$) of radiation-induced paramagnetic centers in LiF has the shape of an undifferentiated Gaussian curve and lags the modulation field by 90 degrees has been confirmed.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
DIRECT DETERMINATION OF LINE SHAPES OF ROTATIONAL SPECTRA FROM INTERFEROMETRIC MEASUREMENTS, by Trevor Williams. Technical rept. on Contract AF 18(600)1307. 30 Sep 59, 22p. 2 refs. AFOSR-TN-60-349; AD-239 732.
Order from LC mi$2.70, ph$4.80 PB 149 161

Much idealized, the rotational spectrum of a linear molecule may be considered to consist of a number of equally-spaced lines of identical shapes and intensities. We have been scanning such spectra with an interferometer rather than a conventional grating spectrometer. It is consequently of interest to know what kind of interferogram may be expected to arise from a periodic spectrum. It is shown that all the structure in the interferogram is contained in a sequency of "signatures" at path differences of 0, 1/2B, 2/2B, $\cdots$ For a symmetric line shape the signatures are all symmetric and homologous, but asymmetry in the line shape introduces increasing asymmetry in the successive signatures. These predictions are in agreement with experience. By measuring two vertical distances on each signature it is possible to determine as many harmonics in the Fourier expansion of the line shape as there are signatures. Comparison with experimental results from the large interferometric modulator at The Johns Hopkins University will be given. (Author)

Maryland U., College Park.
DELTA FUNCTION MODEL OF CHEMICAL BINDING, by Ellis R. Lippincott and Margaret Oakley Dayhoff. Rept. on Contract DA 36-034-ORD-2175. Mar 59, 56p. 16 refs. OOR rept. 1607.6C; AD-214 751.
Order from LC mi$3.60, ph$9.30 PB 149 653

A semi-empirical delta function model of chemical binding is presented from which a large number of bond properties may be calculated for diatomic molecules and the bonds of polyatomic molecules. The predicted properties are dissociation energy, bond length, vibrational frequency and anharmonicity.

Minnesota U. School of Chemistry, Minneapolis.
CARBON-13 HYPERFINE SPLITTING IN SEMIQUINONES, by D. C. Reitz, F. Dravnieks, and J. E. Wertz. Rept. on Contract AF 18(603)17. 31 Aug 60, 7p. 5 refs. AFOSR-TN-60-929.
Order from LC mi$1.80, ph$1.80 PB 150 238

The electron spin resonance spectra of 2,5-dihydroxysemiquinone and semiquinone exhibit hyperfine splittings consistent with the number of ring protons on each molecule. In addition, there are lines of weak intensity in both spectra which may be attributed to the natural abundance of C^{13} in ring carbon atoms.

Oregon U., Eugene.
THE POSITION DEPENDENCE OF COLLISION INDUCED SATELLITES OF ALKALI LINES ON THE NATURE OF THE ALKALI, by Shang-Yi Ch'en and Ralph A. Wilson, Jr. Interim technical rept. no. 4 on Contract DA 04-200-ORD-713. June 60, 28p. 3 refs. OOR rept. no. 1981.5-P.
Order from LC mi$2.70, ph$4.80 PB 150 394

The dependence of the positions of both the red and the violet satellite bands of alkali lines in absorption, resulted from collisions between the alkali atoms and various foreign gases, on the nature of alkalis was investigated from the microphotometer traces of over 100 satellites of the absorption lines of Li, Na, K, Rb and Cs in the presence of He, Ne, Ar, Kr, and Xe. For a given foreign gas, the absolute magnitudes of satellite-line separation, $|\Delta\nu|$ in cm^{-1} for both red and violet satellites decreased with increasing atomic weight of the alkalis; while for a given alkali, the $|\Delta\nu|$ increased for red satellites but decreased for violet satellites with the atomic weights of the foreign (perturbing) gas. Red satellites were observable only for heavy gases (Kr and Xe).

Rochester U., N. Y.
IMPURITY STATES IN SOLID NEON, by Albert Gold. Rept. no. 6 on Contract AF 49(638)432. June 60, 68p. 45 refs. AFOSR-TN-60-705.
Order from LC mi$3.90, ph$10.80 PB 150 201

A formalism for the treatment of optical absorption by an isolated substitutional impurity center is given. The tight-binding approximation is used and the method of constructing one-electron trial functions for the system is outlined. The first-order absorption energies, oscillator strengths, and integrated absorption coefficients are computed in an approximation which includes spin-orbit interaction and the overlapping of heterocentric atomic wave functions through terms of order S^2. The first-order energies are corrected for van der Waals interactions using a variational formalism. A phenomenological method for computing the emission energies of the system is given. The specific example of an argon impurity atom in solid neon is treated numerically. The computation predicts absorption lines at 11.7 and 11.6 eV due, respectively to the $^1P_1$ and $^3P_1$ states of the argon impurity, with an uncertainty of 1.3 eV. The oscillator strengths for these transitions are calculated to be 0.164 and 0.017 respectively, giving rise to integrated absorption coefficients of 0.84×10^6 N_O and 0.09×10^6 N_O eV cm^{-1} for the two states, where N_O is the (small) fractional concentration of impurities in the host lattice. (Author)

Optics

Army Chemical Warfare Labs., Army Chemical Center, Md.
INFRARED FILTER MATERIALS FOR APPLICATION TO LOPAIR (LONG-PATH INFRARED) SYSTEMS, by Hugh R. Carlon. 1 June 59, 20p. 4 refs. CWL Technical memo. no. 32-42; AD-217 807.
Order from LC mi$2.40, ph$3.30 PB 150 103

The physical, optical and spectral characteristics of various filter materials for use in the construction of infrared detector filter wheels (fluorothene, talc, Teflon, polyethylene, indium antimonide, calcium fluoride, and barium fluoride) were discussed. The types discussed were plastic films, fused salts, minerals, and special alloys. Wherever possible, spectral characteristics were shown for various thicknesses of the materials. Teflon, polyethylene, indium antimonide, and calcium fluoride were in the infrared beam. No attempt was made to correct the curves to represent the actual radiation seen by the detector as a result of radiation characteristics of the infrared source. If such a correction were made, the area under both curves would be equal, and the condition of optical balance would be verified mathematically. Peak efficiency for the system discussed was 35%, but it is possible to select materials resulting in 50% efficiency.

Columbia U., New York
POINTS OF MULTIPLICITY $\geq$ OF PLANE BROWNIAN PATHS, by A. Dvoretzky, P. Erdös, and S. Kakutani. Rept. on Contract Nonr-266(59). June 59, 9p. 4 refs. CU-5-59-Nonr-266(59)MS.
Order from LC mi$1.80, ph$1.80 PB 147 893

Hughes Research Labs., Malibu, Calif.
FUNDAMENTAL LIMITATION IN THE POINTING ACCURACY OF A RADIO TELESCOPE, by Nicholas George. Scientific rept. no. 2 on Contract AF 19(604)5725. 1 Apr 60, 22p. 7 refs. AFCRC-TN-60-585.
Order from LC mi$2.70, ph$4.80 PB 149 912

The angular pointing accuracy of a radio telescope is limited by the finite angular width of the diffraction pattern of the receiving aperture and by the presence of noise in the receiver. A formula is derived which expresses the angular uncertainty inherent in training a radio telescope toward a point source as a function of the flux level of the source, the bandwidth and the sensitivity of the receiver, the observation time, and the angular rate of change of the diffraction pattern. This formula is applied to the case of a weak source of cosmic radio waves, and it is found that if the source spectral intensity varies as $1/f^{\mu}$, then the angular pointing accuracy varies with frequency as $1/f^{1-\mu}$. For non-thermal sources, an average value of $\mu = 0.8$ is reported in the literature, and thus one finds only a slight frequency dependence of the angular pointing accuracy, i.e., as $1/f^{0.2}$. This result is valid for any aperture shape, and in this paper appropriate formulas are given for the linear, rectangular, and circular apertures. Finally, a sample computation indicates that an angular pointing accuracy of 30 seconds of arc is possible using present-day receiver components and an aperture size of 3.4 meters (approximately). The effects of atmospheric turbulence, dimensional tolerance, and mechanical stability are not considered. (Author)

Itek Corp., Waltham, Mass.
COMMUNICATION THEORY AND SCALAR DIFFRACTION THEORY, by Edward L. O'Neill, Richard Barakat, and David E. Lev. Final rept. on Contract AF 19(604)5544. Apr 60, 121p. 51 refs. Itek P-168; AFCRC-TR-60-142.
Order from LC mi$6.30, ph$19.80 PB 149 435

This report attempts to present solutions to certain problems in visible optics which in the course of events should prove to be of considerable interest to those in the microwave field. Chapter I is concerned

with an extension of the Maréchal scheme for phase error balancing to fifth order terms: In Chapter II, the transfer functions for representative high numerical aperture systems are calculated and plotted. Chapters III and IV are concerned with the numerical evaluation of the axial energy distribution and the contours of constant encircled energy for various amounts of spherical aberration at several focal positions. Chapter V deals with the solution of three problems of scalar diffraction theory posed by Luneberg but not completed.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
PREPARATION AND PERFORMANCE OF SINTERED CdS PHOTOCONDUCTORS, by R. R. Billups, W. L. Gardner, and M. D. Zimmerman. Rept. on Contract AF 19(604)5200. 12 Mar 59, 15p. 10 refs. Technical rept. no. 200; AD-212 580.
Order from LC mi$2.40, ph$3.30 PB 147 010

This report released for sale to the public 13 Oct 60.

The performance of sintered CdS layers is dependent upon their activation and the parameters of the sintering process. A procedure of activation of Cds powders is given with an accompanying discussion of techniques used in the production of sintered layers. Data are presented relating the dependency of the electrical and optical characteristics of the sintered layer with variations in activation and in the sintering parameters, such as atmosphere, temperature and time of bake, and method of cooling. Sintered layers of desired characteristics can be produced and data from such layers are discussed. Examples are given as to how these layers are utilized in device applications. (Author)

Naval Ordnance Lab., Corona, Calif.
INTERFEROMETRIC MEASUREMENT OF WAVELENGTHS OF INFRARED EMISSION LINES IN THE 1- TO 2- MICRON REGION, by Curtis J. Humphreys and Edward Paul, Jr. 19 Feb 58, 31p. 15 refs. NAVORD rept. 4636; NOLC rept. 390; AD-162 994.
Order from LC mi$3.00, ph$6.30 PB 149 771

A method was developed for the precise evaluation of spectral emission lines in the 1- to 2-μ region by interferometric intercomparison with selected internationally adopted wavelength standards. The essential feature of the method is the provision for scanning the interference pattern by uniform rotation of a Fabry-Perot interferometer so that a diametral section of the system of circular fringes moves across the slit of a high-resolution infrared spectrometer. Data are obtained in the form of chart records of the fringe positions. NOLC digital computer facilities are utilized for reduction. Aluminum coatings proved satisfactory. Interferometer separations up to 30 mm were used in reported work. Wavelengths are reported as follows: argon, 19 lines; krypton, 15 lines; natural mercury, 10 lines, mercury 198, 8 lines; cadmium, 4 lines; helium, 1 line, namely, λ 20581A. The absolute accuracy now being achieved is 1 part in 10^7 in favorable cases. (Author)

Washington Square Coll., New York U., N. Y.
A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS, by J. H. Rohrbaugh. Scientific rept. no. 9, 1 Sep-31 Nov 59, on Millimeter Wave Project, Contract AF 19(604)2673. [1959] 25p. 7 refs. AFCRC-TN-60-157; AD-234 816.
Order from LC mi$2.70, ph$4.80 PB 147 880

The optical behavior of the NaCl crystal in the infrared is investigated at various temperatures. Neuberger's [J. Neuberger, Absorption of NaCl in the Infrared, Thesis, New York Univ., 1957] derivation is used near room temperature. Neuberger applies the Blackman anharmonic theory to the Kellerman model of the NaCl crystal for his derivation of the optical constants. At low temperatures, his damping factor had to be modified by including the zero point energy. This was obtained by the use of the previously derived 20°K frequency spectrum of the normal modes of vibration. It is seen that the change of the optical constants is already experimentally detectable with the experimental accuracy currently achievable for a difference of 20°K near room temperature. (Author)

Solid State Physics

Armour Research Foundation, Chicago, Ill.
MECHANISM OF WEAR OF NONMETALLIC MATERIALS, by C. H. Riesz. Rept. for May 59-Jan 60 on Research on Interface Phenomena, Contract AF 33(616)5962. May 60, 25p. 14 refs. WADC Technical rept. 59-316, Part II.
Order from OTS $0.75 PB 161 955

A fundamental study was made of the wear mechanism of nonmetallic materials at high temperatures. Single-crystal sapphire was examined in a friction apparatus made for studies up to 2200°C. A sapphire ball loaded at 22, 50, and 127 g was passed over a sapphire plate at .0053 cm/sec at 29-921°C. Both slider and plate were oriented such that the C_O-axis was normal to the direction of traverse. With cleaned, as-received materials coefficient of friction values were scattered. Prior heat treatment at 900-925°C reduced scatter and gave peak values of .25-.30 near 600°C. The results suggest that the surfaces of the sapphire were imperfect. Observations by other investigators on variation of modulus of rupture appear to have a common basis. Wear areas on ball and plate were 6μ wide; subsurface changes extended to 30μ. Electron microscopy inspection suggests high surface temperatures occurred coincidently with the friction process, but direct evidence of an adhesion mechanism is inconclusive. (Author)

Battelle Memorial Inst., Columbus, Ohio.
EFFECT OF HIGH PRESSURE ON ELECTRICAL PROPERTIES OF NiO, CoO AND Cu_2O, by A. P. Young, W. B. Wilson, and C. M. Schwartz. Technical note no. 1 on Contract AF 49(638)441. 1 Sep 60, 27p. 20 refs. Technical Document AFOSR-TN-60-629.
Order from LC mi$2.70, ph$4.80 PB 150 266

The effect of pressure on electrical resistance and Seebeck coefficient at or near room temperature in NiO, CoO, CuO, and Cu_2O has been determined. Equations relating the Seebeck coefficient to hole concentration have been used to calculate the effect of pressure on hole mobility. In all materials examined, hole mobility was decreased by pressures to 60 000 atm. It has been proposed that NiO charge transport occurs by the motion of holes trapped at local sites by polarization of the surrounding lattice. The effect of pressure on the diffusion of self-trapped holes has been considered. Motion of self-trapped holes in an ionic crystal and of vacancies in a metal may be similar to the extent that the motion of either probably involves cooperative movements of surrounding ions or atoms. Some inward relaxation probably occurs around either a hole trapped at a local site in an ionic crystal or around a vacancy in a metal. In either case pressure would be expected to decrease the jump frequency for motion of the defect. It is proposed that in NiO, CoO, and CuO, the decreased hole mobility with pressure was due to a decrease in diffusion rate of self-trapped holes. The explanation for pressure effects in Cu_2O may be more complicated since Cu_2O is generally regarded as a wide band semiconductor. (Author).

Brown U., Providence, R. I.
INVESTIGATIONS OF SURFACE PROPERTIES OF SILICON AND OTHER SEMICONDUCTORS, PHASE I AND II, by H. E. Farnsworth, D. Haneman and others. Scientific rept. no. 3, 30 Apr-30 June 60, on Contract AF 19(604)5986. July 60, 19p. 12 refs. ERD TN-60-775.
Order from LC mi$2.40, ph$3.30 PB 150 208

Measurements on a $(11\bar{1})$ GaSb face have been extended to include secondary emission observed as a function of oxygen and carbon dioxide adsorption. Diffraction and adsorption measurements have also been made on a (111) GaSb face. The adsorption rates of oxygen and carbon dioxide were greater by about a factor of 10 for the $(11\bar{1})$ face than for the (111) face. A germanium crystal was subjected to wet and dry cycles of nitrogen and oxygen. The effects of these ambients on the surface recombination states was determined by combined measurements of surface recombination velocity and surface conductivity. Studies of the formation of p-type films on vacuum-heated silicon have continued. The original baking temperature of the vacuum system has been varied over the range from 300°C to 450°C without influencing the number of diffused acceptors. Results have been obtained for a (110) silicon crystal which are in conformity with those previously obtained for the (100) and (111) crystal faces. (See also PB 147 758)

Brown U. Div. of Applied Mathematics, Providence, R. I.
DIMENSIONAL CHANGES IN CRYSTALS DUE TO DISLOCATIONS, by R. A. Toupin and R. S. Rivlin. Technical rept. no. 51 on Contract Nonr-562(10). Oct 59, 28p. 4 refs. C11-51; AD-228 130.
Order from LC mi$2.70, ph$4.80 PB 149 945

The second-order elasticity theory is used to show how changes in the average dimensions of elastic bodies, either isotropic or anisotropic, due to the introduction of dislocations, can be calculated when the displacement gradients produced by the dislocations are sufficiently small. It is shown that the average value of each of the stress components, in a rectangular Cartesian coordinate system, is zero. This result is then used, within the framework of the second-order theory, to obtain an expression for the average value of each of the infinitesimal strain components as the average value of an expression of second degree in the displacement gradients which are associated with the dislocations in the body according to the classical theory. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
STRESS ANALYSIS IN THE PLASTIC RANGE, by William Prager. Technical rept. no. [52] on Contract Nonr-562(10). Oct 59, 24p. 28refs. C11-52; AD-228 129.
Order from LC mi$2.70, ph$4.80 PB 149 946

Problems of plastic stress analysis are illustrated by using a truss as an example. The state of stress can be specified by the values of a finite number of parameters. For this discrete model, linear programming, quadratic programming, and differential quadratic programming are shown to be important tools of plastic stress analysis. In discs, plates, and shells, and in the 3-dimensional continuum, the state of stress is specified by functions of position. While extreme characterizations of the state of stress were given and individual problems were solved for these continuous models, efficient methods of plastic stress analysis have yet to be developed. In view of the complexity of the problem, there is no doubt that these methods will have to be numerical rather than analytical. (Author)

Colorado U., Boulder.
NUCLEAR RESONANCE OF Al IN SYNTHETIC RUBY. Technical note on Contract AF 49(638)611. June 60, 8p. 6 refs. AFOSR-TN-60-724.
Order from LC mi$1.80, ph$1.80 PB 149 837

The quadrupole coupling constant $\Delta\nu$ and the line widths of Al were investigated at 300°K, 77°K, and 4.2°K and Cr^{3+} impurity concentrations of 0.1%, 1.5%, and 4%. The results indicated that the most significant contribution to the line width was the nuclear dipole-dipole interaction except for the 4% crystal at 4.2°K where the paramagnetic dipole-nuclear dipole interaction became important.

Compagnie Générale de T[élégraphie] S[ans] F[il] (France).
PREPARATION OF II-IV SEMI-CONDUCTOR COMPOUND MIXTURES AND MEASUREMENT OF THEIR ELECTRICAL AND THERMAL PROPERTIES. Quarterly status technical rept. no. 4, 1 Jan-30 Mar 60, on Contract AF 61(052)243. [1960] 24p. AD-237 885.
Order from LC mi$2.70, ph$4.80 PB 148 213

Single crystals of Mg_2Sn about 8 cm long were obtained regularly by using a heating element whose interior tube was of alumina and in which the interval between tubes was filled with powdered alumina. The

first crystals obtained were n type with the number of carriers of the order of 10^{18}/cc. Spectrographic analysis revealed traces of Cu and Ca and extremely faint traces of Si, Fe, and Ni. After fusion with the same heating element, n or p type crystals with the number of carriers of the order of 10^{17}/cc were obtained. The type is apparently imposed by stoichiometric departure so that if the speed of cooling is controlled, crystals of Mg_2Sn which are very close to the theoretical composition may be obtained. Measurements of resistivity and Hall coefficient were made on 2 single crystals, one each of the n and p types. The samples, A_1 and A_2, were taken from the head and tail of the same ingot. At liquid air temperature, the number of A_1 carriers was one-tenth that of the A_2. Phase studies indicated Pb and Sn are unequally distributed along the length of a crystal if the ingot is slowly recrystallized, starting at one end. A method for measuring semiconductor thermal diffusivity is appended; one end of a cylindrical bar is maintained at constant temperature and the other receives a periodic thermal flux of energy. The solution is derived by superposing the nonperiodic and periodic states, given the characteristic linear heat equation and boundary conditions. (See also AD-236 763)

Conservatoire des Arts et Métiers, Paris (France).
X-RAY DIFFRACTION IMAGES OF A CRYSTALLINE SURFACE, by M. Cagnon and A. Guinier. Technical note no. 2 on Contract AF 61(052)51. Jan 60, 27p. 7 refs. AFOSR-TN-60-681.
Order from LC mi$2.70, ph$4.80 PB 149 588

The influence on the X-ray image of defects such as superficial scratches, subboundaries, slip planes has been studied in detail with a lithium flouride crystal. The first part of the work has been the construction of a convenient camera and the study of the conditions necessary to obtain a satisfactory geometrical resolving power.

Detroit U. [Mich.]
DEVELOPMENT OF A MATHEMATICAL THEORY OF PLASTICITY BASED ON THE CONCEPT OF SLIP III, by H. Payne, S. J. Czyzak and others. Rept. on Contract AF 19(600)1466. 1 Sep 60, 58p. 24 refs. AFOSR-TR-60-107.
Order from LC mi$3.60, ph$9.30 PB 150 242

The Taylor model can be considered as the more realistic one of the several which have been proposed and the modifications of this model by Lin, Bishop and Hill, and Payne have made it possible to solve the stress-strain relation for certain problems. The fact that good agreement between theory and experiment has been obtained for these problems justifies acceptance of the model as one which describes the behavior of material under stress. The Taylor model has been investigated quantitatively for face centered cubic crystals only. (See also PB 144 773)

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
AN INVESTIGATION INTO THE THERMAL AND ELECTRICAL PROPERTIES OF THE MERCURY-TELLURIDE CADMIUM-TELLURIDE SEMI-CONDUCTOR SOLID SOLUTION SYSTEM, by John Blair. Scientific rept. no. 2 on Contract AF 19(604)4153. 15 June 60, 99p. 66 refs. AFCRC-TN-60-753; DSR-7994.
Order from LC mi$5.40, ph$15.30 PB 150 051

This report deals with three separate but essentially interrelated subjects. The thermal and electrical properties of dilute solid solutions of cadmium telluride in mercury telluride are investigated, and techniques are developed for the preparation and evaluation of single crystals in this material system. The common focal point in this investigation was provided by thermoelectric energy conversion.

General Electric Research Lab., Schenectady, N.Y.
DIFFUSION OF Li IN Si AT HIGH T AND THE ISOTOPE EFFECT, by E. M. Pell. Scientific rept. no. 2 on Contract AF 19(604)5551. 25 Feb 60, 31p. 25 refs. AFCRC-TN-60-182; AD-234 621.
Order from LC mi$3.00, ph$6.30 PB 148 247

The diffusion rate of Li in Si at high temperatures has been re-investigated using an outdiffusion technique. The resulting D for Li-7 is $(2.21 \pm 0.07) \times 10^{-6}$ cm^2/sec at $(800 \pm 5)^oC$ and 2.4×10^{-5} cm^2/sec at $(1350 \pm 5)^oC$. At 800°C, the value for D_{Li-6}/D_{Li-7} is $1.075 \pm .02$, in accordance with the expected inverse dependence on the square root of the mass. The ionic charge of the Li and the atomic mechamism for Li diffusion is discussed in the light of these and other results.

General Telephone and Electronics Labs., Inc., Bayside, N. Y.
INFRARED SCATTERING STUDY, by G. H. Schwuttke. Final rept. on Contract AF 19(604)3482. 30 Apr 60, 72p. 30 refs. TR 60-300.7; AFCRC-TR-60-157.
Order from LC mi$4.50, ph$12.30 PB 150 094

Imperfections in silicon single crystals have been studied by means of infrared light scattering, copper decoration, and X-ray extinction microscopy. Scope and limitations of these three methods have been explored and compared with etching techniques. Measurements have been conducted to check the reliability of etching and decoration techniques in crystals of low and high oxygen concentration, using X-ray extinction photomicrographs as standards. (Author) (See also PB 142 964)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
X-RAY DIFFRACTION STUDIES OF THERMAL MOTIONS IN CRYSTALS, by R. A. Young. Annual rept. no. 1, 1 June 58-31 May 59, on Contracts Nonr-991(00) and 991(06). [1959] 184p. 50 refs. AD-228 067.
Order from LC mi$8.40, ph$28.80 PB 149 856

A discussion is presented relevant to the literature, theoretical background, and experimental considerations and techniques pertinent to studies of thermal motions in crystals, particularly AgCl, by means of observations of Bragg intensities. A method for determining temperature factors from temperatures dependences of X-ray intensities is derived. Equipment design and performance, design of experiments, experimental techniques, and characteristics of the specimen are discussed with respect to accuracy and reproducibility.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
A THEORETICAL STUDY OF PENDELLÖSUNG FRINGES. PART 1. GENERAL CONSIDERATIONS. PART 2. DETAILED DISCUSSION BASED UPON A SPHERICAL WAVE THEORY, by N. Kato. Technical rept. no. 3 on Contract Nonr-1866(39). 10 Nov 59, 64p. 12 refs. AD-237 681.
Order from LC mi$3.90, ph$10.80 PB 148 320

The assumption of an incident plane wave is shown to be inadequate for single crystal experiments of X-ray diffraction (Laue case). A dynamical theory of diffraction is formulated for a general type of monochromatic incident wave. Fundamental aspects of wave behavior are discussed in terms of wave bundle considerations. Diffraction phenomena are classified by $\Delta\theta$ (an angular width of single crystal reflection) and Ω_o (a width in which the angular spectrum of an incident coherent wave takes an appreciable value). If $\Delta\theta' >> \Omega_o$, a plane wave assumption is adequate. This is usually the case for electron diffraction. If $\Delta\theta << \Omega_o$, a spherical wave assumption is more appropriate and most of X-ray cases fall under this alternative. Furthermore, a criterion is given to distinguish between Fresnel and Fraunhofer diffraction in a crystalline medium. "Pendellösung" fringes of X-rays can be interpreted as Fraunhofer diffraction, while those of electrons are observed in a Fresnel diffraction region. The essential features of section patterns, particularly "hook-shaped" fringes, can now be explained. (Author).

Honeywell Research Center, Hopkins, Minn.
ENVIRONMENTAL EFFECTS ON THE MECHANICAL PROPERTIES OF IONIC SOLIDS WITH PARTICULAR REFERENCE TO THE JOPPE EFFECT, by R. J. Stokes, T. L. Johnston, and C. H. Li. Technical rept. no. 6 on Contract Nonr-2456(00). Oct 59, 26p. 14 refs. HR-59-510; AD-228 082.
Order from LC mi$2.70, ph$4.80 PB 149 870

Mechanical properties of sodium chloride crystals are extremely sensitive to the presence of surface microcracks. Removal of these cracks by immersion in water leads to an enhancement of ductility (10-20% tensile elongation) which is retained indefinitely in dry air providing: (a) the crystal is dried without leaving a surface precipitate, (b) microcracks are not reintroduced by mishandling the gauge length. Storage in a damp atmosphere results in a surface deposit and consequent re-embrittlement. Elimination of surface flaws in other ionic solids does not necessarily result in an enhancement of ductility. Instead, there is a change in fracture behavior which is manifested by a change in the location of fracture origin. The Joffe effect is regarded as the action of a solvent in promoting this change in fracture behavior. Other environmental effects on mechanical properties are distinguished in terms of the type of environment and the initial surface condition. (Author)

Illinois Inst. of Tech., Chicago.
DISTRIBUTION OF ELECTRONS IN CADMIUM SULFIDE CRYSTALS, by Ganesh P. Mohanty and Leonid V. Azaroff. Rept. on Contract AF 49(638)425. 19 July 60, 8p. 5 refs. AFOSR-TN-60-792.
Order from LC mi$1.80, ph$1.80 PB 149 893

The (0001) electron density projections have been determined for a pure CdS crystal having a high dark resistivity and one doped with chlorine having low resistivity. Extremely accurate intensities (±2%) were obtained so that small variations in the electron distribution could be determined. It was found that the atoms in the doped crystal had larger effective sizes than in the undoped crystal. Also, the presence of a very small peak in an interstitial position of the structure suggests that some of the atoms occupy interstitial sites. This result differs markedly from an earlier investigtion by Shuvalov who reports the formation of "electron bridges" between adjacent atoms in CdS crystals having low dark resistivities The results obtained in this investigation also differ from Shuvalov's in regard to variations in diffraction intensities of certain reflections. Possible reasons for these differences are discussed. (Author)

Illinois U., Urbana.
HALL MOBILITY OF HOLES IN SILVER BROMIDE, by Roland Clements Hanson. Doctoral thesis. Technical note no. 4 on Contract AF 49(638)579. June 60, 78p. 90 refs. AFOSR TN-60-795; AD-240 108.
Order from LC mi$4.50, ph$12.30 PB 149 438

Hall mobility measurements have been made on holes introduced into AgBr by a bromine atmosphere in the temperature range from room temperature to 150°C. These measurements were made using conventional electrode geometry and sensitive high impedance a-c techniques similar to those used by Macdonald and Robinson. The Hall mobility for holes varied from 2.0 ± 0.5 cm^2/volt-sec at room temperature (27°C) to 0.5 ± 0.15 cm^2/volt-sec at 150°C. The hole mobility is about 30 times smaller than the electron mobility determined by other workers at room temperature. The temperature dependence of the hole mobility is about T^{-4}. This is much steeper than the temperature dependence of the electron mobility in this region. Preliminary measurements were also made on the thermoelectric power of AgBr in a bromine atmosphere. If the classical theory used is correct, these measurements indicate that the density of states effective mass for the holes is very small. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
VIBRATIONAL THERMODYNAMIC PROPERTIES OF LATTICES WITH DEFECTS. II. TWO- AND THREE-DIMENSIONAL SIMPLE CUBIC LATTICES, by J. Mahanty (Doctoral thesis), A. A. Maradudin, and G. H. Weiss. Rept. on Contracts AF 49(638)399 and AF 18(600)1315. Mar 60, 22p. 7 refs. Technical note BN-198; AFOSR-TN-60-372; AD-235 773.
Order from LC mi$2.70, ph$4.80 PB 148 993

Work is continued and applied to two- and three-dimensional crystals of previously developed methods [J. Mahanty, A. Maradudin, G. Weiss, Prog. Theor. Phys. 20:369, 1958] for the evaluation of the changes in thermodynamic properties of a lattice due to the presence of defects of various kinds. The effects are considered of an isotope defect and a pair of isotope defects on the zero point energy and free energy of two- and three-dimensional cubic lattices. The free energy and self entropy of a vacancy in a three dimensional cubic lattice is evaluated. (Author) (See also PB 135 619)

Institute of Mathematical Sciences, New York U., N. Y.
AN ACCURATE BOUNDARY CONDITION TO REPLACE TRANSITION CONDITIONS AT DIELECTRIC-DIELECTRIC INTERFACES, by Julius Kane and Samuel N. Karp. Rept. on Contract AF 19(604)5238. May 60, 69p. 11 refs. Research rept. no. EM-153; AFCRC-TN-60-391.
Order from LC mi$3.90, ph$10.80 PB 150 033

Most problems involving dielectrics cannot be solved exactly, e.g., diffraction by a dielectric wedge. It is the purpose of this work to describe a technique by which the transition conditions at an interface between two dielectrics can be conveniently and accurately replaced by a single mixed boundary condition.

Institute of Mathematical Sciences, New York U., N. Y.
RADIO PROPAGATION PAST A PAIR OF DIELECTRIC INTERFACES, by Julius Kane and Samuel N. Carp. Rept. on Contract AF 19(604)5238. May 60, 37p. 11 refs. Research rept. no. EM-154; AFCRC-TN-60-392.
Order from LC mi$3.00, ph$6.30 PB 150 054

A previous report introduced a linear boundary condition that serves to accurately replace transition conditions at dielectric-dielectric interfaces. In this work this procedure is applied to obtain an approximate solsolution for an otherwise mathematically intractable problem. The original geometry of the problem is that of a dielectric half space above two dielectric quarter spaces. After the technique of reformulation is applied, the problem reduces to one of obtaining a solution of a two-part boundary value problem, in the upper half space. This problem is solved exactly by the method of Wiener and Hopf. Physically reasonable results are obtained in a form suitable for numerical computation. (Author)

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
SOME OPTICAL PROPERTIES OF THE CUPROUS HALIDES AND RELATED COMPOUNDS, by R. Coelho. Rept. on Contract Nonr-1841(10). Oct 59, 35p. 41 refs. Technical rept. 143.
Order from LC mi$3.00, ph$6.30 PB 149 496

The optical absorption spectra of evaporated films of cuprous chloride, bromide, and iodide have been investigated at various temperatures, in an attempt to find how the partial covalence of these compounds affects their optical excitation.

Massachusetts U., Amherst.
ON THE CRYSTALLIZATION OF POLYETHYLENE, by Marion B. Rhodes and Richard S. Stein. Technical rept. no. 15 on Contract Nonr-2151(00). 13 Oct 59, 9p. 6 refs. AD-232 560.
Order from LC mi$1.80, ph$1.80 PB 149 481

A series of light scattering photographs was made on cooling low-density samples from a polyethylene melt having a density of 0.9203 g/cc, a melt index of 2.1, M_n = 23,000, and M_w = 184,000. The photographs were taken with vertically polarized incident light and with a vertically oriented analyzing polaroid between the sample and the photographic film (Vv polarization). The first scattering pattern developing on cooling showed no preferred orientation with respect to the polarization direction, and was characteristic of scattering resulting from density fluctuations. The cooling patterns obtained with a vertically oriented incident polarizer and a horizontally oriented analyzer (Hv polarizer) exhibited polarization which could arise only from anisotropic structure. These pictures showed a gradual increase in intensity with no maximum, which is in agreement with the density fluctuation interpretation of the maximum. A series of Vv photographs obtained on reheating showed no maximum but a gradual decrease in orientation fluctuation type of scattering. The experiments, which are consistent with the proposed 2-stage crystallization mechanism and the proposed origin of the scattering maximum, afford a means for separating and studying the kinetics of the processes.

Massachusetts U., Amherst.
THE SCATTERING OF LIGHT FROM POLYETHYLENE SAMPLES HAVING "RINGED" SPHERULITES. II, by Richard S. Stein and Alphonse Plaza. Technical rept. no. 14 on Contract Nonr-2151(00). 13 Oct 59, 6p. 4 refs. AD-232 559.
Order from LC mi$1.80, ph$1.80 PB 149 480

Materials Research Lab., U. of California, Berkeley.
ORIGIN AND PROPAGATION OF CRACKS IN MAGNESIUM OXIDE SINGLE CRYSTALS, by K. Muray, E. R. Parker, and L. Himmel. Technical rept. no. 1 on Ductile Ceramics Research, Contract AF 49(638)601, ARPA Order 24-59, Task 2. May 60, 30p. 11 refs. AFOSR-TN-60-554; Series no. 150; issue no. 1.
Order from LC mi$2.70, ph$4.80 PB 150 005

Investigations reported herein show that crack nucleation in MgO begins at slip-band intersections where impurities are located in the crystals. Cracks were found to propagate along surfaces containing abnormally high concentrations of impurities. (Author)

Mellon Inst., Pittsburgh, Pa.
INTERMOLECULAR COUPLING OF VIBRATIONS IN MOLECULAR CRYSTALS: A VIBRATIONAL EXCITON APPROACH, by R. M. Hexter. Rept. on Contract AF 49(638)542. 17 Mar 60, 43p. 30 refs. AFOSR-TN-60-325.
Order from LC mi$3.30, ph$7.80 PB 149 830

A vibrational exciton theory is developed which parallels in many ways the electronic exciton theory originally put forward by Davydov and amplified by Craig and Hobbins and by Fox and Schnepp. The kernel of the theory is the adoption of a transition dipole-transition dipole interaction as the potential which perturbs the isolated molecule energies and which thereby couples the motions of pairs of molecules in a crystal. As a result of the quantitative application of this theory, molecular dipole derivatives of several of the parallel modes of methyl chloride are obtained from the correlation field splittings of the corresponding fundamentals in the spectrum of solid methyl chloride. An isotope effect upon correlation field splittings is reported and is accounted for in terms of the same theory.

Mineralogical Lab., U. of Michigan, Ann Arbor.
ULTRAVIOLET PIEZOBIREFRINGENCE OF DIAMOND, by Malcolm Alvin Conrad. Research supported by ONR Contract. 1959, 56p. 31 refs.
Order from LC mi$3.60, ph$9.30 PB 149 855

Measurements of optical properties aid the development of the theory of solid state physics. The importance of stress-optical investigations is augmented by the close association of stress-optical, piezoelectric, and electro-optical properties. With few exceptions, stress-optical studies have been confined to the visible portion of the spectrum. The purpose of this study is to extend these limits by measurement of the piezobirefringence constants of diamond to its transmission limit in the ultraviolet portion of the spectrum.

New York U., N. Y.
PARAMAGNETIC RESONANCE IN THE SOLID STATE, by Hartmutt Kallmann. Quarterly progress rept. no. 5, July-Sep 59, on Contract DA 36-039-sc-78056. Oct 59, 8p. AD-229 083.
Order from LC mi$1.80, ph$1.80 PB 150 588

This report released for sale to the public 13 Oct 60.

An analog integrator for the automatic recording of EPR absorption spectra is described in detail. This accessory to the Varian spectrometer makes it possible to compare the spectra of standard samples with unknown spectra to obtain the number of unpaired electron spins in the unknown. The integrator also facilitates the measurement of line widths and line separations. An experiment on the effect of β radiation on the benzene-carbon tetrachloride system was set up. Diphenylpicrylhydrazyl is used as a scavenger for radicals produced. A copper activated zinc sulfide phosphor was examined for trapped electrons by electron paramagnetic resonance. When the phosphor was excited by blue light at room temperature a concentration of about 10^{16} electrons per cm^3 was calculated after comparison with diphenylpicrylhydrazyl. In the dark, the number of trapped electrons decays to about half the initial number in 18 hours. (Author) (See also PB 147 941)

Northwestern Technological Inst., Evanston, Ill.
TRANSFORMATION STUDIES OF GRAY TIN SINGLE CRYSTALS, by R. G. Wolfson, M. E. Fine, and A. W. Ewald. Rept. on Contract AF 49(638)524. June 60, 15p. 5 refs. AFOSR-TN-60-794.
Order from LC mi$2.40, ph$3.30 PB 150 105

Measurements of the linear growth rate of white tin into thin single-crystal wafers of gray tin, over the temperature range 24.2 to 46.5°C, are presented. The rate is not a single-valued function of the temperature. Imposed upon the strong temperature dependence of the average rate is a variation which is well defined at a given temperature; the spread in the observed values decreases sharply with increasing temperature. The variation is attributed to two observed stress-relaxation processes: cleavage in the gray tin and plastic deformation accompanied by recrystallization in the white tin. (Author)

Ohio State U. Research Foundation, Columbus.
RESEARCH ON SOLID-STATE PROPERTIES OF METALLIC CERAMIC AND ELECTRONIC MATERIALS, by P. M. Harris. Final rept. on Contract AF 18(600)769. Sep 59, 10p. AFOSR-TR-59-[109].
Order from LC mi$1.80, ph$1.80 PB 152 014

This report released for sale to the public 13 Oct 60.

Contents:
Charge distribution and characteristic temperature of metallic lithium from x-ray scattering at 300° and 100°K.
An investigation of the transformation and structure of silver mercuric iodide
Laue-Bragg scattering and charge distribution in lithium hydride

Raytheon Co., Waltham, Mass.
INVESTIGATION OF THE MICROWAVE PROPERTIES OF FERROELECTRICS, by Georg Rupprecht. Scientific rept. no. 1 on Contract AF 19(604)4085. June 60, 36p. AFCRC-TN-60-595.
Order from LC mi$3.00, ph$6.30 PB 149 905

Newly developed measuring techniques are described which make it possible to measure the complex dielectric constant of ferroelectric material over a wide range of temperatures and frequencies. At the same time, non-linear behavior can be studied. Strontium titanate single crystals have been measured in the temperature range from 80°K to about room temperature and over a frequency range from 100 c/sec to 24 kMc/sec. The essential result of these experiments is that there is no dispersion of the dielectric constant

up to K-band frequencies and a relation exists between the change of the dielectric constant above the Curie temperature as a function of external electric field and temperature. The dependence of the non-linear effect on the crystal orientation has been investigated. An interpretation of these results along the lines of Slater's theory of ferroelectricity in perovskite structures gives a qualitative but not a quantitative agreement. X-ray studies on $SrTiO_3$ single crystals are described, which also shed some doubt on the basic assumptions of Slater's theory. (Author)

Research Chemicals, Burbank, Calif.
PELTIER EFFECTS FOR CRYSTAL GROWING, by Louis L. Thomas. Rept. for Dec 58-Nov 59 on Electrical and Electronic Materials, Contract AF 33(616)6150. May 60, 52p. 10 refs. WADD Technical rept. 60-17.
Order from OTS $1.50 PB 161 985

Available literature on crystal growing and refining processes has been reviewed. In accordance with the results of the literature survey and analysis of the problem, the zone melting technique has been chosen for modification to study the potential of the Peltier effect for improving crystal properties. Zone melting apparatus, modified according to the criteria developed, has been fabricated. Germanium rods have been zone melted. Concurrent experimental work included measurement of resistivity, Hall effect, magneto-Seebeck effect at the melting point, and Peltier effect as applied to zone melting. (Author)

Rome U. (Italy).
CHEMISORPTION AND CATALYSIS ON OXIDE SEMICONDUCTORS, by V. Caglioti, A. Cimino and others. Final technical rept. no. 2, 1 Feb 59-31 Jan 60, on Contract DA 91-591-EUC-1057. 27 Feb 60, 57p. 29 refs.
Order from LC mi$3.60, ph$9.30 PB 149 448

Chemisorption of hydrogen on ZnO (powder samples), with and without the addition of Li^+ or Ga^{3+} has been investigated in the temperature range -80° to 350°C, and at pressures between 70 and 715 torr. The electrical conductivity of powdered samples of pure ZnO has been studied as a function of the temperature and of the hydrogen pressure. A model for chemisorption is postulated. According to this model the quasi-free electrons present in ZnO can initiate the chemisorption process. The heat evolved during adsorption may in part be utilized to excite new electrons, which become available for chemisorption (site creation). Another fraction of the heat is utilized for the desorption, a process which also sets in immediately. The observed chemisorption therefore depends on the rate of excitation and of decay of electrons, and on the desorption process. Electrical conductivity measurements on doped samples are presented. An enhancement of conductivity was found which, as for pure ZnO, is more marked at higher temperatures. Photoconductivity (u. v. irradiation) experiments on sintered ZnO pellets were performed at hydrogen pressures of 2 or 25 torr, in the temperature range 30° to 300°C. A decrease of the photo-effect is observed in the presence of hydrogen.

Stanford Electronics Labs., Stanford U., Calif.
ANALYTICAL TECHNIQUE FOR OPTIMIZING THE HALL EFFECT, by G. M. Krembs. Rept. on Contract Nonr-225(31). 15 Oct 59, 94p. 46 refs. Technical rept. no. 1702-2; AD-228 792.
Order from LC mi$5.40, ph$15.30 PB 149 492

Study is made of signal levels and noise in the Hall effect as a function of the material constants, the geometrical configuration, and the ambient and the operating conditions. An analytical technique is desired for determining the optimum values of these parameters whenever the Hall effect application requires either a large Hall voltage per unit of magnetic field strength or a good signal-to-noise ratio. The major results of this study can be summarized as follows: (1) from a thermal analysis of the signal level in a Hall device mounted on a simple heat-sink structure it is shown that there exists an optimum crystal temperature at which the Hall voltage is a maximum; (2) since no material exists with all the ideal properties desired for a Hall generator, the proper choice of available materials is found to depend strongly on the temperature of the environment; (3) the power spectrum for the noise sources in the Hall device is demonstrated by means of a theoretical analysis of the Hall voltage as a function of the fluctuating charge density to be proportional to the spectrum for the current noise, where the value of this proportionality constant is determined as a function of the material parameters and other variables; and (4) the signal-to-noise ratio, formulated from the investigations of the signal level and Hall noise spectrum, is shown to have an optimum temperature which differs from the maximum signal condition, and to approach a constant value with increasing magnetic field strength, provided the misalignment noise is negligible. (Author)

Stanford U., Calif.
PROTON RESONANCE SHIFTS IN DIPHENYL PICRYL HYDRAZYL, by M. E. Anderson, G. E. Pake, and T. R. Tuttle, Jr. Rept. on Paramagnetic Resonance, Contract AF 18(603)131. July 60, 9p. 6 refs. Technical note no. 131-7; AFOSR-TN-60-736.
Order from LC mi$1.80, ph$1.80 PB 150 377

This note reports experiments in the temperature range between 4.2°K and 1.4°K in which a number of components are clearly resolved and the 1/T dependence of these shifts is clearly exhibited. In addition, the first of a series of deuterium substitution experiments has permitted explicit identification of one of the shifted components.

Uppsala U. (Sweden).
THE STRUCTURES OF Co_2P, Ru_2P AND RELATED PHASES, by Stig Rundqvist. Technical note no. 12 on Contract AF 61(052)40. 4 May 60, 38p. 35 refs. AFOSR-TN-60-338; AD-240 307.
Order from LC mi$3.00, ph$6.30 PB 149 581

The crystal structures of Co_2P and Ru_2P have been refined using single-crystal methods. Both phosphides crystallize in the C 23 structure type. A structural comparison with related phosphides and silicides is given. Co_2P has an extended homogeneity range at higher temperatures, the phosphorus-rich limit at 1000°C corresponds to the formula $Co_{1.94}P$.

There are evidences that the widening of the homogeneity range is connected with random vacancies on metal atom sites. This paper gives an account of single-crystal structure determinations of Co_2P and Ru_2P. Some phase-analytical data for the binary Co_2P and Ru_2P, and the ternary $Co_2(P, Si)$ phases are also reported and discussed. (Author)

Uppsala U. (Sweden).
THE TERNARY COMPOUND $SbCl_5 \cdot TiCl_4 \cdot 3POCl_3$, by Göran Adolfsson, Ragnar Bryntse, and Ingvar Lindqvist. Technical note no. 11 on Contract AF 61(052)43. 1 Apr 60, 4p. 2 refs. AFOSR-TN-60-192; AD-240 308.
Order from LC mi$1.80, ph$1.80 PB 149 579

Utah U., Salt Lake City.
AMBIENT HISTORY DEPENDENCE IN THE ELECTRICAL RESISTANCE OF CORUNDUM, by R. N. Tucker and P. Gibbs. Technical rept. no. 11 on Contract Nonr-1288(03). 15 Oct 59, 34p. 7 refs. AD-231 183.
Order from LC mi$3.00, ph$6.30 PB 149 475

The conduction current of single-crystal α-Al_2O_3 was measured over the temperature range 200°C to 900°C. It was observed that the conduction current was strongly dependent upon both the environmental history and the dislocation structure of the sample. Boiling the samples for one hour in various aqueous solutions [6-N HCl, $Mg(NO_3)_2$] and NaCl lead to significant increases in the conduction current as compared to samples which had been cleaned by heating at 1000°C in N. In each of the controlled contamination cases, the conduction current passed through a maximum: for HCl-contamination, the maximum occurred at about 350°C; for $Mg(NO_3)_2$-contamination, at about 570°C; and for NaCl-contamination, at about 705°C. The maxima were sharply followed by pulses in the conduction current, the frequency of which were observed to be sensitive to external mechanical vibrations. The pulses and maxima were absent upon cooling from 1000°C or reheating the cleaned crystal in a dry N atmosphere. Conduction current measurements were made on deformed samples, both parallel and transverse to the bend-induced dislocation structure. The parallel, contaminated conduction current showed a more than ten-fold increase over the other cases. (Author)

Wayne State U., Detroit, Mich.
PREPARATION OF LARGE AREA SINGLE CRYSTAL CUPROUS OXIDE AND THE ELECTRICAL CONDUCTIVITY OF SINGLE CRYSTAL CUPROUS OXIDE AT HIGH TEMPERATURES, by Robert S. Toth, Rein Kilkson, and Dan Trivich. Technical rept. no. 2 on Contract AF 18(600)481. 30 Apr 60, 97p. 51 refs. AFOSR-TN-60-485.
Order from LC mi$5.40, ph$15.30 PB 149 759

A method has been developed for the preparation of single crystals of cuprous oxide in the form of thin sheets of large area. The cuprous oxide was prepared initially in polycrystalline form by oxidation of copper sheet in air at temperatures below 1050°C. Subsequent annealing of the polycrystalline cuprous oxide sheet at higher temperatures, from 1070 to 1130°C, caused the grains to grow to large size, frequently attaining sizes of greater than a square inch in area. The process for preparing single crystal cuprous oxide was effective only on thin sheets, less than 0.060" thick. The single crystal character of the large grains was verified by X-ray examination, which further showed that the crystals were not strained and that preferred orientations of [211] and [311] existed. The electrical conductivity of the single crystal cuprous oxide was measured in the temperature range of 1100°C to 500°C at oxygen pressures from 152 mm to 10^{-5} mm. The plot of the logarithm of the conductivity against the logarithm of the oxygen pressure at constant temperature was found to be linear over a pressure range of 50 mm to 10^{-2} mm, with a slope of 0.1420 (approximately 1/7). The curve departs from linearity at lower pressures and also goes through a minimum with decreasing pressure. The activation energies, obtained from the straight line plots of the logarithm of the conductivity against the reciprocal of the absolute temperature, gave essentially constant values of 0.65 ev. at oxygen pressures from 50 mm to 10^{-2} mm. At pressures of 10^{-3} and 10^{-4} mm., the activation energy increased sharply to 1.05 ev. The conductivity in air at temperatures of 1020° to 1100°C gave an activation energy of 0.767 ev.

Wayne State U., Detroit, Mich.
THE PROPERTIES OF ELECTROLYTICALLY PREPARED CUPROUS OXIDE AND THE EFFECT OF SULFIDING ON THE PROPERTIES OF CUPROUS OXIDE PHOTOVOLTAIC CELLS, by Robert S. Toth, Nicolaos Economou, and Dab Trivich. Technical rept. no. 3 on Contract AF 18(600)481. 30 Apr 60, 50p. 31 refs. AFOSR-TN-60-725.
Order from LC mi$3.30, ph$7.80 PB 149 760

A method of preparing thin films of Cu_2O by an electrodeposition technique has been developed for the study of these films. The basic properties of these films differ only slightly from results on thermally prepared Cu_2O except that water has been found to be incorporated in the deposit. This can be eliminated by annealing at a proper temperature. The sulfide treatment of the Cu_2O surface of a copper oxide photovoltaic cell has been found to affect only slightly the output of thermally prepared cells. Sulfiding on electrolytically prepared cells was found to increase the power output by a factor of 10^2 to 10^3. The reason for the increased output is the lowering of the series resistance of the cells by the sulfide layer and a consequent increase in the efficiency of collection of the carriers produced at the photosensitive junction. This effect is larger for high resistance electrolytic Cu_2O than for the lower resistance thermal Cu_2O. The effect of the sulfiding treatment on the photovoltaic output can be maximized by proper selection of sulfide layer thickness and geometry of the top contact. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
INVERSION BY FAST PASSAGE IN A MULTILEVEL SYSTEM [AND] ELECTRON PARAMAGNETIC RESONANCE IN SEMICONDUCTING RUTILE, by P. E. Wagner, P. F. Chester and others. Quarterly rept. on Contract AF 19(604)5589. 14 Apr 60, 19p. 7 refs. Research rept. 403FD449-R5; ERD-TN-60-755.
Order from LC mi$2.40, ph$3.30 PB 149 812

Observations of Cr^{+++} resonances in ruby following adiabatic fast passage show inversion of the 2-4 transition when fast passage is applied to the 2-3 and 3-4 transitions, but only when the 2-3 and 3-4 transitions coincide during fast passage. Analysis is given for the inversion requirements in the two cases: sequential passage, as proposed by Siegman and Morris, and coincident passage. Electron paramagnetic resonance has been observed in oxygen deficient rutile at helium temperatures. The paramagnetic center is discussed in terms of Ti^{+++} associated with certain oxygen vacancies. The study is continuing. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
MAGNETO-OPTICAL EFFECTS IN FERRIMAGNETIC OXIDES, by P. C. Bailey and A. Goldman. Final rept. for 15 Mar 59-15 Mar 60 on Contract AF 19(604)552. [1960] 85p. 30 refs. AFCRC-TR-60-147.
Order from LC mi$4.80, ph$13.80 PB 149 572

The optical properties of thin transparent sections of many of the rare earth garnets and orthoferrites were investigated. Single crystals grown for this purpose were the garnets of yttrium and the rare earths from samarium to europium, and the corresponding orthoferrites. In addition, crystals of α-Fe_2O_3 were grown and investigated. The properties studied included optical absorption, Faraday rotation, reflectivity, circular dichroism and magnetic birefringence. Measurements were made at room and liquid nitrogen temperatures in the visible and infra-red (1-25μ) region, and the results correlated with existing theories. The absorption and rotation of all the garnets were similar with anomalies present in the cases of dysprosium, erbium, thulium and ytterbium. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
EXCITON AND MAGNETO-OPTICAL EFFECT IN STRAINED AND UNSTRAINED GERMANIUM, by David F. Edwards and Vito J. Lazazzera. Rept. on Proj. Michigan, Contract DA 36-039-sc-78801. Aug 60, 17p. 14 refs. 2900-197-R.
Order from LC mi$2.40, ph$3.30 PB 150 183

Measurements have been made of the direct-transition magneto-optical effect in strained and unstrained germanium at 77°K. The results indicate that the absorption peaks correspond to transitions to exciton levels associated with each Landau level in qualitative agreement with the theoretical calculations of Loudon (The Theory of the Absorption Edge in Semiconductors, unpublished doctoral dissertation, Oxford University, 1959) and of Howard and Hasegawa (Bull. Am. Phys. Soc., 1960, Ser. II, vol. 5, p. 178). (Author)

Theoretical Physics

Air Force Cambridge Research Center, Bedford, Mass.
THE IMPORTANCE OF THE FOURTH STATE OF MATTER TO THE MISSION OF THE AIR FORCE, by Lawrence C. Mansur. Jan 60, 20p. 37 refs. AFCRC-TN-60-137; AD-235 257.
Order from LC mi$2.40, ph$3.30 PB 147 882

A discussion is presented of the reasons for the intense interest in plasma or gaseous physics. A brief resume of the history since Langmuir is presented. The physical and electrical characteristics are discussed as are the proposed and existing uses of a plasma as a power generator, as a generator of electromagnetic radiation, as a material, as an electronic device, and as a sometimes helpful and sometimes hindering environment. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE DECAY OF PLANE SHOCK WAVES, by S. Chandrasekhar. 8 Nov 43, 14p. Rept. no. 423.
Order from LC mi$2.40, ph$3.30 PB 150 453

This report released for sale to the public 11 Oct 60.

The problem of the decay of plane shock waves is considered and it is shown that there exists a special class of shock pulses for which the problem of decay admits of an explicit solution. The case in question arises when shocks of moderate intensities (Mach numbers less than 1.5 if an accuracy of one per cent is demanded) are considered. In these cases the changes in entropy as well as in the quantity 5 c - u (where c denotes the local velocity of sound and u the mass velocity) as the shock front is crossed can be neglected. The case of linear shock pulses in which both u and c are linear functions of x behind the shock front is considered particularly in some detail.

Cambridge U. (Gt. Brit.)
A DISCUSSION OF DUAL DIAGRAMS IN PERTURBATION THEORY, by P. V. Landshoff. Technical scientific note no. 8 on Contract AF 61(052)233. May 60, 11p. 9 refs. AFOSR-TN-60-729.
Order from LC mi$2.40, ph$3.30 PB 150 343

A discussion is given of the dual diagram method of finding singularities corresponding to a contribution to the S-matrix from a Feynman graph in perturbation theory. It is shown that it may be necessary to draw the dual diagram in a space of greater dimensions than that spanned by the external momentum vectors of the Feynman graph, but that this possibility does not affect previous conclusions concerning anomalous thresholds in vertex parts. The effects are considered of the dimensionality of space on the singularities for processes involving many external particles. (Author)

Cambridge U. (Gt. Brit.)
SOME PROPERTIES OF SINGLE LOOP DIAGRAMS IN PERTURBATION THEORY, by M. Fowler, P. V. Landshoff, and R. W. Lardner. Technical scientific note no. 7 on Contract AF 61(052)233. May 60, 11p. 6 refs. AFOSR-TN-60-728.
Order from LC mi$2.40, ph$3.30 PB 150 342

Methods are summarized for finding singularities of a contribution to the S-matrix for a Feynman diagram in perturbation theory, with particular reference to single-loop diagrams. They are then applied to the third order vertex function and to an extension of the work of Tarski on scattering in fourth order, with internal stability conditions relaxed. The results for the vertex function are used to show that the S-matrix for production processes does not have a two-variable spectral representation. Finally, it is shown that the leading singularities for the fifth order contribution to single pion-production in π-N scattering do not produce anomalous thresholds. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
IRREVERSIBILITY IN INTERACTING SPIN SYSTEMS, by J. Philippot. Rept. on Contract AF 18(600)1315. Mar 60, 16p. 14 refs. Technical note BN-200; AFOSR-TN-60-346; AD-235 772.
Order from LC mi$2.40, ph$3.30 PB 148 995

A system whose hamiltonian is split into two terms $H = H_0 + \lambda V$ exhibits two types of irreversible processes. The first processes are described by the unperturbed hamiltonian, H_0, only. The second processes, which result from the perturbation, lead to an increase of the entropy of the system. These processes are illustrated by the examples of free precession and cross relaxation. General formula are given for transition probabilities. The expressions applied to cross relaxation in lithium fluoride agree with the results obtained by Bloembergen (Physica 15:410, 1949) and Pershan.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON VAN HOVE'S DIAGONAL SINGULARITY CONDITION, by J. Philippot. Rept. on Contract AF 18(600)1315. Mar 60, 13p. 4 refs. Technical note BN-199; AFOSR-TN-60-344; AD-235 770.
Order from LC mi$2.40, ph$3.30 PB 148 994

The diagonal singularity property of Van Hove (Physica 21:517, 1955; 23:441, 1957, 25:268, 1959) is shown not to be represented by a singularity of the δ type in the many body systems of interacting particles or phonons. This property is verified in certain scattering problems, and is a consequence of the random distribution of the scattering centers.

Institute of Field Physics, U. of North Carolina, Chapel Hill.
THE "MEASURE" IN THE FEYNMAN QUANTIZATION OF GENERAL RELATIVITY, by Bryce S. DeWitt. Rept. on Contract Nonr-855(07). Oct 59, 8p. 4 refs. Publication no. 5.
Order from LC mi$1.80, ph$1.80 PB 149 879

Institute of Mathematical Sciences, New York U., N. Y.
MAGNETO-HYDRODYNAMICS. Final rept. on Contract AF 19(604)2138. Dec 59, 15p. 10 refs. AFCRC-TR-60-224; AD-236 066.
Order from LC mi$2.40, ph$3.30 PB 148 990

Studies and mathematical investigations were conducted on the motion of charged particles of an ionized fluid in the presence of external electric and magnetic fields, with particular applications to motions in the ionized layers of the atmosphere and to the influences such motions have on the geomagnetic field at or near the earth's surface. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
THE DECAY $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$ AND THE $\Sigma^0 - \Lambda^0$ RELATIVE PARITY, by Nina Byers. Technical note no. 22 on Contract AF 49(638)388. July 60, 13p. 7 refs. Technical Note 388-22; AFOSR-TN-60-769.
Order from LC mi$2.40, ph$3.30 PB 149 577

Institute of Theoretical Physics, Stanford, U., Calif.
GROUND STATE OF ODD-ODD NUCLEI, by A. deShalit and J. D. Walecka. Technical note no. 23 on Contract AF 49(638)388. July 60, 12p. 8 refs. Stanford technical note 388-23; AFOSR-TN-60-837.
Order from LC mi$2.40, ph$3.30 PB 149 798

Institute of Theoretical Physics, Stanford U., Calif.
HIGH-FREQUENCY REGION OF THE BREMSSTRAHLUNG SPECTRUM, by R. H. Pratt. Technical note no. 21 on Contract AF 49(639)388. July 60, 27p. 22 refs. Stanford technical note 388-21; AFOSR-TN-60-823.
Order from LC mi$2.70, ph$4.80 PB 149 797

The McVoy-Fano theory of the connection between the atomic photoelectric effect and the high-frequency region of the Bremsstrahlung spectrum has been extended to next order in α Z. The contribution from P states is determined and is important in heavy elements. Predictions for the high-frequency limit are in reasonable agreement with experiment. Information is also obtained concerning angular distributions and polarization correlations. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
OBSERVATION OF π-π RESONANCE IN PION PRODUCTION, by S. D. Drell and F. Zachariasen. Technical note no. 20 on Contract AF 49(638)388. June 60, 12p. 6 refs. Technical note 388-20; AFOSR-TN-60-645.
Order from LC mi$2.40, ph$3.30 PB 149 576

Maryland U., College Park.
ON THE ANALYTIC PROPERTIES OF THE 4-POINT FUNCTION IN PERTURBATION THEORY, by Alfred Chi-Tai Wu. Rept. on Contract AF 49(638)24. July 60, 144p. 30 refs. Physics Dept. technical rept. no. 186; [AFOSR] TN-60-804.
Order from LC mi$7.20, ph$22.80 PB 149 539

Contents:
Simple examples of the 4-point functions
Function of six complex variables represented by a 4-fold Feynman parameter integral
Sources of singularities of the 4-point function
The relevance criteria for the 4-point singularity manifold
Determination of the boundary of the 4-point domain
Explicit form of the 4-point function
Partially differentiated form
The 3-point roots
Envelope problem for the ϕ-manifold
Some algebraic details for the 4-mass envelope
Note on the determinant expansion

Maryland U., College Park.
QUASI-PARTICLE APPROACH TO INTERACTION IN AN IDEALIZED METAL, by John J. Quinn and Richard A. Ferrell. Rept. on Contracts Nonr-1797(00) and AF 49(638)399. Sep 59, 25p. 17 refs. Physics Dept. technical rept. no. 156; AD-229 342.
Order from LC mi$2.70, ph$4.80 PB 148 890

The properties of a degenerate electron gas with a background of positive charge capable of propagating phonons are studied by means of a quasi-partical approach. The ground state of the system is pictured as a vacuum state, and any additional particles or holes together with their polarization clouds are thought of as quasi-particles. The Coulomb repulsion and the effective electron-electron attraction due to phonon exchange are treated separately. The specific heat, spin susceptibility, and compressibility are determined in terms of the effective energy of interaction $V_{pp'}$ of two quasi-particles. Considering only the lowest order process contributing to $V_{pp'}$ reproduces known results for the high density limit Coulomb correction to specific heat and spin susceptibility, but gives a new result for the phonon correction. To lowest order, the electron-phonon interaction produces no change in the spin susceptibility, in contrast to general expectation. For real metallic densities higher order graphs must be included; however for this case it may be possible to choose $V_{pp'}$ empirically. (Author)

Maryland U., College Park.
STRICT LOCALIZATION IN QUANTUM FIELD THEORY, by James Milton Knight. Doctoral thesis. Rept. on Contract AF 49(638)24. July 60, 55p. 15 refs. Physics Dept. technical rept. no. 187; AFOSR-TN-60-818.
Order from LC mi$3.60, ph$9.30 PB 149 835

A definition of strict localization of states in quantum field theory is presented. This definition is based on considering products of field operators as the primary measurable quantities of the theory. An example of a localized state is given, showing that such a state arises when a free field interacts with an external current that is limited to a bounded region of space-time. It is shown by means of a graphical technique that a state having a finite number of particles cannot satisfy the definition of localization. A simple representation of localized states is investigated, and arguments are given to support its generality and uniqueness. (Author)

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF MICROWAVE PROPERTIES OF PLASMAS. Scientific rept. no. 8, 1 Feb-30 Apr 60, on Contract AF 19(604)5226. May 60, 16p. M. L. rept. 725; AFCRC TN-60-590.
Order from LC mi$2.40, ph$3.30 PB 150 376

A cesium plasma with a high percentage of ionization has been obtained, and measurements were consistently repeatable over long long periods of time. The characteristics of density and impedance of the ionized plasma are discussed. Various possible noise measurement experiments have been examined. The experimental apparatus for generating harmonics has been built. Some aspects of the apparatus and some early experiements with the apparatus are discussed. Theoretical analysis is continuing and an equation for the case of no magnetic field has been derived. A better theoretical understanding has been obtained of the requirements necessary for improved parametric gain. Three basic requirements are discussed. Some low frequency properties of hot cathode mercury vapor discharge tubes are now being investigated. A new discharge tube has been used to determine the effect of frequency upon the sheath interaction. These findings were studied and interpreted. The role of temperature in the theory of nonlinear effects in plasma is reviewed. (Author) (See also PB 148 168).

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
ENERGY TRANSFER IN PLASMAS. Technical note no. 5 on Contract AF 30(602)2050. 23 May 60, 19p. 3 refs. RADC TN-60-124.
Order from LC mi$2.40, ph$3.30 PB 149 299

A continuation of the mathematical analysis of microwave propagation in a non-uniform plasma, in which the confluent hypergeometric function approximation is discussed, is presented. Anomalous high absorption of microwaves in helium gas excited at one boundary by microwave radiation at cyclotron frequency has been observed. The addition of small amounts of argon caused this absorption to decrease, indicating that the cause for the high absorption may be in the unusually large population of excited states produced at the hot boundary. Similar experiments are being conducted with air. Experimental designs for the study of non-uniform plasmas and for plasma-acoustical experiment are described. (Author)

Microwave Lab., Stanford U., Calif.
MILLIMETER WAVE GENERATION AND AMPLIFICATION IN PLASMAS, by G. S. Kino. Scientific rept. no. 6 on Contract AF 19(604)5226. Dec 59, 24p. 14 refs. M. L. Rept. no. 676; AFCRC-TN-60-114; AD-234 973.
Order from LC mi$2.70, ph$4.80 PB 147 884

A review of two possibilities for millimeter wave generation in a gas discharge plasma is given. The encouraging experimental results obtained so far with harmonic conversion in a plasma are discussed, and the nonlinear effects are explained in terms of a simple zero temperature theory. The amplification which occurs when an electron beam passes through a plasma is discussed in the light of millimeter wave

applications. The use of sound waves in a plasma to set up an artificial periodic system in the plasma is described as a possible way in which the coupling problem may be solved.

Oxford U. (Gt. Brit.)
TRANSVERSE COMPRESSION WAVES IN A 'STABILISED' DISCHARGE, by Daryl Reagan. Technical note no. 4 on Contract AF 61(514)1183. [1960] 15p. 8 refs. AFOSR-TN-60-279; AD-234 220.
Order from LC mi$2.40, ph$3.30 PB 147 620

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
LONGITUDINAL ION OSCILLATIONS IN HOT PLASMA, by Burton D. Fried and Roy W. Gould. 28 June 60, 37p. 12 refs. STL/TR-60-0000-GR185.
Order from LC mi$3.00, ph$6.30 PB 150 278

The linearized, longitudinal waves in a hot plasma include, besides the familiar electron plasma oscillations (epo), ion plasma oscillations (ipo) with $\omega \approx \omega_p(m/M)^{1/2}$. The properties of these ipo are explored using a Vlasov equation description of the plasma.

Scuola di Perfezionamento in Fisica Teorica e Nucleare, Naples (Italy).
FINAL TECHNICAL REPORT. Rept. for 1 May 59-31 July 60, on Contract DA 91-591-EUC-1096.
Order from LC mi$1.80, ph$1.80 PB 150 373

The main results of the two-year research reported here are: (1) a consistent formulation of field theory, totally rid of ambiguities and infinities, susceptible of exact mathematical treatment, (2) the proof that the ultraviolet divergences are eliminated correctly by an appropriate re-definition of the concept of integral, such as is imposed by the hyperbolic nature of the field equations. As a by-product one obtains the Lie equations of the renormalization group: these, tested on the Lee model, have given the expected answers, (3) a similar procedure permits to factor out, in a rigorous and perturbation-independent manner, the infrared divergences of electrodynamics, yielding a strict and very simple proof of the conjecture of many authors on this subject. (Author).

Syracuse U., N. Y.
THE CONSTRUCTION AND PROPERTIES OF NON-EQUILIBRIUM GIBBSIAN ENSEMBLES, by Robert L. W. Chen. Rept. on Contract AF 49(638)461. July 60, 33p. 7 refs. AFOSR[TN]60-746.
Order from LC mi$3.00, ph$6.30 PB 149 872

The methods of constructing Gibbsian ensembles are discussed for isolated systems undergoing irreversible processes and then the properties of these ensembles are examined in detail. Different kinds of physical situations call for different types of representative ensembles. In particular, situations are contrasted in which: (1) the system is just beginning an irreversible process, and (2) the system has had some uninterrupted past history. These basic considerations would enable one to resolve some apparent contradictions described in current literatures. (Author)

Syracuse U., N. Y.
A STATIONARY GIBBSIAN ENSEMBLE, by Walter Louis Sadowski. Rept. on Contract AF 49(638)461. July 60, 54p. 8 refs. AFOSR-TN-60-824.
Order from LC mi$3.60, ph$9.30 PB 149 885

The Bergmann-Lebowitz equation is derived by integrating the Liouville equation over domains of collision of system particles with those of the reservoir. On the basis of a specific physical model the stationary non-equilibrium distribution function is investigated. The kernel of the non-equilibrium problem is expanded in a power series of the temperature difference across the system. The expansion obtained contains the temperatures of the two reservoirs in the zeroth-order of the distribution function. The resulting zeroth-order distribution function contains numerical factors which make it slightly different from the equilibrium distribution. The physical significance of these factors is discussed. A specific property of the perturbative kernel is used to find the approximate solution to the first-order perturbative equation. The one-particle distribution function in μ-space is obtained by integrating the first-order n-particle distribution function.

Technical Research Group, Inc., Syosset, N. Y.
THE EFFECTS OF A PLASMA SHEATH ON THE IMPEDANCE PROPERTIES OF SOME SLOT ANTENNAS. PART I. ANALYTICAL FORMULATION, by Sylven Cutler. Scientific rept. no. 1 on Contract AF 19(604)4574, SA no. 1. Dec 59, 32p. 12 refs. TRG-127-SR-1; AFCRC-TN-59-993; AD-234 593.
Order from LC mi$3.00, ph$6.30 PB 147 885

The impedance properties of a slot antenna radiating into a plasma layer in space are obtained by determining the equivalent admittance of a slot radiating into a layer of complex refractive index. The equations are derived which give the equivalent admittance for a simplified problem whose solution can be used to obtain the impedance properties for practical antennas. The simplified problem consists of a single slot formed by the open end of a waveguide radiating into the layer of complex refractive index in a planar half space. The admittance is given in a variational expression in terms of the slot field. (Author)

Vienna U. (Austria)
THE CONFORMAL INVARIANCE IN QUANTUM FIELD THEORY, by J. Wess. Scientific note no. 6 on Contract AF 61(052)265. 20 June 60, 26p. 8 refs. AFOSR-TN-60-1003.
Order from LC mi$2.70, ph$4.80 PB 150 358

The properties of a conformal invariant quantum field theory are considered. A short discussion of the conformal group in four dimensions and of the topology, introduced into the pseudo-euclidean space by this group, is given. With the help of the commutation relations the spectrum of the generators in the Hilbert-space is investigated. The only possible discrete eigenvalue of P^2 and of the P^ν's is zero and the generator for scale transformations S has a continuous spectrum. The eigenfunctions of S in the x-representation are calculated; they form a complete set. The conservation laws valid in an invariant theory and the commutation relations predict a certain form of the conserved quantities expressed in terms of the energy-momentum tensor and

of the coordinates. For scalar, spinor and vector fields the generators are derived by the action principle of Schwinger. (Author).

Weizmann Inst. of Science (Israel).
MANY BODY PERTURBATION METHODS IN SOLUBLE MODEL, by Amnon Katz. Technical note. no. 2 on Contract AF 61(052)337. 1 Mar 60, 54p. 18 refs. AFOSR-TN-60-802.
Order from LC mi$3.60, ph$9.30 PB 150 041

It is pointed out that because statistics should not be obeyed in Goldstone's perturbation expansion there exist two-body contributions from diagrams other than ladders. The role of diagrams with "wrong" statistics is investigated in a model in which the perturbation is a single particle potential. A summation of all diagrams is carried out in this model and compared to the sum of all ladders. It is found that the "wrong statistics" contributions are important in deciding the region of convergence of the series and the location and nature of the singularities which limit it. In the case of two-body interactions with short range and low density the most important contributions with wrong statistics are the two-body contributions of "many body diagrams". Their inclusion is equivalent to using the Cooper type solution of a Bethe Goldstone equation.

Thermodynamics

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
COLLISION INTEGRALS FOR SPHERICALLY SYMMETRIC MOLECULES INTERACTING WITH AN EXPONENTIAL REPULSIVE POTENTIAL, by Louis Monchick. Rept. on Contract NOrd-7386. July 59, 26p. 13 refs. CM-956; AD-225 995.
Order from LC mi$2.40, ph$7.80 PB 149 619

The exponential potential function $A e^{-r/\rho}$ is regarded as the true qualitative form of the repulsive intermolecular potential at moderately small internuclear distances (or equivalently, high temperatures). Because of the increasing interest in gases at high temperatures it has become desirable to be able to evaluate the transport properties under these conditions. The calculation of integrals related to the usual collision integrals $\Omega(l,s)$ and cross-sections Q(l) was carried out for the exponential repulsive potential. Some high temperature viscosities were calculated and compared to the calculated results of Amdur and Mason (The Physics of Fluids 1:370-383, Sept. -Oct. 1958), which are based on an experimental scattering potential. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.].
PERFORMANCE OF A D-C ARC-EXCITED PLASMA GENERATOR, by W. K. McGregor, J. J. Ehrlich, and M. T. Dooley. Rept. on ARO, Inc. Contract AF 40(600)800S/A 11(60-110). Aug 60, 47p. 4 refs. AEDC-TN-60-112.
Order from LC mi$3.30, ph$7.80 PB 149 976

A direct-current, arc-excited plasma generator, designed and fabricated at the Rocket Test Facility, Arnold Engineering Development Center is described. The voltage vs current relationship at different pressures is examined in the light of previous work on simple enclosed arcs. Also an energy balance is presented from which the enthalpy increase of the gas and the energy conversion efficiency is determined. For this generator the arc voltage ranged from 30 to 100 volts, the current ranged from 60 to 1000 amperes, and the chamber pressure was adjusted between 1.1 and 2.4 atmospheres. Power inputs of from 2 to 60 kw to 0.0025 to 0.01 kg sec of argon produced enthalpy rises of from 50 to 1000 kcal/kgm with efficiencies in the range of 65 to 90 percent. Data are reported for both argon and helium used as the working gas. A study of gas contamination due to electrode erosion is also presented; the percentage by weight of contamination at normal operating conditions is shown to be less than 0.05 percent using tungsten and carbon electrodes and 0.003 percent using tungsten and copper electrodes. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
NORMALLY REFLECTED SHOCK FRONT PARAMETERS, by R. E. Shear and P. McCane. May 60, 17p. 3 refs. Memo. rept. no. 1273.
Order from LC mi$2.40, ph$3.30 PB 150 104

Calculations are presented of pressure, density and temperature changes across a shock front in air which is normally reflected from a perfectly rigid wall. The medium, air, is treated as a real gas. Comparisons are made with the results of Doering and Burkhardt. (Author)

Enrico Fermi Inst. for Nuclear Studies, U. of Chicago, Ill.
RESEARCH ON THE STUDY OF FLUID BEHAVIOR IN THE PRESENCE OF ROTATION AND MAGNETIC FIELD, by S. Chandrasekhar. Final rept. 1 May 55-30 Nov 59, on Contract N6ori-02056. 30 Nov 59, 80p. 103 refs. AD-237 331.
Order from LC mi$4.50, ph$12.30 PB 148 015

Contents:
Studies on thermal instability
Theoretical study
The instability of a layer of fluid heated below and subject to simultaneous action of a magnetic field and rotation II
Experimental studies
Experiments on the inhibition of thermal convection by a magnetic field
Apparatus for studying convection under the simultaneous action of a magnetic field and rotation
Experiments on the instability of a layer of mercury heated from below and subject to the simultaneous action of a magnetic field and rotation II
Experimental observations of overstable cellular convection
Studies on heat-transfer
Theoretical studies
Heat transfer by convection
Heat-transport by convection in presence of an impressed magnetic field

Experimental studies
Theoretical and experimental study of heat transfer by cellular convection in the presence of impressed magnetic fields
An experiment on heat transfer by overstable and ordinary convection

General Electric Co., Cincinnati, Ohio.
THERMODYNAMIC AND ELECTRICAL PROPERTIES OF MERCURY VAPOR AT PRESSURES BELOW ATMOSPHERIC AND HIGH TEMPERATURES, by A. Sherman and F. Martinek. Technical note for 1 Feb 59-28 Feb 60 on High Temperature Heat Transfer to Tubes and Nozzles, Contract AF 49(638)243. 1960, 43p. 16 refs. AFOSR-TN-60-657.
Order from LC mi$3.30, ph$7.80 PB 149 815

The thermodynamic properties of mercury vapor have been calculated for temperatures up to 15,000 °K and pressures between 1 and 10^{-4} atmospheres. The first ionization is shown to be essentially complete at 15,000 °K. At the lower pressures the ionization is completed earlier. Corrections have been included to account for the lowering ionization potential and the finite limit of the electronic term series. The largest corrections occur at the higher pressures; the correction at 10^{-4} atmospheres being negligible. For example, the temperature required to give 95% degree of ionization at one atmosphere is corrected by approximately 2%. (Author)

Massachusetts Inst. of Tech., Cambridge.
HEAT TRANSFER TO SUPERCRITICAL FREON-12, by J. V. Del Bene and J. P. Barger. Technical rept. no. 2 on Contract Nonr-1841(14). Oct 59, 87p. 6 refs. AD-230 557.
Order from LC mi$4.80, ph$13.80 PB 149 512

The experimental results support data for heat transfer to supercritical water obtained by N. L. Dickinson and C. P. Welch [Trans Am Soc Mech Engrs 80:746-752, 1958]. Both data show a peaking of the local heat transfer coefficient when plotted against wall temperature. Since the theoretical analyses do not predict this behavior, it appears as though these analyses have not simulated the correct physics of the flow and heat transfer mechanisms. Further, the experimental results show that heat transfer to supercritical fluids is extremely complex. The report outlines a procedure for analyzing new data to obtain a better understanding of the phenomena occurring in supercritical heat transfer. The investigation brings to light the problem of decomposition of Freon-12 at high pressures and temperatures. However, it also shows by carefully planning runs, rematching certain "master" runs, and frequently examining the test-section for cleanliness, that Freon-12 can definitely be used to obtain experimental data. Evidence is also given as regards a variation in the critical point of Freon-12 from one bottle of fluid to another. Finally, the details for constructing a detailed pressure-enthalpy diagram for supercritical Freon-12 are presented. (Author)

North American Aviation, Los Angeles, Calif.
DESIGN, CONSTRUCTION, AND TEST OF AN ABSORPTION-EMISSION PYROMETER. 31 July 47, rev. 11 Sep 47. 30p. 1 ref. Rept. no. AL-248.
Order from LC mi$2.70, ph$4.80 PB 152 013

This report released for sale to the public 11 Oct 60.

Experimental data on the instrument is included. The results of comparison tests between the Absorption-Emission Pyrometer and sodium D-line equipment have been taken as evidence of the correctness of the theory underlying the operation of the former. It has proven satisfactory for measuring the temperature of acetylene flames.

[Space Sciences Lab., General Electric Co., Philadelphia, Pa.]
ON THE APPROXIMATE SOLUTION TO THE PROBLEM OF AERODYNAMIC SURFACE MELTING OF A MATERIAL OF LARGE PRANDTL NUMBER, by George W. Sutton. Rept. on Contract AF 04(645)24. 8 Aug 58, 8p. 2 refs. Aerophysics Operation Research Memo. no. 17.
Order from LC mi$1.80, ph$1.80 PB 150 043

The approximate solution may be used only for order of magnitude estimates, since it underestimates the rate of vaporization, and overestimates the energy absorbtion capacity of the melting material.

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
SOME UNEXPECTED RESULTS OF SHOCK-HEATING XENON, by Per Gloersen. Rept. on Contract AF 04(647)269. 26 Apr 60, 56p. 29 refs. Technical Information Series R60SD364.
Order from LC mi$3.60, ph$9.30 PB 148 654

Results from a detailed experimental study of the structure of pressure-driven, incident shock waves in very pure xenon contained in a thoroughly pumped Pyrex shock tube are presented and discussed. As a result of some optical measurements, the following features of the luminosity delay time were discovered: independence of the pressure in the undisturbed xenon in the range 0.75 to 4.0 mm of Hg, dependence on shock velocity in a way not explainable on the basis of reasonable volume processes alone, and dependence on shock tube diameter.

Stanford U., Calif.
TEMPERATURE STRESSES IN SHELLS CAUSED BY LOCAL HEATING, by W. Flügge and G. E. Strickland, Jr. Rept. on Contract Nonr-225(16). 15 June 59, 88p. 15 refs. Div. of Engineering Mechanics Technical rept. no. 118; AD-228 391.
Order from LC mi$4.80, ph$13.80 PB 147 896

Contents:
The basic equations of a heated shell
Shells of zero Gaussian curvature
Shells of constant Gaussian curvature
A generally applicable iterative solution
Tensor notation used in this work
An approximate equation of heat conduction

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
VISCOSITY OF TWO COMPONENT GASEOUS MIXTURES, by Joseph O. Hirschfelder, Marion H. Taylor, and Taro Kihara. Rept. on Contract DA 11-022-ORD-2526. 8 July 60, 18p. 9 refs. WIS-OOR-29; OOR rept. no. 1898.11-C.
Order from LC mi$2.40, ph$3.30 PB 150 411

The conditions are found where the viscosity of a binary mixture of dilute gases either has a maximum or a minimum with respect to variations in the composition. A maximum in the viscosity is most likely to occur for a mixture of a polar and non-polar gas in which the viscosities of the pure components are nearly equal and their molecular weights are quite different. A minimum should occur for a mixture of two non-polar gases in which both the viscosities and molecular weights of the pure components are nearly equal. There are many experimental examples of maxima in the viscosity but up to the present time no cases have been discovered where the viscosity has a minimum. The maximum value of the viscosity and the mole fraction at which it occurs can be used to determine the energy of interaction between unlike molecules. (Author).

Wave Propagation

Antenna Lab., Ohio State U. Research Foundation, Columbus.
BISTATIC REFLECTION CHARACTERISTICS. Final engineering rept. for 1 May 58-31 Oct 59 on Contract AF 19(604)3501. 1 Nov 59, 14p. 5 refs. Rept. 827-7; AFCRC TR-60-116; AD-234 488.
Order from LC mi$2.40, ph$3.30 PB 149 282

Unclassified research is summarized on work performed on the bistatic radar reflection characteristics of simple shapes. Several analytical methods for approximating the echo area were investigated. An echo-measuring system operating from 8.3 to 12.8 kmc in an anechoic chamber was employed for measurements of bistatic radar cross section. A lens-corrected transmitting horn was designed to permit measurements to be taken at close range while maintaining proper illumination of small scatterers. Measurements at any bistatic angle from 0° to 150° can be made as a continuous function of aspect. A method was developed for accurate measurement of relative echo signal phase by comparison with the phase of a nulling signal used to balance the system. Bistatic echo patterns of simple shape such as spheroids, cones, hemispheres, and combinations of these were measured in the principal scattering planes. All measurements were calibrated by comparison with standard spheres, whose echo areas as a function of bistatic angle can be calculated. A pictorial representation is given of the bistatic cross section of small spheres relative to their geometrical cross section for ka (circumference in wavelengths) from 0.8 to 2.9. (Author)

Center for Radiophysics and Space Research, Cornell U., Ithaca, N. Y.
COMMENTS ON THE PROBLEM OF INCOHERENT SCATTERING, by T. Laaspere. Scientific rept. no. 1 on Contract AF 19(604)6158. 15 Dec 59, 56p. 9 refs. Research rept. RS1; AFCRC-TN-60-124; AD-234 842.
Order from LC mi$3.60, ph$9.30 PB 147 883

Contents:
Scattering due to Doppler shift
Scattering due to irregularities in electron density
Effects of the magnetic field on the spectrum of backscatter
General considerations
The problem of sidebands
Second-order effects
Scattering by moving free electrons
Derivation of the expression for the electric field
Proof that under certain assumptions equal backscattered power is predicted by both approaches
Problems needing clarification
Spectrum of backscatter under the assumption of incoherent scattering by individual electrons
Comments on the problem of addition of powers in radar backscatter
Scattering from a moving string of dipoles
Density fluctuations in an ideal gas
Born's remarks about scattering
A Debye length in three-dimensional problems in mks units.

Centro di Studio per la Fisica Delle Microonde (Italy).
VOLUME DENSITY OF RADIO ECHOES FROM METEOR TRAILS, by N. Carrara, P. F. Checcacci and others. Technical note no. 3 on Contract AF 61(052)227. Oct 59, 24p. 12 refs. AFCRC-TN-60-150; AD-234 545.
Order from LC mi$2.70, ph$4.80 PB 147 886

The volume density of radio echoes from meteor trails has been evaluated by taking into account not only the orientation of the trails, but also the meteor evaporation process and the characteristics of the transmitter-receiver system.

Columbia U. School of Engineering, New York.
RADIO STAR SCINTILLATION AND MULTIPLE SCATTERING IN THE IONOSPHERE, by Dmitri S. Bugnolo. Technical rept. T-5/D on Contract AF 49(638)350. 1 Apr 60, 42p. 10 refs. CU-12-60-AF-350-EE; AFOSR-TN-60-451; AD-237 587.
Order from LC mi$3.30, ph$7.80 PB 148 067

Recent experimental evidence of radio star scintillation indicates that multiple scattering effects are of importance in the ionosphere. It is therefore of interest to apply the transport equation for the expectation of the photon density function to this problem. The solution of the transport equation is used to predict the mean squared scattering angle and corresponding size of the ionospheric irregularities as measured on the earth. The particular example discussed in detail is based on a Gallet model for turbulence in the underside of the F layer under night time conditions. However, it should be noted that the general theoretical results can be applied to any other model as well. (Author)

Columbia U. School of Engineering, New York.
SURFACE WAVES ON RADIALLY INHOMOGENEOUS DIELECTRIC CYLINDERS: FORMULATION OF PROBLEM, by Arvids Vigants. Technical rept. no. 2 on Contract AF 19(604)3879. 1 June 60, 31p. 18 refs. CU-10-60-AF-3879-EE; AFCRC-TN-60-584.
Order from LC mi$3.00, ph$6.30 PB 149 807

Differential equations for Hertz potentials describing surface wave propagation in a medium with circular cylindrical symmetry and radial variation of permittivity have been derived. The equations are in the form of a system of two linear second order differential equations with variable coefficients. Series solutions of the differential equations, valid close to cut-off, have been formulated. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
REFLECTION OF RADIO WAVES FROM THE SUN. by Takeo Hatanaka. Technical rept. no. 2 on Contract Nonr-401(27). 15 Oct 59, 14p. 6 refs. Research rept. EE-450; AD-230 795.
Order from LC mi$2.40, ph$3.30 PB 149 873

The possibility of receiving a radio echo from the sun, especially at a frequency of 400 Mc/s, is discussed. Attenuation in the solar atomosphere, assuming a smooth atmosphere, is found to be so large that no echo is expected from the sun. This is in agreement with previous results where echoes at lower frequencies were predicted. Reflections from prominences and coronal condensations, and incoherent scattering from electrons are also considered, with almost negative results. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
USE OF THE SMITH CHART AND OTHER GRAPHICAL CONSTRUCTIONS IN THE MAGNETO-IONIC THEORY, by G. A. Deschamps and W. L. Weeks. Scientific rept. no. 1 on Contract AF 19(606)5565. 20 Apr 60, 61p. 7 refs. AFCRC-TN-60-468.
Order from LC mi$3.90, ph$10.80 PB 150 095

The complex refractive index of a magnetoionic medium for various directions of propagation is evaluated graphically. Most of the constructions make use of a Smith Chart on which the scales have been suitably relabled. The directions considered are longitudinal, quasi-longitudinal, transverse, and quasi-transverse with respect to the applied magnetic field. The losses are taken into account. The energy transferred to the medium is characterized by conductivity coefficients that are also evaluated graphically. By using an overlay the refractive index is converted into the reflection coefficient at a plane boundary of the medium. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
SOME EFFECTS OF TREES ON LOW ANGLE RADIO PROPAGATION AT A WAVELENGTH OF 10.4 CM, by A. H. LaGrone and C. W. Chapman. Rept. on Contract AF 19(604)5504. 15 July 60, 32p. 4 refs. Rept. no. 6-36; ERD-TN-60-766.
Order from LC mi$3.00, ph$6.30 PB 149 977

Results are reported of measurements made at very low angles of 2, 880 mcps signals over wooded areas with the elevation angle to the transmitter the principal variable. A narrow beam receiving antenna was used to observe the effect of the trees on the apparent location of the signal source. Various measurements were made on the effects of a single large tree on the signal. A hypothetical direction finding system was assumed and its pointing characteristics determined. Theoretical curves were computed and were presented to assist in the evaluation of sights selected for low angle direction finding systems. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
REMARKS CONCERNING THE DETERMINATION OF ELECTRON DISTRIBUTION IN THE IONOSPHERE BY MEANS OF RADIO SOUNDINGS, by Irvin Kay. Rept. on Contract AF 19(604)3495. Nov 59, 11p. 9 refs. Research rept. no. EM-149; AFCRC-TN-59-978; AD-233 306.
Order from LC mi$2.40, ph$3.30 PB 148 987

Institute of Mathematical Sciences, New York U., N. Y.
THE VIRTUAL MASS OF A FINITE CONICAL SHELL, by Ellis J. Rich and Samuel N. Karp. Rept. on Contract AF 19(604)5238. May 60, 17p. 5 refs. Research rept. no. EM-158; AFCRC-TN-60-393.
Order from LC mi$2.40, ph$3.30 PB 150 055

The purpose of this paper is to obtain a solution of a hitherto unsolved problem in fluid flow, particularly, in the way a finite conical shell affects the flow of fluid in which the direction of travel at infinity is parallel to the axis of the cone. The solution has applications not only in fluid dynamics but also in the calculation of the scattering of an electromagnetic wave by such a cone at low frequency, the latter being of current technological interest. The principal results obtained are a formula for the dipole coefficient at infinity, and for a related quantity, the virtual mass, in terms of the cone angle. A subsidiary result is the expression of the velocity potential at all points of space. (Author)

Navy Electronics Lab., San Diego, Calif.
ATMOSPHERIC REFRACTION ERROR IN RADAR ELEVATION ANGLES, by W. F. Moler and E. E. Gossard. Rept. for 1 July 56-1 May 57. 12 July 57, 24p. 4 refs. Research rept. no. 795; AD-205 222.
Order from LC mi$2.70, ph$4.80 PB 147 572

The theory of radar range and angular tracking errors for high elevation angles is reviewed. Several modifications of the theory, for use in practical applications, are introduced. It is shown that the surface refractive index can be used to predict angular error for targets above 10^5 feet for ground-sited radars. Radiosonde data from five arctic stations were analyzed in terms of frequency distribution of angular error by seasons. Radiosonde data previously analyzed by the Air Defense Command Forecast Center were used to obtain approximate frequency distributions of angular error for stations along the northern border of the United States. Surface weather observations taken hourly from three arctic stations were

analyzed to determine the period and magnitude of angular error changes for periods shorter than those which could be analyzed from the radiosonde data. (Author)

National Bureau of Standards, Boulder, Colo.
LOW- AND VERY LOW-RADIOFREQUENCY MODEL IONOSPHERE REFLECTION COEFFICIENTS, by J. R. Johler, L. C. Walters, and J. D. Harper, Jr. 1 July 60, 139p. Technical note no. 69.
Order from OTS $2.00 PB 161 570

The results of extensive computations performed during the course of a theoretical investigation of a sharply bounded model ionosphere for low- and very low-radiofrequency wave propagation are presented in the form of graphs and tables. (Author)

National Bureau of Standards, Boulder, Colo.
RADIO REFRACTOMETRY, by Jack W. Herbstreit. June 60, 20p. 44 refs. Technical note no. 66.
Order from OTS $0.50 PB 161 567

The measurement of the radio refractive index properties of the atmosphere and the application to radio propagation problems is the subject of this paper.

Navy Electronics Lab., San Diego, Calif.
AN ANNOTATED BIBLIOGRAPHY OF LITERATURE PERTINENT TO TROPOSPHERIC SCATTER PROPAGATION, 1945-1957, by N. R. Ortwein. Rept. for Dec 57-June 58. 4 Aug 58, 28p. 113 refs. Research rept. 858; AD-216 127.
Order from LC mi$2.70, ph$4.80 PB 147 571

Norwegian Defence Research Establishment.
SOME PROPERTIES OF THE REGULAR AND IRREGULAR IONOSPHERIC LAYERS NEAR THE AURORAL ZONE, by Bernt Maehlum. Rept. on Contract AF 61(514)937. Mar 59, 59p. 7 refs. NDRE rept. no. 29; AFCRC-TN-60-152; AD-234 543.
Order from LC mi$3.60, ph$9.30 PB 147 881

Some studies of the ionospheric layers are reported as observed near the auroral zone. The statistical behavior of the layers E, F1 and F2 is also treated. Studies of the irregular layers Es and Fs are presented. A short study of the occurrence of polar blackouts is given. (Author)

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
A MAGNETICALLY INSULATED SHOCK TUBE, by Richard G. Fowler and Eugene B. Turner. Rept. on Contract AF 04(647)309. [1959] 48p. 7 refs. STL/TR-60-0000-09180.
Order from LC mi$3.30, ph$7.80 PB 149 762

This report describes experimental results obtained with a magnetically insulated shock tube. The one-inch diameter tube is enclosed by a solenoid field coil which produces a longitudinal magnetic field of up to 20,000 Gauss throughout both the electrical discharge and expansion chambers. Peak currents of up to 95,000 amperes are produced in the discharge tube by a 50 μf capacitor bank charged up to about 8 kv. The electrical characteristics of the discharge were determined from voltage and current signals. The magnetic field was found to substantially reduce the attenuation of the shock wave moving down the tube, presumably by a reduction of the boundary layer thickness behind the shock wave. With a magnetic field strength of 7500 Gauss and higher, a contact surface, such as occurs in diaphragm type shock tubes, is clearly defined in the wave speed pictures, while at zero and low magnetic field strengths the contact surface is not visible. There was evidence from the reflected shock velocities and from the convex shape of the shock front that the magnetic field was inhibiting the degrees of freedom perpendicular to the field lines resulting in a gas with a higher effective γ. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A RAPID BEAM-SWINGING EXPERIMENTIN TRANS-HORIZON PROPAGATION, by A. T. Waterman, Jr. Rept. on Contract DA 36-039-sc-73151. 23 July 58, 10p. 9 refs. Technical rept. no. 770-1; AD-203 173.
Order from LC mi$1.80, ph$1.80 PB 149 404

By using a broadside phased array for an antenna, a narrow beam can be swung, rapidly and in quick succession through a limited sector by fast control of the phasing, rather than by movement of the entire antenna structure. This technique is used at the receiving end of a 101-mile beyond-the-horizon transmission path in order to probe the portion of the troposphere through which the signal is propagated. At the frequency employed of 3.12kMc, a 0.49^{o} beam is swung in azimuth through a 4.2^{o} sector each tenth of a second. A variety of phenomena are observed with this technique which have not been directly apparent in slower beam-swinging experiments.

Stanford Electronics Labs., Stanford U., Calif.
SOME PROPERTIES OF RADIO WAVES REFLECTED FROM THE MOON AND THEIR RELATION TO THE LUNAR SURFACE, by Tor Hagfors. Scientific rept. no. 8 on Contract AF 19(604)2193. 8 Aug 60, 30p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 150 239

This report presents a theoretical discussion of the statistical properties of radio waves reflected from the moon. This discussion is based on the assumption of a large number of scattering areas simultaneously contributing to the signal. The properties of the echoes are usually described in terms of pulse broadening or by means of an average-power pulse-response when very short pulses are transmitted. Here it is shown that the same type of information may be obtained by studying the correlation of complex amplitudes of two sine waves reflected from the moon at frequencies separated by $\Delta\omega$. By studying this correlation as a function of $\Delta\omega$ it is possible to compute the power pulse response of the earth-moon-earth propagation circuit. It is suggusted that this method will prove particularly useful in the study of the surface properties of distant targets such as the planets of our solar system. It is also shown how the correlation technique can be extended to a two-dimensional mapping of a rotating rough body. (Author).

Stanford Electronics Labs., Stanford U., Calif.
THE USE OF NOSE WHISTLERS IN THE STUDY OF THE OUTER IONOSPHERE, by R. L. Smith, Technical rept. no. 6 on Contract AF 18(603)126. 11 July 60, 127p. 85 refs. AFOSR-TN-60-861.
Order from LC mi$6.30, ph$19.80 PB 149 752

Electromagnetic energy at very low frequencies can be propagated from one hemisphere to the other along the earth's magnetic field lines in the outer ionosphere. The action of free electrons disperses the original impulse-like signal (from a lightning discharge) to form descending gliding tones, called whistlers. If the highest frequency of the whistler is comparable with the minimum electron gyrofrequency along the propagation path, the dispersion at the higher frequencies causes rising tones which are contiguous with the descending tones at the lower frequencies. The whistler is then called a "nose" whistler. Spectrographic analysis of whistlers and nose whistlers often reveals a number of pure isolated components which have a common source. Examination of whistler data and a new theory of the propagation path lead to the conclusion that each component represents energy from the lightning source which has been trapped in a field-aligned column of enhanced ionization in the outer ionosphere. The data indicate that the lifetime of these columns is a few hours. The theory suggests that enhancements of approximately five per cent are sufficient to explain the observed whistlers. The theory further indicates that the average group velocity of energy trapped in a column can be closely approximated by assuming that the energy travels along the maximum of ionization in the column with wave normals aligned with the magnetic field. The frequency of minimum time delay, called the nose frequency, indicates the location of the field line path. The minimum time delay gives a measure of the ionization density in the region near the top of the path. Examination of nose whistler data from a number of stations leads to a model of electron density in the outer ionosphere. The data also show an annual variation of 2:1 in the ionization density during sunspot maximum. (Author).

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
MARK I PERCEPTRON OPERATORS' MANUAL, by John C. Hay, Ben E. Lynch and others. Rept. on Proj. PARA, Contract Nonr-2381(00). 15 Feb 60, 62p. 6 refs. Rept. no. VG-1196-G-5; AD-236 965.
Order from OTS $1.75 PB 161 997

This report released for sale to the public 16 Sep 60 (USGRR, v. 34, p. 350)

The Mark I Perceptron is a pattern learning and recognition device. It is intended as an experimental tool for the direct study of a limited class of perceptrons. This manual is intended primarily as a guide to the setting up and operation of the machine. It does not require extensive familiarity with the theory of perceptron systems. For those familiar with the theory, but not necessarily concerned with actually operating the machine, the manual should serve to indicate the machine's potentialities as a research instrument.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ON THE CONVERGENCE OF REINFORCEMENT PROCEDURES IN SIMPLE PERCEPTRONS, by Frank Rosenblatt. Rept. on Project PARA, Contract Nonr-2381(00). 15 Feb 60, 72p. 9 refs. Rept. no. VG-1196-G-4 and amendments 1, 2; AD-234 874.
Order from OTS $2.00 PB 161 996

This report released for sale to the public 16 Sep 60, (USGRR, v. 34, p. 350)

Previous reports have described a number of theoretical nerve nets called perceptrons, and have attempted to analyze their ability to associate responses to stimuli using a variety of training procedures and memory functions. Proofs have been found for a number of theorems of fundamental importance for the theory of such networks. The main findings are summarized: (1) there exist certain simple memory functions and training procedures by which it can be guaranteed that a perceptron will ultimately arrive at a solution to any given response-association problem; (2) a variety of problems are shown to be soluble; (3) the same procedures which yield solutions for binary classification problems can be employed to assign arbitrary response functions to stimuli; and (4) a considerable variety of perceptron models, differing from one another in the transfer functions of their association units, are shown to be identical with respect to their ability to arrive at solutions to learning problems. Included are amendment 1 (Technical memo. no. 12, AD-236 736), and amendment 2, Improved Error Correction Procedure, (Technical memo. no. 13).

Institute for the Study of Metals, U. of Chicago, Ill.
HIGH PRESSURE RESEARCH, SERIES II. Annual rept. no. 3, Series 2, Oct 58-Oct 59, on Contract Nonr-2121(03). [1959] 87p. 103 refs.
Order from LC mi$4.80, ph$13.80 PB 149 485

Contents:
On the dynamical theory of diffusion in crystals. III. Some model calculations and relation to continuum theory
Preliminary experiment on the quenching of lattice defects in noble metals under hydrostatic pressure up to 8500 bars
Diffusion measurements under pressure in the temperature range 800-1000°C
Internal friction in iron at low temperatures
The formation of an amorphous form of quartz under shock conditions
A note on the behavior of iron under static high pressures
Diffusion of cadmium in pure and cadmium doped AgBr
The relation between the Eyring and Doolittle diffusion equations
The effect of pressure on self-diffusion in lead
A new device for obtaining X-ray diffraction patterns from substances exposed to high pressure
A high-pressure microwave window
Diffusion of impurities in amorphous polymers
(See also PB 143 063)

Institute of Mathematical Sciences, New York U., N. Y.
TOPICS IN THE THEORY OF DISCRETE INFORMATION CHANNELS, by Richard A. Silverman and Sze-Hou Chang. Rept. on Contracts AF 19(604)5238 and AF 19(604)3053. Apr 60, 45p. 17 refs. Research rept. no. EM-152; AFCRC-TN-60-366.
Order from LC mi$3.30, ph$7.80 PB 150 034

The present article discusses various topics in the theory of discrete information channels, including the general binary channel, channels with fading, cascaded channels, and channels with memory. (Author)

Statistical Techniques Research Group, Princeton U., N. J.
AUTOCORRELATION ANALYSIS AND THE DESIGN OF EXPERIMENTS, by G. M. Jenkins and J. Chanmugam. Technical rept. no. 37 on Contract DA 36-034-ORD-2297. June 60, 76p. 26 refs. OOR rept. no. 1715:34; AD-239 911.
Order from LC mi$4.50, ph$12.30 PB 150 403

These are many examples in industry and in the sciences of situations where the uncontrolled variation in the observed responses is subject to autocorrelation when the independent variables are kept constant. The present work is concerned with the investigation into the effect of this autocorrelation on the strategy of experimentation.

Communication Theory

Applied Mathematics and Statistics Labs., Stanford U., Calif.
SPECTRAL ANALYSIS OF A PROCESS OF RANDOMLY DELAYED PULSES, by M. V. Johns, Jr. Technical rept. no. 51 on Contract N6onr-25140. 10 Oct 59, 15p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 149 944

The purpose of this report is to obtain formulae for the covariance and asymptotic spectral distribution functions of a process consisting of a sequence of pulses separated by random time delays.

Ohio State U. Research Foundation, Columbus.
ORTHOGRAPHIC REPRESENTATIONS OF ENGLISH PRONUNCIATION AS AN AID IN TEACHING ILA, by Henry M. Moser, Herbert J. Oyer, and Wallace C. Fotheringham. Technical rept. no. 56 on Contract AF 19(604)4575. Dec 59, 110p. AFCRC-TN-59-75.
Order from LC mi$5.70, ph$16.80 PB 150 248

Specially devised orthographies in Chinese, Dutch, French, German, Italian, Japanese, Korean, Spanish, and Thai were constructed for a list of common English aviation words as an aid to their pronunciation by foreign nationals. Those prepared for German, Japanese, and Spanish were employed with native speakers of these three languages at the AF Language School, Lackland AFB, Texas. It was found that for each of these three groups, the specially designed orthographies, with or without the additional aid of auditory stimulation, resulted in significantly more intelligible pronunciations than the reading of these aviation words from only a printed list. Additionally, each individual speaker in this study improved the intelligibility of his pronunciations when aided by the appropriate orthography. The comparative value of orthography alone vs. orthography plus auditory stimulation varies considerably among language groups. The average improvement would make a distinguishable difference in the air traffic communication setting. (Author)

Photographic Equipment

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BALLISTIC CAMERA (BC-4) SYNCHRONIZATION SYSTEM, by Ralph E. A. Putnam. May 60, 37p. 2 refs. Rept. no. 1108; AD-240 010.
Order from LC mi$3.00, ph$6.30 PB 149 765

Prospects for utilizing ballistic cameras in precision tracking of missiles and satellites, as well as in geodetic work, have been enhanced by the development of a high precision camera (Wild BC-4) with optical properties suitable for these applications. While these cameras have proved useful in night-time tracking of targets carrying short duration flashing lamps, full utilization of their potential capabilities has been restricted by lack of means to synchronize exposures of widely spaced cameras to the high degree of accuracy necessary. This report describes a synchronization system developed for these cameras, and presents test data on a laboratory setup of the essential system elements.

Johns Hopkins U., Baltimore, Md.
INCREASED FIELD DEPTH IN TRACK PHOTOGRAPHY BY MEANS OF SPHERICAL ABERRATION, by F. Rasetti. Rept. on Contract AF 18(603)143. May 60, 5p. AFOSR-TN-60-531.
Order from LC mi$1.80, ph$1.80 PB 149 359

A considerable increase in depth of field for a given luminosity of the lens can be obtained by using a lens provided with convenient spherical aberration instead of a perfectly corrected lens.

SOCIAL SCIENCES

Documentation

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
TEST PROGRAM FOR EVALUATING PROCEDURES FOR THE EXPLOITATION OF LITERATURE OF INTEREST TO METALLURGIST. II. ACQUISITION OF DOCUMENTS FOR MACHINE SEARCHING, by Allen Kent, Alan M. Rees and Jessica Melton. Rept. on National Science Foundation Grant NSF-G-10338. [1960] 47p.
Order from LC mi$3.30, ph$7.80 PB 149 845

In order to permit a significant test, it was necessary first to expand substantially the subject coverage of the service to provide literature of interest to metallurgists. The activity involved in this preparatory program include identification and acquisition of documents of potential interest.

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
TEST PROGRAM FOR EVALUATING PROCEDURES FOR THE EXPLOITATION OF LITERATURE OF INTEREST TO METALLURGISTS, III, ANALYSIS AND QUALITY CONTROL, by Allen Kent, Jessica Melton, and Alan M. Rees. Rept. on National Science Foundation Grant NSF-G-10338. [1960] 54p 4 refs.
Order from LC mi$3.60, ph$9.30 PB 150 260

In two earlier reports, there were described the background and plans and the acquisitions program of the ASM mechanized searching service which is to be evaluated. The present report covers the procedures for analysis and quality control of abstracts of documents included in this service, and discusses the alterations in procedures that have been necessitated by the expansion of the service to fields allied to, but outside of the core of metallurgy. (Author).

Michelson Labs., Naval Ordnance Test Station, China Lake, Calif.
WRITING THE TECHNICAL ARTICLE: A MATTER OF DESIGN, by Gerard A. Pottebaum. July 60, 12p. 6 refs. Technical Article 6; NOTS TP-2432.
Order from LC mi$2.40, ph$3.30 PB 150 169

This article discusses some fundamental practices that apply in both fiction and exposition. The design of the formal report is briefly reviewed, the design of the article is analyzed, and the two are compared. (Author)

Office of Scientific Research and Development.
MICROFILM INDEX. 1946, declassified 24 Aug 60. 770p. 18000 refs.
Order from OTS $8.00 ($10.00 foreign) PB 161 976

This volume is an index of the technical laboratory and field reports and other reference material which appeared in the bibliographies for the Summary Technical Reports of NDRC. It is divided into three separate sections: (1) a microfilm index and bibliographical listing of reports for each division, panel, and committee; (2) a cross reference composed of microfilm index headings and items culled from information contained in the report titles; and (3) a microfilm reel catalogue.

Zator Co., Cambridge, Mass.
SOME MATHEMATICAL FUNDAMENTALS OF THE USE OF SYMBOLS IN INFORMATION RETRIEVAL, by Calvin N. Mooers. Rept. on Contract AF 30(602)1900 Apr 59, 22p. 10 refs. ZTB-123; RADC-TN-59-133; AD-213 782.
Order from LC mi$2.70, ph$4.80 PB 147 541

A mathematical model and formalism is presented for the process of gaining information through observation, reporting the information, and retrieving it. The model makes use of observational operators H acting upon a hypothetical space of events $\{e\}$. A digital representation of the events and operators is introduced and a formalism of their interaction is developed. The action of the operators H on $\{e\}$ is shown to produce open sets. In terms of the open sets, the possibility of achieving smoothness or continuity in the transformation from the imagined event p prescribing retrieval to the retrieved information is developed. A number of theorems result.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS. Nov 60.
Order from OTS $1.25, $10.00/year PB 161 287

Contents:
Articles:
Multichannel, Multicolor Oscilloscope, by S. H. Hersh
Summary of Rocket Astronomy and Astrophysics Research at NRL (March 1959-October 1960), Staff Written
Scientific program:
Atmosphere and Astrophysics: Measurement of water vapor distribution in the stratosphere
Chemistry: Radiant transfer of heat and the thermal conductivity of "flinak". Anodic oxidation of the Ag-Ag_2O electrode in alkaline solutions. Isothermal study of the concentration and transport of radioactive steel components in liquid lithium. Removal of organic contaminants from the atmosphere of a submarine by a sodium zeolite (Type 13X molecular sieve)
Mechanics: Effect of chamfered bolt holes on bolts in shear under dynamic load. Dynamics of the lower yield strength of mild steel. Thermoelectric power of indium-lead alloys
Metallurgy and Ceramics: Validity of a cyclic heating-cooling method of measuring the electronic specific heat of nickel-palladium alloys. New method for analyzing small, metallic, irradiated specimens. Thermodynamic analysis of solubility in liquid metal systems
Optics: Photometry at low levels of intensity. A closed-circuit TV system for passive use at night
Radio: Ocean wave-profiling radar system. Electrical breakdown in high vacuum (electron tubes)
Solid-State Physics: Variation of effective mass ratio with magnetic field for InAs at room temperature. Model for describing the effect of pressure on the absorption and emission spectra of alkali halide phosphors
Sound: Digital amplitude probability distribution analyzer. Effect of hydrostatic pressure on ten groups of electrical and electronic components to be used in oceanographic experiments

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General

Report number series. Used by the Office of Technical Information in Cataloging Reports. Report number system, by F. E. Stratton. Office of Technical Information Extension, Oak Ridge, Tenn. Aug 60. 23p. Order from OTS. 50 cents. TID-85 (2nd Rev., Suppl.)

Biology and Medicine

Description of facilities and mechanical components medical research reactor (MRR), by J. B. Godel. Brookhaven National Laboratory, Upton, New York. Feb 60. 64p. Order from OTS. $1.75. BNL-600 (T-173)

Biological effects of Sr^{90} in miniature swine. I. Experimental designs and preliminary observations, by W. J. Clarke and J. R. McKenney.. Hanford Atomic Products Operation, Richland, Wash. Jan 60. Contract AT(45-1)-1350. 10p. Order from OTS. 50 cents. HW-63499

Literature search on the relative biological effectiveness (RBE) of ionizing radiations, by W. H. Langham, and others. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Mar 60. Contract W-7405-ENG-36. 251p. Order from OTS. $3.50. LAMS-2343

Biology and Medicine semiannual report for October 1959 through March 1960, by J. H. Lawrence and A. Pfau. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. 210p. Order from OTS. $3.00. UCRL-9235

Relation of adrenal cortical volume to survival following x-irradiation, by A. P. Casarett and F. T. Brayer. The University of Rochester, Rochester, N. Y. June 60. Contract W-7401-eng-49. 31p. Order from OTS. 75 cents. UR-574

Chemistry—General

Analysis of yttrium metal and yttrium oxide (No. 3 of a Series), by J. O. Hibbits and others. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati 15, Ohio. July.60. Contracts AT(11-1)-171 and AF 33(600)-38062. 15p. Order from OTS. 50 cents. APEX-571

Measuring the release of short-lived fission gases during capsule irradiations, by C. W. Townley and other. Battelle Memorial Institute, Columbus, Ohio. Sep 60. Contract W-7405-eng-92. 9p. Order from OTS. 50 cents. BMI-1466

X-ray spectrographic determination of potassium, uranium, and thorium in pyrochemical samples, by M. C. Lambert. Hanford Atomic Products Operation, Richland, Wash. June 60. Contract AT(45-1)-1350. 23p. Order from OTS. 75 cents. HW-65801

A high-temperature vacuum extensometer, by J. R. Bohn and G. Murphy. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. July 60. Contract W-7405-eng-82. 24p. Order from OTS. 50 cents. IS-167

Performance characteristics of an electromagnetic pump, by D. H. Thompson and R. W. Fisher. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. Aug 60. Contract W-7405-eng-82. 49p. Order from OTS. $1.25. IS-188

The heats of fusion of the cadmium halides, mercuric chloride, and bismuth bromide, by L. E. Topol and L. D. Ransom. Atomics International A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 60. Contract AT(11-1)-GEN-8. 7p. Order from OTS. 50 cents. NAA-SR-5111

A vibrational potential function for symmetrically substituted biphenyls, by R. H. Shudde and G. W. Lehman. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Aug 60. Contract AT(11-1)-GEN-8. 19p. Order from OTS. 50 cents. NAA-SR-5153

Thermal decomposition of uranyl sulfate, by K. J. Notz, Jr. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Mar 60. Con-AT(30-1)-1156. 48p. Order form OTS. $1.25. NLCO-814

Dichlorobenzidine as a curing agent for adiprene L-100, by A. J. Quant. Sandia Corporation, Albuquerque, N. Mex. Sep 60. 14p. Order from OTS. 50 cents. SCR-187

Master Analytical Manual. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 60. 612p. Order from OTS. $6.75. TID-7015 (Suppl. 2)

Micro determination of carbon in metals, by J. W. Frazer and R. T. Holzmann. University of California, Lawrence Radiation Laboratory, Livermore, Calif. June 60. Contract W-7405-eng- 48. 7p. Order from OTS. 50 cents. UCRL-6020

Analysis of current distribution in electrolytic cells with flowing mercury cathodes, Thesis, by E. A. Grens II. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. July 60. Contract W-7405-eng-48. 78p. Order from OTS. $2.00. UCRL-9187

Fractional crystallization from melts, by W. R. Wilcox. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 239p. Order from OTS. $3.00. UCRL-9213

The electronic structure of octahedrally coordinated protactinium (IV). Thesis, by J. D. Axe. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. July 60. Contract W-7405-eng-48. 68p. Order from OTS. $1.75. UCRL-9293

The effect of angular momentum on fission probability. Thesis, by J. Gilmore. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. July 60. Contract W-7405-eng-48. 84p. Order from OTS. $2.00. UCRL-9304

The performance of base-form ion exchangers for pH control and removal of radioisotopes from a pressurized water reactor system, by G. P. simon, C. S. Abrams, and W. T. Lindsay, Jr. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. July 60. Contract AT-11-1-GEN-14. 69p. Order from OTS. $1.50. WAPD-TM-215

Air lift pumps - characteristics and application to liquid-liquid extraction systems, by J. S. Hurst. Union Carbide Nuclear Company, Division of Union Carbide Corporation, Y-12 Plant, Oak Ridge, Tenn. May 60. Contract W-7405-eng-26. 23p. Order from OTS. 50 cents. Y-1304

Chemistry—Radiation and Radiochemistry

Photoproduction of calcium-47, by M. S. Foster, D. L. Weaver and A. F. Voigt. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. Aug 60. Contract W-7405-eng-82. 16p. Order from OTS. 50 cents. IS-184

Chemistry—Separation Processes for Plutonium and Uranium

The fluorination of uranium from dried solids and its application to the fluoride volatility process, by C. E. Johnson and J. Fischer. Argonne National Laboratory, Argonne, Ill. Aug 60. Contract W-31-109-eng-38. 19p. Order from OTS. 50 cents. ANL-6117

Reprocessing of power reactor fuels. Ninth quarterly progress report for October 1, 1959 to January 1, 1960, by L. H. Meyer and others. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. C. Mar 60. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-479

Study of the feasibility of aqueous recovery of spent fuels. Part 4. Equipment design data, by R. J. Annesser and others. University of Michigan, Engineering Research Institute, Ann Arbor, Mich. July 54. Decl. August 22, 1960. 295p. Order from OTS. $1.60. ERI-2240-4-F

Study of the feasibility of aqueous recovery of spent fuels. Part 7. Analysis of costs and engineering evaluation of results of study, by J. G. Lewis and H. A. Ohlgren. University of Michigan, Engineering Research Institute, Ann Arbor, Mich. July 54. Decl. August 24, 1960. 144p. Order from OTS. 80 cents. ERI-2240-7-F

Nitric acid dissolution of uranium-aluminum alloy, by R. E. Burns and C. H. Holm. Hanford Works, Nucleonics Division, Richland, Wash. Aug 52. Decl. August 12, 1960 Contract W-31-109-Eng-52. 19p. Order from OTS. 30 cents. HW-18414

Darex pilot plant studies, by J. J. Shefcik. Hanford Atomic Products Operation, Richland, Wash. Feb 60. Contract AT(45-1)-1350. 34p. Order from OTS. $1.00. HW-64010

Yankee band cutting, by V. L. Hammond and V. P. Kelly. Hanford Atomic Products Operation, Richland, Washington. June 60. Contract AT (45-1)-1350. 20p. Order from OTS. 50 cents. HW-65380

Idaho Chemical Processing Plant technical progress report for January through March 1960, by C. M. Slansky and others. Phillips Petroleum Company, Idaho Falls, Idaho. July 60. Contract AT(10-1)-205. 61p. Order from OTS. $1.50. IDO-14520

Processing of high-fired uranium dioxide fuels by a reduction--mercury extraction--oxidation process, by A. F. Messing and O. C. Dean. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-25. 13p. Order from OTS. 50 cents. ORNL-2909

Recovery of uranium from DI (2-ethylhexyl) phosphoric acid (Dapex) extractant with ammonium carbonate, by F. J. Hurst and D. J. Crouse. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 19p. Order from OTS. 50 cents. ORNL-2952

Controlled Thermonuclear Processes

Crowbar code, by D. A. Baker and L. W. Mann. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. May 60. Contract W-7405-ENG-36. 32p. Order from OTS. 75 cents. LAMS-2435

Quarterly report covering the period January 1 through March 31, 1960, by K. Bernstein and others. Project Matterhorn, Princeton University. Princeton, N. J. Sep 60. Contract AT(30-1)-1238. 32p. Order from OTS. 75 cents. MATT-Q-10

Diagnostic methods for space potentials in ion beams, by T. O. Passell. University of California, Lawrence Radiation Laboratory, Livermore, Calif. Feb 60. Contract W-7405-eng-48. 44p. Order from OTS. $1.25. UCRL-5819-T

Electron beam pinch. Thesis by E. R. Horton and R. L. Spoerlein. University of California, Lawrence Radiation Laboratory, Livermore, Calif. June 60. Contract W-7405-eng-48. 27p. Order from OTS. $1.00. UCRL-6011

Instability of a positive column in a magnetic field, by T. K. Allen, G. A. Paulikas, and R. V. Pyle. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. 22p. Order from OTS. 50 cents. UCRL-9110

Criticality Studies

Results of critical experiments in loose lattices of UO_2 rods in H_2O, by V. E. Grob and others. Westinghouse Electric Corporation, Atomic Power Department, Pittsburgh, Pa. Mar 60. Contract AT(30-1)-2176. 51p. Order from OTS. $1.50. WCAP-1412

Equipment, Methods and Techniques

Status of Sandia Laboratory hypersonic facilities, by R. C. Maydew. Sandia Corporation, Albuquerque, N. Mex. Aug 60. 15p. Order from OTS. 50 cents. SCR-230

Enclosure and sealing methods, by G. S. Wallace. Sandia Corporation, Albuquerque, N. Mex. July 60. 23p. Order from OTS. 75 cents. SCTM-184-60(25)

Capability improvement study of a tracer-controlled duplicating lathe, by E. B. Del Grande and other others. Union Carbide Nuclear Company, Y-12 Plant, Oak Ridge, Tenn. Apr 60. Contract W-7405-eng-26. 53p. Order from OTS. $1.25. Y-1297

Geology and Mineralogy

Airborne and ground reconnaissance in the Espanola area, Sante Fe County, New Mexico, by G. E. Collins and R. E. Freeland. Production Evaluation Division, , Grand Junction Operations Office, Denver, Colo. Oct 56. 16p. Order from OTS. 50 cents. RME-1075 (Rev.)

Health and Safety

Metal recovery plant radiation report for January to March, 1957, by C. D. Hylton. Oak Ridge National Laboratory, Oak Ridge, Tenn. Oct 57. Decl. July 26, 1960. Contract W-7405-eng-26. 6p. Order from OTS. 25 cents. ORNL-2359

A system for automated presentation of a vigilance task and recording of subject performance, by H. E. Anderson. Sandia Corporation, Albuquerque, N. Mex. July 60. 17p. Order from OTS. 75 cents. SCTM-188-60(14)

Inspection of a fire-damaged radiation source, by P. W. Howe, J. E. Rainey, and H. F. Soule. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 11p. Order from OTS. 50 cents. UCRL-9291

Instruments

Logarithmic spiral light pipe for scintillators, by W. C. Kaiser, A. J. MacKay and W. W. Managan. Argonne National Laboratory, Argonne, Ill. Aug 60. Contract W-31-109-eng-38. 11p. Order from OTS. 50 cents. ANL-6196

A precision current integrator, by I. T. Myers and G. T. Orton. Hanford Atomic Products Operation, Richland, Wash. Feb 60. Contract AT(45-1)-1350. 11p. Order from OTS. 50 cents. HW-65802

Revised neutron flux, spectrum, and tissue dose measurements at the Godiva II critical assembly, by J. A. Sayeg. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Sep 60. Contract W-7405-ENG-36. 23p. Order from OTS. 50 cents. LA-2432

A multichannel digital recording system, by R. W. Truitt. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 60. Contract AT(11-1)-GEN-8. 21p. Order from OTS. 50 cents. NAA-SR-5354

Instrumentation and controls division semiannual progress report for period ending July 31, 1953, by C. J. Borkowski. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 54. Decl. May 10. 1960. Contract W-74-5-eng-26. 33p. Order from OTS. 40 cents. ORNL-1694

A method for calculating the cutting force component parallel to the plane of motion of the cutter, by C. I. Millard. Sandia Corporation, Albuquerque, N. Mex. Aug 60. 6p. Order from OTS. 50 cents. SCDR-204-60

An investigation of long-term stability of zener voltage references, by R. P. Baker and J. Nagy, Jr. Sandia Corporation, Albuquerque, N. Mex. June 60. 21p. Order from OTS. 75 cents. SCR-194

Inertial power supplies for ballistic missile reentry vehicles, by R. J. Martin. Sandia Corporation, Albuquerque, N. Mex. July 60. 15p. Order from OTS. 50 cents. SCR-219

A method for ascertaining the effect of large targets present in terrain return signals, by D. M. Gragg. Sandia Corporation, Albuquerque, N. Mex. Sep 54. 12p. Order from OTS. 50 cents. SCTM-187-54(54)

Pulse response of terrain return program receivers, by F. J. Janza, R. A. Hessemer, Jr., and C. S. Williams, Jr. Sandia Corporation, Albuquerque, N. Mex. Sep 54. 14p. Order from OTS. 50 cents. SCTM-208-54(54)

Instrumentation application of carrier-erase magnetic-tape recording, by R. S. Reynolds. Sandia Corporation, Albu querque, N. Mex. Aug 60. 10p. Order from OTS. 50 cents. SCTM-237-60(52)

Low noise amplifiers for use with solid state detectors, by J. L. Blankenship and others. Oak Ridge National Laboratory, Union Carbide Nuclear Company, Oak Ridge, Tenn. and Office of Technical Information Extension, Oak Ridge, Tenn. Aug 60. 41p. Order from OTS. 50 cents. TID-6119

Metallurgy and Ceramics

The response of concrete shear keys to dynamic loading, by E. G. Nawy and J. M. Shah. Massachusetts Institute of Technology, Cambridge, Mass. Jan 59. Contract AT(29-2)-616. 65p. Order from LC. Mi $3.90, ph $10.80. AECU-4562

Behavior of bond under dynamic loading, by A. A. Lippins. Massachusetts Institute of Technology, Department of Civil and Sanitary Engineering, Cambridge, Mass. Sep 59. Contract AT(29-2)-616. 101p. Order from LC. Mi $5. 70, Mi $16.80. AECU-4563

Thorium bismuthide--ultrasonic control of crystal size. Aeroprojects, Inc., West Chester, Pa. Mar 59. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4605

Review of the intermetallic compounds of plutonium, by F. H. Ellinger. Los Alamos Scientific Lab., Los Alamos, N. Mex. 1959. 49p. Order from LC. Mi $3.30, ph $7.80. AECU-4629

A survey of non-fuel-bearing materials for the marine gas-cooled reactor, by J. C. Bokros, L. Dijkstra, and U. Merten. General Atomic Div., General Dynamics Corporation, San Diego, Calif. May 58. Contract AT(04-3)-187. 52p. Order from LC. Mi $3.60, ph $9.30. AECU-4692

Results of experiments made with U.S.B.M. electrocerium, by W. N. Miner. Los Alamos Scientific Laboratory, N. Mex. Feb 59. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4669

Electron diffraction study of the removal and formation in vacuo of oxide films on uranium and plutonium, by J. T. Waber, C. Olsen, and D. D. Whyte. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. 1959. 29p. Contract W-7405-eng-36. 29p. Order from LC. Mi $2.70, ph $4.80. AECU-4742

The manufacture of centrifugally cast alloy fuel slugs (Mark-II fuel loading for EBR-I), by F. L. Yaggee. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 37p. Order from OTS. $1.00. ANL-5724

Examination of irradiated EBWR Core-I fuel elements, by C. F. Reinke and R. Carlander. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 31p. Order from OTS. 75 cents. ANL-6091

The adiabatic elastic moduli of single-crystal alpha uranium at 25°C, by E. S. Fisher. Argonne National Laboratory, Argonne, Ill. June 60. Contract W-31-109-eng-38. 91p. Order from OTS. $2.00. ANL-6096

A study of irradiation effects in type "A" nickel and type 347 stainless steel tensile specimens, by S. H. Paine, W. F. Murphy and D. W. Hackett. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 43p. Order from OTS. $1.00. ANL-6102

Self-diffusion in Beta uranium, by S. J. Rothman, J. Gray, Jr., J. P. Hughes, and A. L. Harkness. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 20p. Order from OTS. 50 cents. ANL-6126

Dispersed phase strengthening of corrosion-resistant aluminum, from Armour Research Foundation of Illinois Institute of Technology. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 42p. Order from OTS. $1.25. ANL-6188

Fundamental alloy development studies. Quarterly progress report no. 5 for November 1, 1956 to January 31, 1957, by C. E. Lundin and D. T. Klodt. University of Denver, Denver Research Institute, Denver, Colo. Feb 57. Decl. with deletions November 4, 1959. 39p. Order from LC. Mi $3.00, ph $6.30. APEX-300(Del.)

Fundamental alloy development studies. Quarterly progress report no. 7 for May 1, 1957 to July 31, 1957, by C. E. Lundin and D. T. Klodt. University of Denver, Denver Research Institite, Denver, Colo. Aug 57. Decl. with detetions November 4, 1959. 28p. Order from LC. Mi $2.70, ph $4.80. APEX-334(Del.)

Fundamental alloy development studies. Quarterly progress report no. 9 for November 1, 1957 to January 31, 1958, by C. E. Lundin, D. T. Klodt, R. D. Seibel, and M. M. Mote. University of Denver. Denver Research Institute, Denver, Colo. Feb 58. Decl. with deletions November 4, 1959. 65p. Order from LC. Mi $3.90, ph $10.80. APEX-360(Del.)

Component development. Progress report no. 4, by J. D. Roach. Titanium Alloy Manufacturers. Division of National Lead Company, Niagara Falls, N. Y. May 58. Decl. with deletions November 4, 1959, Contracts AT(11-1)-171 and

AF 33(600)-38062. 18p. Order from LC. Mi $2.40, ph $3.30. APEX-423(Del.)

Fundamental alloy development studies. Quarterly progress report no. 4 for May 1, 1958 to July 31, 1958, by C. E. Lundin, D. T. Klodt, R. D. Seibel, and M. W. Mote. University of Denver, Denver Research Institute, Denver, Colo. Aug 58. Decl. with deletions November 4, 1959. Contracts AT(11-1)-171 and AF 33(600)-38062. 94p. Order from LC. Mi $5.40, ph $15.30. APEX-424(Del.)

Fundamental alloy development studies. Quarterly progress report no. 10 for February 1, 1958 to April 30, 1958, by C. E. Lundin, D. T. Klodt, R. D. Seibel, and M. M. Mote. University of Denver. Denver Research Institute, Denver, Colo. May 58. Decl. with deletions November 4, 1959. Contracts AT(11-1)-171 and AF 33(600)-38062. 52p. Order from LC. Mi $3.60, ph $9.30. APEX-449(Del.)

Evaluation of rolling contacts in the range of 550°F to 1000°F, by S. F. Murray and P. Lewis. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Feb 58. Contracts AT(11-1)-171 and AF 33(600)-38062. 90p. Order from OTS. $2.00. APEX-560

Structural analysis of molybdenum-base alloys by use of a material constant and the least-square error, by A. L. Ross and B. R. Thompson. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Feb 57. Contracts AT(11-1)-171 and AF 33(600)-38062. 24p. Order from OTS. 50 cents. APEX-568

Investigation of solid film lubricants and sliding contacts at temperatures above 1000°F, by M. B. Peterson. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Aug 60. Contracts AT(11-1)-171 and AF 33(600)-38062. 63p. Order from OTS. $1.50. APEX-569

Evaluation of oxidation-resistant ceramics for high-temperature reactor elements, by C. G. Harman, E. F. Ferrell, H. E. Wagner, and J. F. Quirk. Battelle Memorial Institute, Columbus, Ohio. Dec 52. Decl. December 15, 1959. Contract W-7405-eng-92. 39p. Order from LC. Mi $3.00, ph $6.30. BMI-787

The effects of chemical impurities on the quality rolled uranium rod, by H. A. Saller, J. R. Keeler, and L. J. Cuddy. Battelle Memorial Institute, Columbus, Ohio. Oct 54. Decl. December 15, 1959. Contract W-7405-eng-92. 18p. Order from LC. Mi $2.40, ph $3.30. BMI-952

Progress relating to civilian applications during December, 1956, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Jan 57. Decl. August 15, 1960. Contract W-7405-eng-92. 55p. Order from OTS. 55 cents. BMI-1152

Progress relating to civilian applications during January, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Feb 57. Decl. August 15, 1960. Contract W-7405-eng-92. 75p. Order from OTS. 55 cents. BMI-1161

Process relating to civilian applications during February, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Mar 57. Decl. August 16, 1960. Contract W-7405-eng-92. 71p. Order from OTS. 55 cents. BMI-1173

Progress relating to civilian applications during March, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Apr 57. Decl. August 15, 1960. Contract W-7405-eng-92. 80p. Order from OTS. 55 cents. BMI-1176

Progress relating to civilian applications during June, 1957, by R. W. Dayton and C. R. Tiptons, Jr. Battelle Memorial Institute, Columbus, Ohio. July 57. Decl. August 15, 1960. Contract W-7405-eng-92. 58p. Order from OTS. 50 cents. BMI-1201

Progress relating to civilian applications during July, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Aug 57. Decl. August 15, 1960. Contract W-7405-eng-92. 69p. Order from OTS. 50 cents. BMI-1213

Progress on ceramic coated fuel particles at Battelle. Presented at the AEC Information Meeting held at Battelle Memorial Institute on July 12, 1960, by W. S. Diethorn and others. Battelle Memorial Institute, Columbus, Ohio. Sep 60. Contract W-7405-eng-92. 31p. Order from OTS. 75 cents. BMI-1468

Creep and corrosion properties of Zircaloy-2 in steam at 750 F, by E. J. Jablonowski and F. R. Shober. Battelle Memorial Institute, Columbus, Ohio. Aug 60. Contract W-7405-eng-92. 20p. Order from OTS. 50 cents. BMI-1457

Monthly progress report, by R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Aug 55. Decl. August 12, 1960. Contract AT(30-1)-1405. 14p. Order from OTS. 30 cents. BRB-13

Extrusion of uranium for Hanford cored slug program - II, by G. T. Murray and R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Nov 55. Decl. August 15, 1960. Contract AT (30-1)-1405. 47p. Order from OTS. 45 cents. BRB-16

Extrusion of uranium for Hanford cored slug program--III and IV, by G. T. Murray and R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Dec 55. Decl. August 12, 1960. Contract AT(30-1)-1405. 33p. Order from OTS. 40 cents. BRB-17

Extrusion of uranium for Hanford cored slug program - VII, by G. T. Murray and R. M. Treco. Brideeport Brass Company, Bridgeport, Conn. Feb 56. Decl. August 12, 1960. Contract AT (30-1)-1405. 28p. Order from OTS. 35 cents. BRB-20

Monthly progress report for January 1956, by R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Feb 56. Decl. May 17, 1960. Contract AT(30-1)-1405. 33p. Order from OTS. 40 cents. BRB-29

Monthly progress report for April - May 1956, by R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. June 56. Decl. August 15, 1960. Contract AT(30-1)-1405. 39p. Order from OTS. 40 cents. BRB-31

A Nonbond detector for hollow slugs, by J. D. Ross and R. W. Leep. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. C. Oct 56. Decl. August 12, 1960. Contract AT(07-2)-1. 12p. Order from OTS. 25 cents. DP-164

An evaluation of nickel-copper alloys for use as graphite-cladding materials at elevated temperatures, by D. G. Guggisberg, and J. C. Bokros. General Dynamics Corporation, San Diego, Calif. Apr 60. Contract AT(04-3)-187. 19p. Order from OTS. 75 cents. GA-1281

Carbon steel for the Hanford new production reactor, by W. D. Gilbert and others. Hanford Atomic Products Operation, Richland, Wash. Nov 58. Contract W-31-109-Eng-52. 17p. Order from OTS. 50 cents. HW-58299REV

Casting aluminum-plutonium alloys, by C. H. Bloomster. Hanford Atomic Products Operation, Richland, Wash. Mar 60. Contract AT(45-1)-1350. 19p. Order from OTS. 75 cents. HW-63166

Weld alloying improvement with square type current waves on alternating-current tungsten-arc inert-gas-shielded welding, by T. B. Correy. Hanford Atomic Products Operation, Richland, Wash. May 60. Contract AT(45-1)-1350. 71p. Order from OTS. $2.00. HW-64252

Ultrasonic inspection of PRTR fuel element cladding, by P. L. Farnsworth. Hanford Atomic Products Operation, Richland, Wash. Apr 60. Contract AT(45-1)-1350. 19p. Order from OTS. 75 cents. HW-64562

Progress report on fuel element development and associated projects, by W. C. Francis and S. E. Craig. Phillips Petroleum Company, Idaho Operations Office, Idaho Falls, Idaho. Aug 60. Contract AT(10-1)-205. 151p. Order from OTS. $2.25. IDO-16574

Uranium glasses: II. Uranium silicate glasses, by C. D. Wirkus and D. R. Wilder. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. June 60. Contract W-7405-eng-82. 30p. Order from OTS. 75 cents. IS-158

High temperature corrison of some metals and ceramics in fluorinating atmospheres, by C. F. Hale and others. Union Carbide Nuclear Company pany, Division of Union Carbide Corporation, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Sep 60. Contract W-7405-eng-26. 63p. Order from OTS. $1.75. K-1459

Aluminum canning of nickel-plated, Hanford four-inch uranium fuel slugs by hot-pressing, by H. T. Sumsion, C. J. Beck, and L. S. DeLuca. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. May 55. Decl. August 25, 1960. Contract W-31-109-Eng-52. 42p. Order from OTS. 35 cents. KAPL-1335

The application of cold-powder extrusion and sintering to the fabrication of stainless steel- UO_2 fuel elements, by H. G. Sowman and G. L. Ploetz. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. June 55. Decl. August 19, 1960. Contract W-31-109-Eng-52. 15p. Order from OTS. 25 cents. KAPL-1345

Zirconium coating of uranium by iodide decomposition, by W. L. Robb, and A. C. Schafer. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Dec 55. Decl. August 25, 1960. Contract W-31-109-Eng-52. 74p. Order from OTS. 55 cents. KAPL-1424

Burnable poison additives to uranium dioxide, by G. L. Ploetz and H. C. Sowman. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Nov 55. Decl. August 20, 1960. Contract W-31-109-Eng-52. 18p. Order from OTS. 30 cents. KAPL-1447

Fabrication of uranium-rich, uranium-zirconium dispersion fuels by hydrostatic hot pressing, by R. N. Honeyman. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Nov 56. Decl. August 25, 1960. Contract W-31-109-Eng-92. 35p. Order from OTS. 40 cents. KAPL-1670

Cyclic strain fatigue of inconel at 75 to 600°F, by A. E. Dinerman. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Aug 60. Contract W-31-109-Ebg-52. 13p. Order from OTS. 50 cents. KAPL-2084

Welding type 410 stainless steel to inconel, by J. D. Casey. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Mar 60. Contract W-31-109-Eng-52. 8p. Order from OTS. 50 cents. KAPL-2087

Production of molybdenum-uranium and zirconium-uranium alloys, by C. W. Loveland and J. E. Owen. Union Carbide Nuclear Company, Division of Union Carbide Corporation, Paducah, Ky. Aug 60. Contract W-7405-eng-26. 26p. Order from OTS. 50 cents. KY-348

Process development and fabrication of Th-7.6 WT % U fuel elements for the second core loading of the sodium reactor experiment, by J. A. Stanley and M. H. Binstock. Atomics International A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 60. Contract AT(11-1)-GEN-8. 30p. 50 cents. NAA-SR-5144

Briquetted uranium tetrafluoride-magnesium blend for batch reduction charges, by G. E. Wuller, Jr. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Dec 56. Decl. August 25, 1960. Contract AT(30-1)-1156. 21p. Order from OTS. 35 cents. NLCO-672

Papers presented at the X-ray preferred orientation meeting held at National Lead Company of Ohio, November 9 and 10, 1959, by P. R. Morris and others. National Lead Company of Ohio, Cincinnati, Ohio. July 60. Contract AT(30-1)-1156. 64p. Order from OTS. $1.50. NLCO-804

Grain refinement of cast uranium by heat treatment, by G. W. Powell, J. L. Klein, and D. Krashes. Nuclear Metals, Inc. Cambridge, Mass. July 57. Decl. August 25, 1960. Contract AT(30-1)-1565. 32p. Order from OTS. 65 cents. NMI-1180

Thermal coefficient of expansion of uranium by means of bonded wire resistance strain gages, by M. R. Goodman. Oak Ridge National Laboratory, Oak Ridge, Tenn. Dec 49. Decl. May 10, 1960. Contract W-7405-eng-26. 55p. Order from OTS. 50 cents. ORNL-518

Alloying of zirconium-containing fuels with zinc and magnesium, by R. G. Wymer and J. F. Land. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 57. Decl. May 18, 1960. Contract W-7405-eng-26. 11p. Order from OTS. 30 cents. ORNL-2184

The stability of europium oxide in silicon-bearing stainless steel, by C. F. Leitten, Jr. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd. Contract W-7405-eng-26. 83p. Order from OTS. $2.25. ORNL-2946

Development of a compartmented type flat plate fuel element, by W. G. Lidman, R. L. Harmon, and H. S. Kalish. Sylvania-Corning Nuclear Corp., Bayside; Long Island, N. Y. Apr 57. Decl. August 18, 60. Contract AT-30-1-GEN-366. 31p. Order from OTS. 35 cents. SCNC-246

The control of grain size in sintered uranium compacts, by J. L. Zambrow and H. H. Hausner. Sylvania Electric Products, Inc., Bayside, N. Y. Aug 51. Decl. July 13, 1960. Contract AT-30-1-Gen-366. 24p. Order from OTS. 35 cents. SEP-72

Preferred orientation in zirconium alloy wire fuel elements, by R. W. Campbell and W. P. Chernock. Technical Information Service, Oak Ridge, Tenn. [nd., Decl. July 14, 1960. 38p. Order from OTS. 35 cents. SEP-111

The canning of UO_3 powder for sampling, by H. H. Hausner, J. L. Zambrow and S. Storchheim. Sylvania Electric Porducts Inc., Metallurgical Laboratory, Bayside, New York. Mov 51. Decl. July 13, 1960. Contract AT-30-1-Gen-366. 19p. Order from OTS. 30 cents. SEP-79

Zirconium: A bibliography of confidential U. S. Atomic Energy Commission Reports Available through the Civilian Application Program, by Technical Information Service Extension, Oak Ridge, Tenn. July 56. Decl. May 24, 1960. 62p. Order from OTS. 50 cents. TID-3204

Proceedings of the metallurgy information meeting held at Oak Ridge, April 11-13, 1955, by L. K. Jetter and others. Atomic Energy Technical Information Service Extension, Oak Ridge, Tenn. 1955. Decl. December 1, 1959. 533p. in Pt. 1, and 423p. in Pt. II. Order from OTS. Total price $9.00. TID-7502 (Pt. I & II) (Del. 2)

AEC-Euratom conference on aqueous corrosion of reactor materials held in Brussels, Belgium on October 14-17, 1959, by R. R. Nash and others. Office of Technical Information Extension, Oak Ridge, Tenn. July 60. 465p. Order from OTS. $4.75. TID-7587

Summary technical report for the period October 1, 1954 to December 31, 1954, by J. W. Simmons and others. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Jan 55. Decl. August 18, 1960. Contract AT(30-1)-1156. 220p. Order from OTS. $1.10. TID-10111

Metallurgical progress report no. 7 for the period of Apr 1, 1960 to June 30, 1960, by M. L. Wright and others. U. S. Department of the Interior, Bureau of Mines, Albany Metallurgy Research Center, Albany, Ore. June 60. Contract AT(11-1)-599. 47p. Order from OTS. $1.50. USBM-U-745

Outline of alternate control material information obtained at Bettis Plant. Westinghouse Electric Corporation, Bettis Plant, Pittsburgh, Pa. July 56. Decl. May 23, 1960. 102p. Order from OTS. 60 cents. WAPD-SFR-Fs-173

Nuclear Explosions—Peaceful Applications

Proceedings of the conference on scientific applications of nuclear explosions held July 6-8, 1959, Los Alamos, New Mexico, by G. A. Cowan. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Sep 60. Contract W-7405-ENG-36. 75p. Order from OTS. $1.75. LAMS-2443

Oak Ridge National Laboratory sampler for the tamalpais underground nuclear detonation experiment, by J. W. Landry. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 19p. Order from OTS. 50 cents. ORNL-2881

Geologic investigations in support of project chariot in the vicinity of Cape Thompson, northwestern Alaska--Preliminary report, by R. Kachadoorian and others. Geological Survey, Washington, D. C. Jan 60. 94p. Order from OTS. $2.00. TEI-753

Some effects of underground nuclear explosions on tuff, by V. R. Wilmarth. Geological Survey, Washington, D. C. Dec 59. 34p. Order from OTS. 75 cents. TEI-756

Nuclear explosives and mining costs, by F. L. Smith and T. R. Young. University of California, Lawrence Radiation Laboratory, Livermore, Calif. July 60. Contract W-7405-eng-48. 37p. Order from OTS. $1.00. UCRL-5928

Postshot disturbances and surface motions--Operation Hardtack-II, by L. M. Swift and others. Stanford Research Institute, Menlo Park, Calif. Feb 60. 28p. Order from OTS. 75 cents. WT-1740

Particle Accelerators and High-Voltage Machines

Particle accelerator Division, summary report for May 1959 through March 1960, by A. V. Crewe, and others. Argonne National Laboratory, Argonne, Ill. 1960. Contract W-31-109-eng-38. 56p. Order from OTS. $1.25. ANL-6152

Integral scaling magnetic field using distributed windings, by S. C. Snowdon. Midwestern Universities Research Association, Madison, Wis. Aug 60. Contract AT(11-1)-384. 19p. Order from OTS. 50 cents. MURA-583

The use of filamentary targets to produce prolonged secondary-particle beams in the Bevatron, by H. C. Heard. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Mar 60. Contract W-7405-eng-48. 12p. Order from OTS. 50 cents. UCRL-9237

Physics and Mathematics

Table of asymmetric rotor E2 transition probabilities, by P. P. Day and C. A. Mallmann. Argonne National Laboratory, Argonne, Ill. Aug 60. Contract W-31-109-eng-38. 54p. Order from OTS. $1.25. ANL-6184

Introduction to electronic analogue computing, by L. T. Bryant and others. Argonne National Laboratory, Argonne, Ill. July 60. Contract

W-31-109-eng-38. July 60. 81p. Order from OTS. $2.00. ANL-6187

Applied Mathematics Division summary report for July 1, 1959 through June 30, 1960, by W. F. Miller. Argonne National Laboratory, Argonne, Ill. 1960. Contract W-31-109-eng-38. 65p. Order from OTS. $1.50. ANL-6195

Design studies on cesium-137 as a source for high level gamma irradiators. Quarterly progress report no. 3 covering the period from December 1, 1959 to March 1, 1960, by L. Voyvodic. Illinois Institute of Technology, Armour Research Foundation, Chicago, Ill. Mar 60. Contract AT(11-1)-779. 8p. Order from LC. Mi $1.80, ph $1.80. ARF-1150-9

Energy and angular distribution of particles produced by 25-BEV protons, by R. M. Sternheimer. Brookhaven National Laboratory, Upton, N. Y. Feb 60. 12p. Order from LC. Mi $2.40, ph $3.30. BNL-4664

Intermediate heat exchanger test results, by B. M. Wilmer and H. J. Stumpf. Oak Ridge National Laboratory, Oak Ridge, Tenn. Jan 54. Decl. July 16, 1959. Contract W-7405-eng-26. 35p. Order from LC. Mi $3.00, ph $6.30. CF-54-1-155

HRT process flowsheets - revised edition, by R. C. Robertson and J. E. Jones. Oak Ridge National Laboratory, Oak Ridge, Tenn. Dec 59. 18p. Order from LC. Mi $3.00, ph $6.30. CF-55-5-156 (Rev. 5)

Electrical insulation characteristics of helium gas at high pressure and temperatures, by R. D. Stulting. Oak Ridge National Laboratory, Oak Ridge, Tenn. Feb 59. Contract W-7405-eng-26. 15p. Order from LC. Mi $2.40, ph $3.30. CF-59-2-22

Thermal neutron fluxes in HRE-2 determined from Zircaloy-2 induced activity measurements, runs 16 and 17, by J. E. Baker and others. Oak Ridge National Laboratory, Oak Ridge, Tenn. Dec 59. 8p. Order from LC. Mi $1.80, ph $1.80. CF-59-2-54

Shielding properties of ferrophosphorus concrete as a function of temperature, by E. G. Peterson Hanford Atomic Products Operation, Richland, Wash. July 60. Contract AT(45-1)-1350. 79p. Order from OTS. $2.00. HW-64774

An IBM 650 computer program for determining the thermal diffusivity of finite-length samples, by W. L. Kennedy. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. June 60. Contract W-7405-eng-82. 59p. Order from OTS. $1.50. IS-137

Ion fragmentation patterns of N_2^{22}, N_2^{29}, and N_2^{30}, by G. D. Flesch and H. J. Svec. Ames Laboratory, Ames, Iowa. Mar 59. Contract W-7405-eng-82. 5p. Order from LC. Mi $1.80, ph $1.80. ISC-1141

NLLS: A 704 program for fitting non-linear curves by least squares, by P. B. Wood. Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Jan 60. Contract W-7405-eng-26. 62p. Order from LC. Mi $3.60, ph $9.30. K-1440

The depletion of burnable poison in endurnace calculations, by R. C. Dahlberg and F. D. Judge. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Mar 60. Contract W-31-109-Eng-92. 9p. Order from OTS. 75 cents. KAPL-2058

Effect of ship attitutde and ship motion on primary coolant system flow rates, by H. E. Stevens, Jr. Feb 60. Appendix A: Derivation of effect on angular acceleration on driving head in a natural circulation reactor, by J. H. Pigott. Jan 60. Knolls Atomic Power Laboratory, Schenectady, N. Y. Contract 31-109-Eng-52. 32p. Order from LC. Mi $3.00, ph $6.30. KAPL-M-HS-12

Slab rectifier calculations, by M. E. Way. Knolls Atomic Power Laboratory, Schenectady, N. Y. Nov 57. Decl. February 24, 1960. Contract W-31-109-Eng-52. 13p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-MEW-3

Results of tests of D1G/D2G reactor: Compartment component support model, by R. M. Mains. Knolls Atomic Power Laboratory, Schenectady, N. Y. Nov 59. Contract W-31-109-Eng-52. 42p. Order from LC. Mi $3.30, ph $7.80. KAPL-M-RMM-5

Some numerical studies of simultaneous two group inversion, by S. Baron. Knolls Atomic Power Laboratory, Schenectady, N. Y. Feb 60. Contract W-31-109-Eng-52. 20p. Order from LC. Mi $2.70, ph $4.80. KAPL-M-SXB-1

Activation experiments in an NCR-type lattice, by W. B. Wright, S. F. Weinstein and A. D. Musto. Knolls Atomic Power Laboratory, Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 25p. Order from LC. Mi $2.70, ph $4.80. KAPL-M-WBW-8.

Water gap peaking in the presence of hydrogen density gradients, by W. B. Wright and S. F. Weinstein. Knolls Atomic Power Laboratory, Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 16p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-WBW-9

A simplified technique for calculating spectrum-dependent water-gap peaking, by W. J. Levedahl. Knolls Atomic Power Laboratory, Schenectady, N. Y. Dec 59. Contract W-31-109-Eng-52. 15p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-WIL-5

A study of solution multiplicity in some problems of mathematical physics, by G. H. Pimbley. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Sep 60. Contract W-7405-ENG-36. 40p. Order from OTS. $1.00. LA-2431

The flow of fluids through channels with porous walls, by F. A. Guevara and W. E. Wageman. The University of California, Los Alamos Scientific Laboratory, Los Alamos, Calif. July 60. Contract W-7405-ENG-36. 27p. Order from OTS. 75 cents. LA-2449

Approximate calculation of the temperature distribution surrounding coolant holes in a heat generating solid with finite value of fluid heat tranfer coefficient, by T. R. Regenie and J. C. Rowley. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. June 60. Contract W-7405-ENG-36. 22p. Order from OTS. 50 cents. LAMS-2436

On a method of measuring diffusion coefficients for fission products in powdered or sintered materials, by L. Miller. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. June 60. Contract W-7405-ENG-36. 13p. Order from OTS. 50 cents. LAMS-2437

Stability of difference equations selected topics, by F. H. Harlow and others. The University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. July 60. Contract W-7405-ENG-36. 39p. Order from OTS. $1.00. LAMS-2452

Gamma assay by coincidence counting, by L. N. Russell and G. R. Grove. Mound Laboratory, Miamisburg, Ohio. Aug 53. Decl. March 7, 1960. Contract AT-33-1-GEN-53. 6p. Order from LC. Mi $1.80, ph $1.80. MLM-882

Snap-III--Thermoelectric generator environmental test, by L. W. Gross. Martin Company, Nuclear Division, Baltimore, Md. Aug 59. 68p. Order from LC. Mi $3.90, ph $10.80. MND-P-2101

Snap-III--Thermoelectric generator safe handling procedures, by T. J. Dobry, Jr. and P. Guinn. Martin Company, Nuclear Division, Baltimore, Md. Apr 59. 18p. Order from LC. Mi $2.40, ph $3.30. MND-P-2514

Neutron flux distributions in a 19 rod fuel element, by O. R. Hillig. Atomics International Division, North American Aviation, Inc., Canoga Park, Calif. Aug 59. 13p. Order from LC. Mi $2.40, ph $3.30. NAA-SR-Memo-4246

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		146 024
	171	146 246
	215	147 462
	280	148 052
	303	147 845
	312	146 279
	419	146 661
	600	147 224
	707	150 200
	732	147 816
	741	150 199
	742	150 231
	766	149 317
Army Engineer Waterways Experiment Station, Vicksburg, Miss.	25	146 022
		146 024
		146 026
	277	147 738
	308	148 085
		148 086
	312	148 089
	417	146 565
		161 869
	548	149 194
	596	149 199
Army Medical Research Lab., Fort Knox, Ky.	119	147 456
	256	146 267
		146 268
	257	146 269
	383	146 314
	529	146 315
	684	149 767
Army Ordnance Corps, Washington, D. C.	434	146 182
Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.	48	146 159
	250	146 160
	257	147 162
	278	147 962
	709	150 087
Army Polar Research and Development Center, Fort Belvoir, Va.	25	146 026
Army Prosthetics Research Lab., Washington, D. C.	13	145 705
	62	146 214
	63	146 854
	127	145 965
	180	147 026
	742	147 818
Army Research Office, Washington, D. C.	96	161 139
Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.	148	147 463
	165	147 590
	205	145 966
	217	147 579
	220	147 151
	496	148 356
	599	149 182
	738	149 440
	766	149 094
Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.	148	146 835
	283	147 521
		147 742
Army Signal Research and Development Lab., Fort Monmouth, N. J.	22	139 075
	49	145 752
	79	145 754
	89	145 753
	116	146 937
	131	147 388
	136	146 932
	149	146 933
		146 934
		146 936
	200	146 935
	206	146 787
	211	146 982
	270	147 995
		148 114
	275	146 265
		147 998
	276	147 999
	282	148 073
		148 074
	283	148 115
		148 544
	284	146 266
		147 977
		148 117
		148 118
		161 821
	299	146 293
	402	146 347
		146 549
		146 550
		147 996
		147 997
		148 543
	403	146 654
	408	146 391
		148 000
		148 001
		148 540
		148 541
	419	148 071
	420	146 590
		146 653
		148 002
		148 112
	434	148 119
		149 384
	490	146 342
	497	148 113
	544	147 564
		148 539
		148 542
	562	149 416
		149 417
	563	147 819
		149 386
		149 414
Army Signal Reseach and Development Lab., Fort Monmouth, N. J. (con.)	610	149 383
	632	149 418
	634	149 385
	640	149 419
	693	147 820
		147 825
	694	147 823
	709	147 821
		149 415
	710	147 822
		148 120
	726	147 826
		147 827
	736	150 685
	767	147 824
Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.	24	146 499
	25	146 022
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		146 024
		146 025
		146 026
	138	147 184
		147 185
	270	148 469
		148 470
		148 471
	271	148 467
		148 477
	272	148 462
		148 465
		148 466
		148 468
	273	148 460
		148 463
	405	146 560
		148 474
		148 475
	543	147 183
	546	147 353
	547	147 352
		149 125
		149 129
		149 130
		149 131
	548	149 124
		149 133
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Army Transportation Environmental Operations Group, Fort Eustis, Va.	584	149 222
	597	149 221
Army Transportation Research and Engineering Command, Fort Eustis, Va.	58	145 701
Arnold Engineering Development Center, Tullahoma, Tenn.	29	145 749
	71	145 750
	149	146 763
	165	147 330
	191	146 764
		147 008
		147 145
	192	147 375
	304	146 114
	308	146 113
	321	146 115
		146 332
		147 600
	348	147 728
	466	146 569
	563	148 099
	613	147 879
	614	148 961
		149 197
	702	149 975
	750	150 165
	792	149 976
ARO, Inc., Tullahoma, Tenn.	29	145 749
	71	145 750
	149	146 763
	165	147 330
	191	146 764
		147 008
		147 145
	192	147 375
	308	146 113
	321	146 115
		146 332
		147 600
ARO, Inc., Tullahoma, Tenn. (con.)	348	147 728
	466	146 569
		148 100
	563	148 099
	614	148 961
	702	149 975
	750	150 165
	792	149 976
Associated Engineers, Inc., Springfield, Mass.	171	147 281
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Astro-Electronic Products Div., Radio Corp. of America, Princeton, N. J.	92	145 873
Astrophysical Observatory, Smithsonian Institution, Cambridge, Mass.	523	147 552
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Atlantic Research Corp., Alexandria, Va.	17	145 838
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	540	146 543
	599	148 876
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Audiology Lab., Northwestern U., Evanston, Ill.	10	146 144
Avco Corp., Nashville, Tenn.	555	149 302
	702	150 047
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Avco Corp., Wilmington, Mass.	14	145 827
	214	146 907
	270	147 658
	306	161 830
		161 831
	536	148 887
	699	150 341
Avco-Everett Research Lab., Mass.	93	145 772
	94	146 700
		146 853
	165	147 200
	192	147 434
	333	161 824
	346	161 825
	393	147 208
		147 397
	435	147 198
		147 202
		147 206
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		147 213
	465	146 651
	466	147 193
		147 203
		147 209
	467	146 649
		146 655
		147 189
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		147 207
		147 210
		147 398
	468	146 656
		146 658
		147 204
		147 205
		147 214
		147 215
		146 652
	469	147 191
	486	147 395
	501	147 195
	504	146 657
		147 196
		147 211
	511	147 396
	563	147 216
		147 217
	584	147 201
	602	146 650
	614	147 197
	644	147 199
		148 187
	645	146 659
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	387	146 959
	412	146 961
	435	146 346
	533	146 962
	676	148 273
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Aviation Psychology Lab., U. of Illinois, Urbana	252	161 791
Ball Brothers Research Corp., Boulder, Colo.	614	148 476
Ballistic Research Labs., Aberdeen Proving Ground, Md.	49	145 728
	140	146 948
	165	147 051
	166	147 485
	192	146 770
		147 105
	201	147 490
	284	147 649
	299	146 116
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	317	148 458
	435	148 513
	436	148 459
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	479	148 51[illegible]
		148 51[illegible]
	505	148 238
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	554	148 904
		149 011
		149 012
	555	148 902
	584	148 646
	585	148 903
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		149 237
	605	149 994
	646	149 238
	689	149 671
	693	150 091
	700	150 093
	726	149 091
		150 092
	738	150 297
	750	147 789
		148 511
	759	149 884
	761	148 913
	788	150 453
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Bally Ribbon Mills, Inc., Pa.	62	146 278
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Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.	205	146 952
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Battelle Memorial Inst., Columbus, Ohio	15	161 551
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	80	145 938
		145 939
	85	145 734
	145	161 766
	180	147 158
	201	161 758
	264	148 094
	279	161 818
	327	147 733
		161 817
	328	161 823
	332	147 980
		147 981
	447	161 891
	454	147 255
	476	161 850
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Battelle-Institut E. V., Frankfurt-am-Main (West Germany)	337	146 043
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Bausch and Lomb Optical Co., Rochester, N.Y.	598	150 149
Baylor U., Waco, Tex.	393	148 444
Baylor U. Coll. of Medicine, Houston, Tex.	260	147 458
Beach Erosion Board, Corps of Engineers, Washington, D. C.	146	147 492
Beechcraft Research and Development, Inc., Boulder, Colo.	166	147 268
Behavioral Sciences Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	526	161 923
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Bell Aircraft Corp., Buffalo, N. Y.	17	145 906
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Bell Helicopter Corp., Fort Worth, Tex.	278	146 337
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Bell Telephone Labs., Inc., Murray Hill, N. J.	380	148 784
Bell Telephone Labs., Inc., New York	34	145 979
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		147 947
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	556	147 946
	564	149 016
		149 017
		149 024
	565	150 145
	567	147 348
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Bell Telephone Labs., Inc., Whippany, N. J.	565	147 920
Bendix Aviation Corp., Eatontown, N. J.	565	149 117
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Benson-Lehner Corp., Los Angeles, Calif.	226	147 093
Benson-Lehner Corp., Santa Monica, Calif.	351	147 726
Besler Corp., Emeryville, Calif.	444	146 571
Bio-Mechanics Lab., Tufts U., Medford, Mass.	703	151 702
Birmingham U. (Gt. Brit.)	201	146 844
Bjorksten Research Labs., Inc., Madison, Wis.	450	161 845
	598	150 153
Blaw-Knox Co., Pittsburgh, Pa.	280	161 819
Bliley Electric Co., Erie, Pa.	299	147 975
Boeing Airplane Co., Seattle, Wash.	140	161 705
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Bolt, Beranek, and Newman, Inc., Cambridge, Mass.	278	161 781
Bonn U. (West Germany)	18	145 848
Booz, Allen, and Hamilton, Chicago, Ill.	727	150 672
Borden Chemical Co., Philadelphia, Pa.	176	148 896
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British Non-Ferrous Metals Research Association	625	149 431
Brooke Army Medical Center, Fort Sam Houston, Tex.	532	149 148
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Brookhaven National Lab., Upton, N. Y.	207	161 308
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Brown U., Providence, R. I.	89	145 930
	313	147 414
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	497	146 388
	513	146 411
	631	148 558
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Brown U. Div. of Applied Mathematics, Providence, R. I.	27	145 796
	69	139 064
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	70	146 169
	72	145 977
	74	146 255
		146 260
	182	147 089
	189	137 961
	192	147 094
	193	147 403
	197	146 053
	277	138 132
	319	138 131
	321	147 404
	341	147 708
	464	138 003
	465	148 579
	605	149 115
		149 116
	612	149 440
	755	149 804
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	781	149 945
		149 946
Brown U. Div. of Engineering, Providence, R. I.	70	146 169
	193	146 437
		146 438
	466	148 818
	505	148 584
	540	148 819
	614	149 454
	646	149 597
		149 598
	748	150 399
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Brush Beryllium Co., Cleveland, Ohio	18	161 683
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Brussells Free U. (Belgium)	129	147 435
Bryn Mawr Coll., Pa.	131	147 129
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Bulova Research and Development Labs., Inc., Woodside, N. Y.	149	137 442
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Bureau of Mines, Bartlesville, Ohio	394	146 580
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Bureau of Mines, Washington, D.C.	738	146 767
Bureau of Naval Personnel, Washington, D.C.	526	149 350
Bureau of Naval Weapons, Washington, D. C.	313	148 651
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	560	161 959
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		161 961
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Burroughs Corp., Paoli, Pa.	150	146 039
California Forest and Range Experiment Station, Berkeley	685	150 675
California Inst. of Tech., Pasadena	76	145 724
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	441	149 189
	482	146 551
	559	146 540
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		149 508
	646	148 895
	755	147 793
		149 514
	757	161 952
California U., Berkeley	22	145 871
	64	146 082
	182	138 282
	183	146 045
	210	137 959
	264	147 837
	301	147 680
	314	147 859
	336	147 699
	377	148 822
		148 823
		148 824
	378	148 825
		148 826
		148 827
		148 828
		148 829
	388	146 531
	394	146 718
	454	146 415
	483	146 745
	501	148 583
	505	146 360
	689	147 577
	743	150 237
California U., Berkeley. School of Medicine.	534	146 625
California U., Los Angeles	89	145 867
	119	146 051
	136	146 931
	226	137 921
		147 128
	252	148 129
		148 130
		148 131
	285	146 376
	378	146 602
	383	146 695
	403	148 592
	406	147 939
	408	146 645
	421	146 735
	511	146 736
	513	146 682
	530	148 888
	534	147 573
	595	148 834
	605	148 831
		148 832
		148 833
		148 839
	631	147 800
	651	148 835
		148 837
		148 838
	674	148 266
	675	149 507
	682	147 888
	711	149 170
	743	150 251
	775	150 250
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Callery Chemical [illegible], Pa.	392	148 373
	394	148 374
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Calvin Coll., Grand Rapids, Mich.	19	145 898
Cambridge U. (Gt. Brit.)	205	146 443
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Canadian Commercial Corp., Ottawa	557	149 209
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Carbon Research Lab., U. of Buffalo, N. Y.	129	161 733
Carnegie Inst. of Tech., Pittsburgh, Pa.	89	145 928
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	394	149 191
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	492	148 533
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Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.	66	145 976
	606	148 170
	743	148 603
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Case Inst. of Tech., Cleveland, Ohio	85	146 199
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	336	147 723
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	634	148 195
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Catalysis Research Lab., Alfred U., N. Y.	265	147 496
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Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio	351	146 386
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Center for Radiophysics and Space Research, Cornell U., Ithaca, N. Y.	116	147 053
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Centre de Physique Electronique et Corpusculaire (France)	34	146 261
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Centro di Studio per la Fisica delle Microonde (Italy)	585	148 779
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Chalmers U. of Tech., Sweden	338	147 509
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Chatham Electronics, Livingston, N. J.	34	146 041
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Chesapeake Bay Inst., Johns Hopkins U., Annapolis, Md.	274	146 275
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Cincinnati General Hospital, Ohio	125	146 010
Cincinnati Milling Machine Co., Ohio	57	161 680
City Coll. of the City of New York	131	137 956
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Clevite Corp., Cleveland, Ohio	566	161 938
Clevite Research Center, Cleveland, Ohio	59	146 530
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Climax Molybdenum Co. of Michigan, Detroit	77	161 542
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Cloud Physics Lab., U. of Chicago, Ill.	199	137 727
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Coastal Studies Inst., Louisana State U., Baton Rouge	23	146 482
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	265	148 144
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	378	148 564
	606	149 573
	635	148 873
	744	150 195
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Columbia Radiation Lab., New York	711	147 633
Columbia U., New Uork	183	146 429
	201	161 706
	210	147 069
	221	147 156
	314	147 693
		147 702
	394	146 749
	412	161 837
	418	148 573
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		148 577
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		149 852
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Control Systems Lab., U. of Illinois, Urbana	567	149 400
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Convair, Pomona, Calif.	321	146 439
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Cook Research Labs., Morton Grove, Ill.	179	161 756
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Coordinating Research Council, Inc., New York	599	161 900
Copenhagen U. (Denmark)	384	146 307
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Cornell Aeronautical Lab., Inc., Buffalo, N.Y.	132	146 447
	150	146 874
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	201	147 018
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	278	146 370
	309	161 826
	412	161 855
	421	148 783
	447	148 739
	469	148 357
	477	148 242
		148 243
	479	148 376
	508	147 909
	556	148 396
	614	146 544
	615	146 541
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		148 773
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Cornell U., Ithaca, N. Y.	64	145 995
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Crucible Steel Co. of America, Pittsburgh, Pa.	480	161 848
Crucible Steel Co. of America, Syracuse, N. Y.	480	148 003
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Cruft Lab., Harvard U., Cambridge, Mass.	116	146 088
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	567	148 321
	568	148 322
	711	150 197
Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.	436	161 093-4
Cryogenic Lab., Ohio State U. Research Foundation, Columbus	132	147 562
Cuyo U., Mendoza, Argentina	487	146 643
Dancer-Fitzgerald-Sample, Inc., New York	532	148 901
Daniel Guggenheim Airship Inst., Akron, Ohio	23	146 484
Danish National Committee of URSI	269	146 135
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Dartmouth Coll., Hanover, N. H.	25	146 200
	273	146 195
David Sarnoff Research Center, Princeton, N. J.	34	161 541
	151	146 083
	422	149 103
	491	147 272
	568	149 366
	712	149 367
David Taylor Model Basin, Washington, D. C.	140	147 036
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	189	147 270
	286	138 273
	317	147 464
	413	147 727
	442	148 653
	469	148 033
	475	147 257
	488	148 855
	556	146 588
		149 822
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	733	150 676
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	756	150 292
Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.	442	147 083
	620	147 801
	756	147 887
		149 866
Davies Labs. Div., Minneapolis-Honeywell Regulator Co., Beltsville, Md.	712	148 856
Daystrom Systems, La Jolla, Calif.	413	161 858
Dayton U., Ohio	329	161 797
Dayton U. Research Inst., Ohio	202	161 703
Defense Atomic Support Agency, Washington, D.C.	16	146 481
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Defense Electronic Products, Radio Corp. of America, Camden, N. J.	712	149 102
Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio	49	161 202
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Defense Research Lab., U. of Texas, Austin	634	149 616
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De Havilland Aircraft Co., Ltd. (Canada)	557	149 209
Denver Research Inst., Colo.	202	147 737
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Denver U., Colo.	276	147 647
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Department of the Air Force, Washington, D. C.	586	161 913
Detroit Arsenal, Center Line, Mich.	445	146 532
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Deutscher Wetterdienst, Offenbach (West Germany)	28	146 219
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Diamond Antenna and Microwave Corp., Wakefield, Mass.	568	147 361
Diamond Ordnance Fuze Labs., Washington, D. C.	35	146 060
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	286	146 812
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	300	147 163
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	436	146 751
		146 752
		146 913
	496	146 301
	568	148 224
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		150 012
	727	147 794
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Dielectrica Lab., Johns Hopkins U., Baltimore, Md.	35	161 545
Digital Computer Lab., U. of Illinois, Urbana	202	146 033
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Directorate of Engineering Standards, Wright Air Development Div., Wright-Patterson AFB, Ohio	513	161 181
Directorate of Flight and All-Weather Testing, Wright-Patterson AFB, Ohio	30	146 914
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Directorate of Labs., Wright Air Development Div., Wright-Patterson AFB, Ohio	712	161 979
Douglas Aircraft Co., Inc., Long Beach, Calif.	140	161 731
Douglas Aircraft Co., Inc., El Segundo, Calif.	557	161 924
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Dow Chemical Co., Midland, Mich.	77	146 617
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Driver, Wilbur B., Newark, N. J.	57	145 703
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Duke U. Medical Center, Durham, N. C.	257	161 798
Dunlap and Associates, Inc., Stamford, Conn.	10	145 756
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Dynamic Analysis and Control Lab., Mass. Inst. of Tech., Cambridge	374	147 732
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Eagle-Picher Research Labs., Miami, Okla.	215	137 660
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Eastman Kodak Co., Rochester, N. Y.	36	145 878
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Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.	448	148 493
Ecole Normale Superieure (France)	482	146 551
Edison, Thomas A., Industries, West Orange, N. J.	568	149 118
Educational Research Corp., Cambridge, Mass.	36	145 833
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Educational Testing Service, Princeton, N. J.	253	147 453
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Ethel-McCullough, Inc., San Bruno, Calif.	36	145 935
Electric Boat Div., General Dynamics Corp., Groton, Conn.	303	161 806
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Electric Storage Battery Co., Yardley, Pa.	422	147 974
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Electrical Engineering Research Lab., U. of Illinois, Urbana	36	145 936
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	152	146 919
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		148 110
	422	146 357
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	423	148 765
	569	148 766
	648	149 015
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	795	150 095
Electrical Engineering Research Lab., U. of Texas, Austin	222	147 091
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Electrical Engineering Research Lab., U. of Texas, Austin (con.)	544	149 442
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Electro-Optical Systems, Inc., Pasadena, Calif.	569	147 609
Electromagnetic Research Corp., Washington, D. C.	223	146 910
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Electron Tube and Microwave Lab., Calif. Inst. of Tech., Pasadena	36	146 516
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Electron Tube Research Lab., U. of Minnesota, Minneapolis	286	147 906
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Electronic Communication, Inc., Timonium, Md.	36	145 757
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Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.	37	146 876
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Electronic Engineering Co., of California, Santa Ana	569	149 377
Electronic Systems Lab., Mass. Inst. of Tech., Cambridge	152	161 721
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Electronic Tech. Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	152	161 713
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Electronics Research Lab., Columbia U., New York	287	147 029
Electronics Research Lab., Northeastern U., Boston, Mass.	250	147 664
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Electronics Research Lab., Stanford U., Calif.	212	146 479
Electronics Research Lab., U. of California, Berkeley	37	145 767
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Emerson and Cuming, Inc., Canton, Mass.	312	146 291
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Emhart Mfg. Co., Hartford, Conn.	60	161 679
Engelhard Industries, Inc., East Newark, N. J.	714	149 611
Engineering Corps, Washington, D. C.	25	146 022
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Engineering Supervision Co., New York	371	161 887
Enrico Fermi Inst. for Nuclear Studies, U. of Chicago, Ill.	792	148 015
Eye Research Foundation, Bethesda, Md.	682	149 859
Fabric Research Labs., Inc., Dedham, Mass.	62	145 927
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Faculte des Sciences, Orsay (France)	764	150 352
Fairchild Camera and Instrument Corp., Syosset, N. Y.	225	147 020
Fairchild Engine Div., Deer Park, N. Y.	132	146 517
Family Relations Center, San Francisco, Calif.	253	147 688
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Farnsworth Electronics Co., Fort Wayne, Ind.	570	147 965
Fels Group Dynamic Center, U. of Delaware, Newark	530	149 473
Feltman Research Labs., Picatinny Arsenal, Dover, N.J.	18	144 827
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Flight Control Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	141	147 591
	142	147 580
	183	161 085
Flight Dynamics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	615	161 937
Flight Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio	570	150 148
Florida State U., Tallahassee	64	145 769
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Florida U., Gainesville	378	148 564
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Florida U. Coll. of Medicine, Gainesville	682	149 245
Florida U. Engineering and Industrial Experiment Station, Gainesville	18	145 901
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Food Machinery and Chemical Corp., Buffalo, N.Y.	761	150 293
Fordham U., New York	538	148 877
Forest Products Lab., Madison, Wis.	413	149 183
Forschungsinstitut fur Physik der Strahlantriebe, e.v., Stuttgart (West Germany)	218	147 685
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Free U. of Berlin (Germany)	139	146 817
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Fribourg U. (Switzerland)	79	145 852
Fritz Engineering Lab., Lehigh U., Bethlehem, Pa.	748	148 605
Gage Lab., Frankford Arsenal, Philadelphia, Pa.	434	146 182
Garbell Research Foundation, San Francisco, Calif.	557	147 951
Gas Dynamics Lab., Northwestern U., Evanston, Ill.	541	161 908
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Gates and Crellin Labs., of Chemistry, Calif. Inst. of Tech., Pasadena	539	148 860
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General Applied Science Labs., Inc., Westbury, N. Y.	141	147 320
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General Atomic, San Diego, Calif.	89	161 673
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General Electric Co., Cincinnati, Ohio	480	148 927
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General Electric Co., Evendale, Colo.	762	161 980
General Electric Co., Owensboro, Ky.	37	145 925
General Electric Co., Schenectady, N. Y.	37	145 879
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General Electric Co., Syracuse, N. Y.	37	145 816
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General Electric Co., Utica, N. Y.	57	145 725
General Electric Microwave Lab., Palo Alto, Calif.	153	147 452
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General Electric Research Lab., Schenectady, N. Y.	215	147 359
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General Electronic Labs., Inc., Cambridge, Mass.	425	146 546
General Mills, Inc., Minneapolis, Minn.	38	145 835
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General Motors Corp., Warren, Mich.	456	146 416
General Radio Co., Cambridge, Mass.	38	137 907
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General Telephone and Electronics Labs., Inc., Bayside, N. Y.	714	149 168
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Geographisches Institut der Universität Zurich (Switzerland)	26	145 950
Geophysical Inst., U. of Alaska, College	336	147 513
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George Washington U., Washington, D. C.	51	145 964
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George Washington U. School of Medicine, Washington, D. C.	11	146 243
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Georgia Inst. of Tech. Engineering Experiment Station, Atlanta	20	145 847
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Georgia U., Athens	315	147 871
Gilfillan Bros., Inc., Los Angeles, Calif.	570	147 961
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Goethe Link Obeervatory, Bloomington, Ind.,	371	146 354
Goethe U., Frankfurt (West Germany)	138	146 299
Goodyear Aircraft Corp., Akron, Ohio	30	145 804
Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.	336	147 761
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Gottingen U. (West Germany)	510	146 709
Grace, W. R., and Co., Clarksville, Md.	395	148 551
Granger Associates, Palo Alto, Calif.	153	147 423
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Grumman Aircraft Engineering Corp., Bethpage, N. Y.	197	161 759
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Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena	94	146 701
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Guggenheim Jet Propulsion Center, Princeton, N. J.	72	146 401
Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena	20	145 941
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Guggenheim School of Aeronautics, Georgia Inst. of Tech., Atlanta	703	150 116
Hamburg U. (Germany)	733	150 011
Hammersmith Hospital, London (Gt. Brit.)	534	146 957
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Harpur Coll., State U. of New York, Endicott, N. Y.	513	148 580
Harris Transducer Corp., Woodbury, Conn.	83	146 259
Harvard Coll. Observatory, Cambridge, Mass.	674	149 806
Harvard Graduate School of Education, Cambridge, Mass.	251	147 715
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Harvard Medical School, Boston, Mass.	10	146 237
Harvard U., Cambridge, Mass.	18	146 765
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Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.	335	147 719
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Haskins Labs., New York	715	149 881
Hawaii Inst. of Geophysics, Honolulu	545	149 082
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Hebrew U. (Israel)	90	145 862
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Hermes Electronics Co., Cambridge, Mass.	307	147 984
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High Altitude Observatory, Boulder, Colo.	249	147 863
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Hoffman Electronics Corp., El Monte, Calif.	342	148 111
Hogan Labs., Inc., New York	288	147 461
Honeywell Research Center, Hopkins, Minn.	783	149 870
Horizons, Inc., Cleveland, Ohio	478	148 039
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HRB-Singer, Inc., State College, Pa.	715	150 174
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Hughes Aircraft Co., Culver City, Calif.	39	146 561
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Hughes Aircraft Labs., Culver City, Calif.	153	147 425
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Hughes Research Labs., Malibu, Calif.	635	148 087
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Hull U. (Gt. Brit.)	690	150 039
Human Factors Research, Inc., Los Angeles, Calif.	374	146 687
Human Resources Research Office, George Washington U., Washington, D. C.	118	147 429
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Human Sciences Research, Inc., Arlington, Va.	141	161 750-1
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Hunt Corp., Carlisle, Pa.	289	147 976
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Illinois Inst. of Tech., Chicago	176	147 013
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	531	148 899
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	676	150 180
	690	149 985
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Ingersoll Kalamozoo Div., Borg-Warner Corp., Mich.	481	148 461
Inland Testing Labs., Morton Grove, Ill.	58	146 574
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Institut d'Optique, Paris (France)	462	147 252
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Institute for Advanced Study, Princeton, N. J.	65	146 213
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Institute for Applied Experimental Psychology Tufts U., Medford, Mass.	6	161 125
Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park	184	146 422
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Institute of Flight Structures, Columbia U., New York	30	145 800
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Institute of Geophysics, U. of California, Los Angeles	700	149 535
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Institute of Metals and Explosives Research, U. of Utah, Salt Lake City	729	150 167
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Institute of Optics, U. of Rochester, N. Y.	340	148 060
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Institute of Paper Chemistry, Appleton, Wis.	552	161 917
Institute of Personality Assessment and Research, U. of California, Berkeley	7	146 143
Institute of Psychiatry, Maudsley Hospital, London (Gt. Brit.)	12	146 204
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Institute of Research, Lehigh U., Bethlehem, Pa.	221	145 944
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Institute of Rubber Research, U. of Akron, Ohio	63	146 230
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Institute of Statistics, U. of North Carolina, Chapel Hill	745	148 239
Institute of Tech., U. of Minnesota, Minneapolis	90	146 028
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Institute of Theoretical Physics, Stanford U., Calif.	205	146 875
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Instituto de Edafologia y Fisiologiya Vegetal, Madrid, (Spain)	698	147 622
Instituto de Quimica Fisica (Spain)	690	147 614
Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain)	178	147 142
Instrumentation Lab., Mass. Inst. of Tech., Cambridge	203	147 266
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Interaction Lab., Yale U., New Haven, Conn.	254	138 123
International Business Machines Corp., Kingston, N. Y.	716	150 807
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International Business Machines Corp., New York	581	147 345
International Geophysical Year	700	147 873
International Inst. of Meteorology U. of Stockholm (Sweden)	694	147 874
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International Resistance Co., Philadelphia, Pa.	39	161 688
International Telemeter Corp., Los Angeles, Calif.	462	146 723
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Ionosphere Research Lab., Pennsylvania State U., University Park	139	137 685
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Istituto di Chimica Generale dell' Universita, Palermo (Italy)	395	148 360
Istituto do Fisica Superiore, Universita di Pavia (Italy)	213	146 834
Istituto di Metallurgia e Metallografia, Universita degli Studi di Roma (Italy)	133	145 954
Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy)	76	145 861
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I.T.E. Circuit Breaker Co., Philadelphia, Pa.	425	147 953
Itek Corp., Waltham, Mass.	340	147 851
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ITT Labs., Nutley, N. J.	425	146 597
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J. G. Engineering Research Associates, Baltimore, Md.	621	145 249
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Johns Hopkins U., Baltimore, Md.	65	145 774
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Johns Hopkins U. School of Engineering, Baltimore, Md.	218	146 428
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Laboratoire de Physique Theorique et Hautes Energies, Faculte des Sciences, Orsay (France)	757	149 589
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Laboratory for Molecular Studies, U. of Chicago, Ill.	778	148 996
Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.	249	147 714
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Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.	637	149 162
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Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus	8	161 550
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Laboratory of Climatology, Centerton, N. J.	136	137 849
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Laboratory of Social Relations, Harvard U., Cambridge, Mass.	380	146 683
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Manchester Coll. of Science and Technology (Gt. Brit.)	179	146 833
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Manufacturing Labs., Inc., Cambridge, Mass.	497	148 794
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		161 676
	78	161 543
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	532	148 351
	553	146 469
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	266	148 057
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	483	147 940
	485	148 372
	487	146 474
	602	150 302
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Rochester U., N. Y.	91	145 733
	398	148 090
	531	148 899
		148 900
	532	148 901
	779	150 201
Rock Island Arsenal Lab., Ill.	51	145 894
	62	146 485
	64	161 678
		161 689
Rock Island Arsenal Lab., Ill. (con.)	128	147 432
	170	146 906
	204	146 838
	261	147 430
	302	147 431
		147 730
	311	147 731
	440	147 221
		147 338
	450	161 861
	453	147 230
		147 339
		147 341
		148 366
	482	148 365
	590	149 770
	600	149 053
		149 054
	626	146 993
	731	147 340
	763	147 342
Rocketdyne, Canoga Park, Calif.	56	139 229
	740	150 143
	757	161 952
Rodman Lab., Watertown Arsenal, Mass.	445	147 231
		147 232
	477	147 233
	624	161 928
	737	149 571
	760	149 560
Rome Air Development Center, Griffiss AFB, N. Y.	45	145 851
		146 430
	161	146 842
		147 166
	162	146 111
	175	147 524
	212	146 922
	250	147 514
	294	146 271
	294	147 663
		147 753
		147 760
		147 770
		148 022
	303	161 780
	339	147 850
	431	147 641
	579	149 326
		161 894
	590	147 805
	692	161 972
	724	150 268
	746	150 241
	772	149 973
	773	149 972
Rome U. (Italy)	441	146 707
	473	146 708
	543	149 426
	618	149 586
	786	149 448
Roosevelt U., Chicago, Ill.	392	148 532
Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis	73	145 739
		145 740
		145 760
		145 775
	74	145 788
	473	146 379
		146 380
		161 885
	593	147 574
Royal Coll. of Science and Tech., Glasgow (Scotland)	753	150 038
Royal Inst. of Tech. (Sweden)	603	149 451
Rubber Lab., Mare Island Naval Shipyard, Vallejo, Calif.	313	146 283
Rutgers State U., New Brunswick, N. J.	21	145 840
	67	145 741
	83	138 896
	91	145 839
	121	137 996
	187	146 445
		146 908
	261	147 465
	381	148 596
	398	146 334
Rutgers State U., New Brunswick, N. J. (con.)	609	149 910
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Rutgers State U. Coll. of Engineering, New Brunswick, N. J.	501	148 442
St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis	474	148 166
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St. Louis U., Mo.	344	147 866
	529	148 886
Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.	81	145 791
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	766	149 936
School of Aviation Medicine, Brooks AFB, Tex.	11	146 187
	11	146 189
	13	146 145
	16	146 147
	126	146 146
		146 148
	137	147 457
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	376	146 181
	385	148 084
		148 498
	389	148 082
	683	150 203
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Schwinger, Julian, Cambridge, Mass.	348	147 983
	431	147 934
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	634	148 186
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Scuola di Perfezionamento in Fisica Teorica e Nucleare, Naples (Italy)	791	150 373
Servo Corp. of America, New Hyde Park, N. Y.	45	145 851
Shallcross Mfg. Co., Selma, N. C.	431	146 339
Sheffield U. (Gt. Brit.)	499	148 520
Shell Development Co., Emeryville, Calif.	131	147 365
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Sloan-Kettering Inst. for Cancer Research, New York	389	146 593
Smithsonian Astrophysical Observatory, Cambridge, Mass.	165	147 590
	373	148 019
Smyth Research Associates, San Diego, Calif.	432	147 149
	579	149 256
Solar Aircraft Co., San Diego, Calif.	417	148 446
Solid Propellant Information Agency, Johns Hopkins U., Silver Spring, Md.	731	150 779
Sonotone Corp., Elmsford, N. Y.	46	145 802
	579	149 026
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	398	147 346
	724	148 026
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	417	161 862
	735	149 353
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	222	161 735
	333	147 522
	340	147 523
	348	147 636
	398	148 206
	399	148 207
	447	148 763
	543	148 764
	692	148 878
	731	149 846
	742	150 288
	793	148 654
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	69	145 801
	96	138 142
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	163	147 099
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		145 865
	135	146 951
		147 022
	162	146 797
		147 357
	163	146 012
		147 049
	171	146 758
	178	161 720
	196	147 050
	210	145 970
	250	161 832
	267	147 489
	277	146 325
	320	147 684
	399	148 588
	410	147 025
		147 131
		147 150
	432	146 374
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	545	149 791
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	97	145 945
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		149 959
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	684	150 023
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Uppsala U. (Sweden)	92	145 859
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Vanderbilt U. School of Medicine, Nashville, Tenn.	54	146 822
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Varian Associates, Palo Alto, Calif.	47	146 016
	164	146 790
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Vehicle Research Corp., Pasadena, Calif.	416	146 523
		146 592
Vertol Aircraft Corp., Morton, Pa.	144	146 903
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Vienna U. (Austria)	28	145 947
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	629	146 713
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Villanova U., Pa.	273	137 412
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	376	146 463
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	748	147 773
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	171	161 513
	190	147 280
	204	146 827
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	326	151 814
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	400	148 184
	496	146 351
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	747	150 058
	787	149 759
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	48	145 991
		145 997
	68	145 998
	80	145 892
	85	146 254
	92	146 869
	97	145 992
	122	147 001
	188	146 244
	213	146 828
	214	147 364
	215	146 829
	217	147 304
	339	145 972
	461	148 524
	602	149 455
	638	147 275
	726	149 456
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	298	147 930
	317	138 139
		147 867
		147 870
	461	148 875
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	697	148 251
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	463	148 568
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	609	146 450
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